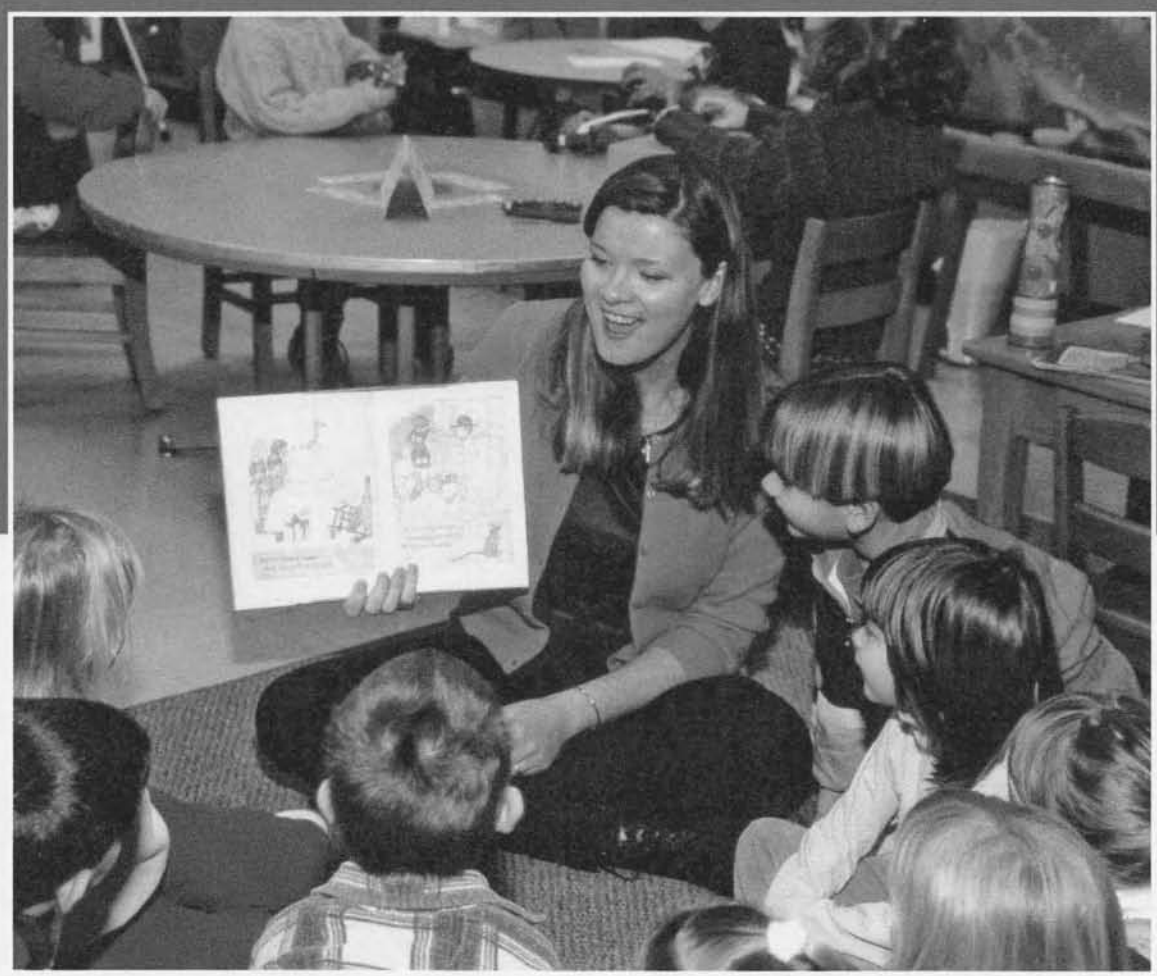
Educational Psychology



Becoming an Expert

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CHAPTER OUTLINE

What Expert Teachers Know That Novice Teachers Do Not

What Is an Expert Teacher?

Developing Expertise in Teaching: A Process

Expert Teachers Have Expert Knowledge

Expert Teachers Are Efficient

Expert Teachers Have Creative Insight

Advantages of Expertise

What Do We Know About Expert Learners?

Use of Effective Learning Strategies

Incremental View of Intelligence

High Aspirations

High Perceived Self-Efficacy

Pursuit of a Task to Completion

Responsibility for Self and Actions

Ability to Delay Gratification

How Educational Psychology Helps Create Expert Teachers and Learners

Descriptive Research

Experimental Research

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this introductory chapter. The chapters that follow will help you explore the answers to these questions in more detail.

- What does it mean to be an expert teacher? What are the ingredients a person needs to maximize the likelihood of becoming an expert teacher? What is the best way to gain teaching expertise?
- What does it mean to be an expert learner? How can you be an expert learner now, as you read this and other textbooks and prepare for classes? How can you spot expert learners in your classes in the future? What is involved in becoming an expert learner, and how can you help every student you teach become an expert learner?
- Why are the topics covered in this book important for teachers? What can you expect to learn from each topic? How will you be able to use what you learn?

Sandy was afraid she was going to be sick. It was her first day of teaching, and she wanted to be and do her absolute best. Sandy had prepared as well as any novice teacher could—she had studied hard in school and read widely on the topic of education. Just as important, Sandy was as motivated as a person could be: She had wanted to be a teacher since she was a child.

"Why am I so nervous?" Sandy wondered, as she watched students file into the first of her several science classes. She greeted each student with a hello and a smile. The students took their seats and looked around expectantly. In the first row, two students were dressed as if they were going to a party. Their notebooks were open, and they sat still, looking like well-behaved soldiers. But behind them, in the next three rows, other students were dressed more like high school students than seventh graders: These girls were talking to one another, and one of them passed a pack of cigarettes across her desk. Sandy took a deep breath, squared the papers on her desk, and began the speech she had rehearsed ten times during August as part of her preparation for the challenge of her new job.

By 3:30 P.M. that day, Sandy looked like the poorer twin of her 8 A.M. self. She was exhausted and confused, and the classroom looked like a college dorm after an all-night party. Four classes of students had filed into that room—120 in all—and each class seemed to contain more monsters and fewer children. Sandy wanted to learn all their names, know their strengths and weaknesses, and teach them science.

In the teachers' lounge, Sandy slipped off her shoes and rubbed her feet. Danielle, a 20-year veteran of middle school teaching, took the next seat and introduced herself. Danielle wasn't put off—in fact, she had Sandy figured out. Like any expert teacher, Danielle appreciated what Sandy was experiencing. Danielle was willing to help, and she offered Sandy advice, information, a shoulder to lean on, whatever she needed. "I think I just have to learn this stuff for myself—the hard way," Sandy replied. Danielle laughed. "I hope you're wrong," she answered. "Teaching is a tough business, and if you can't learn from seasoned colleagues, it'll be a long road." "You're probably right," Sandy responded. "Thanks!"

Over the school year Sandy faced many difficult situations. Luckily, she had Danielle to lean on. The discipline problems, testing worries, parent–teacher conference anxiety, and daily instructional challenges of making science interesting to a bunch of kids entering puberty (who also had other things on their minds) were made much easier as a result of her sage advice. In Danielle's 20 years of teaching, she had been through just about every tough teaching situation you can imagine: She was a goldmine of information. By June 15, Sandy felt like donating one month's salary to Danielle. At that point, she felt more in control and much wiser about the ins and outs of teaching than she had so long ago—had she really started only nine months ago, in September? Sandy was one year into a promising and rewarding career.

THINKING CREATIVELY

It is often said that early in the life of every great person was a teacher who helped launch that person on the path to greatness. What might you do as a teacher to help a talented student onto such a path?

SUGGESTION: Encourage and support the student's interests—help the student obtain extra materials and resources to broaden his or her understanding. Challenge the student to do extra, advanced work. Introduce the talented student to an adult with expertise in the same domain. If necessary, meet with parents to suggest an environment for success. Encourage the student to develop a positive attitude about mistakes and failures.

Sandy was experiencing a situation that every teacher has faced: beginning a demanding profession, wanting to do a good job, but not knowing exactly how to accomplish this goal. Many of you may find yourselves in this position in the near future, while others may have read about Sandy and smiled knowingly, having already been in her shoes. Stop for a moment and ask yourself these questions: What do you expect from a career in teaching? Which challenges are you likely to encounter? Which obstacles will you face? And which strategies will you use to organize your work, get through to the students, and still feel energized when you return home after a long hard day?

Like Sandy, you probably share the goal of becoming an expert teacher like Danielle. **Expert teachers** use a broad base of organized knowledge and experience efficiently and creatively to solve the many kinds of problems that occur in educational settings. When we think about the Danielles of the teaching world, a variety of individual people come to mind—people linked to one another by their expertise as teachers, even though their styles, approaches, and attitudes may differ. Although expert teachers share certain characteristics—such as being able to motivate students to learn complex information, deal with test anxiety in students, and handle discipline problems effectively—they use many different methods for achieving these goals. There is not just one way to be an expert teacher, but rather many ways that fit many different personalities. The key is that expert teachers solve problems effectively and get things done in the classroom. Your goal should be to find the best way for you to become an expert teacher by capitalizing on your strengths and compensating for your weaknesses. The purpose of this book is to help you on your journey.

Remember, some expert teachers are young. Twenty years of teaching experience does not always make an expert, nor are many years of experience necessary to become an expert teacher. Some teachers become expert relatively early in their careers by capitalizing on and learning from both their own experiences and the experiences of other teachers. This textbook will help you acquire the knowledge base you will need to profit from your teaching experiences and develop into an expert as early in your career as possible.

This book will also consider the steps involved in becoming an **expert learner.** Expert learners use strategies to help them learn efficiently and are open to challenges and willing to overcome problems to achieve learning goals. Of course, when you read this book and attend classes in educational psychology, you are also a learner. The more expert you are at learning, the more you will learn and the better you will be able to use what you have learned in your career. Later, when you teach a class, knowing the fundamentals of what makes an expert learner will be critical to your success. You will want to know which students are experts—that is, which students are primed to learn and ready to benefit most from the learning experience. You will also want to know which students are having trouble learning in the context of the school and classroom environments, so you can help these nonexpert students develop expertise.

CONSTRUCTING YOUR OWN LEARNING

Try to develop a list of ten behaviors that consistently distinguished your own best teachers. Recall two or three excellent teachers from your past, as well as two or three teachers you consider less effective. Think back to what the talented teachers did every day: Which types of assignments did they give? How did they structure their classrooms? Which types of activities did they choose? How did they keep the material interesting? How did they encourage you? How did they provide effective feedback? In contrast, in response to these same questions, think about what the ineffective teachers did poorly. Write down the ten key behaviors that characterize the excellent teachers, and distinguish these behaviors from those of the ineffective teachers. What does your list say about the types of instruction you, as a student, found most appealing? What does your list say about what may or may not work with the students you teach? What, exactly, do expert teachers know that novice teachers do not?

THINKING ANALYTICALLY

Evaluate three expert teachers you have known. In what ways were these teachers alike? In what ways did they differ? Were they more alike than different, or vice versa? (*Hint:* Refresh your memory about how to answer these questions, which appear throughout this text, by rereading the section in the Preface that describes this feature of the book.)

SUGGESTION: Some ways expert teachers are alike include sharing a love of and devotion to teaching, having clear objectives and goals, and using novel and creative approaches in the classroom to communicate their ideas. Expert teachers can differ in their presentation style (some may prefer lecturing, while others prefer discussion and dialogue), their friendliness and degree of nurture (some may prefer to challenge students, while others support them), and the importance they place on homework and tests. There are many ways to be an expert teacher.

The "Thinking" Triangle

To understand the exercises you'll find interspersed throughout the chapters in this book, and to use those exercises optimally to help you become an expert learner, you'll need to know a new term.

Triarchic means "having three parts," like the three sides of a triangle. This term refers to a theory of intelligence developed by Robert Sternberg in which intelligence is viewed as having three major aspects: creative, analytical, and practical abilities. You'll find a detailed explanation of the triarchic theory in Chapter 4, but the idea of a triangle of thinking—which is illustrated here—appears throughout the text to encourage you to consider concepts and problems in these three different ways. This shows up in three kinds of "Thinking" questions:

- Thinking Creatively questions encourage you to invent, discover, or design. You are asked to stretch your thinking—to go beyond what you already know.
- Thinking Analytically questions ask you to analyze, compare and contrast, or evaluate concepts or information.
- Thinking Practically questions help you learn how to apply in everyday life what you already know.

FIGURE 1.1 The "Thinking" Triangle

What Expert Teachers Know That Novice Teachers Do Not

Expert teachers differ from novice teachers in the amount and depth of their knowledge, their efficiency, and their insights into problems on the job. This book will help you develop these three attributes so you will become an expert teacher. It introduces important background knowledge that you can apply daily in the classroom. It also reviews techniques for effective teaching that will make you an efficient teacher and equip you with the tools to develop your own insights into the problems you face. As we wrote this book, we focused on your needs as a developing teacher. As we covered topics in psychology that are relevant to education, we concentrated on how you can apply what you are learning to the ultimate challenges you will encounter when you begin teaching.

After you have read this book, you will be well on your way to becoming an expert teacher. Like Sandy, the teacher in the opening vignette, you will have acquired wisdom from other experienced teachers, whose lessons and advice fill these pages. This book can help you in much the same way as a friend who is an experienced teacher: You will acquire wisdom by reading and thinking about the material contained here, which is based on research in psychology that can help you teach more effectively. Think of this book as your own personal mentor or expert teacher who is willing to share knowledge you will need to develop into an expert teacher yourself. And remember, one of the most important findings in educational psychology research is that teacher education really does make a difference (Borko et al., 2000; Darling-Hammond, 2000; Garet, Porter, Desimone, Birman, & Yoon, 2001), even for veteran teachers (Borko, Davinroy, Bliem, & Cumbo, 2000), principals in training, and expert principals (Kerrins & Ching, 2000).

What Is an Expert Teacher?

THINKING ANALYTICALLY

Give three reasons why it is important to study teaching expertise systematically.

SUGGESTION: With a systematic approach, you are more likely to consider a broad range of behaviors associated with effective teaching, rather than just a few obvious ones. A systematic approach forces an observer to be less biased—to consider multiple hypotheses. A systematic approach yields results that are easier to generalize to other situations, teachers, schools, grades, and so forth.

Expert teachers are the driving force of a successful educational system and the backbone of an educated society. Understanding how to turn more people into expert teachers is essential to our society and, presumably, to your personal goals as a reader of this book. If schools are to be first rate, their most important human resources—their teachers and students—must be fully developed.

David Berliner (2004) has noted that developing expertise at teaching takes time, and that teachers' knowledge tends to be highly contextualized—a fancy way of saying that expert teaching knowledge is tied to the teaching of individual subjects and topics within these subjects, in specific types of classrooms and learning environments. But how do we educators know what we should be developing teachers to become? To know where we are headed, we must understand what makes a teacher an expert. We must understand what distinguishes expert teachers from average teachers and develop ways to help novice teachers acquire expertise as smoothly and as early in their careers as possible. The goal is to help beginning teachers like Sandy become expert teachers like Danielle as quickly and smoothly as possible. This happens when expert teachers are used as resources of important, practical knowledge about effective teaching, and when this knowledge is pooled and made available to teachers in training (Kecskemeti & Epston, 2001; Stemler, Elliot, Grigorenko, & Sternberg, 2006).

Teaching expertise can be viewed from two perspectives, both of which will be helpful to you as a student who wants to learn the principles of how to be an effective teacher (Sternberg & Horvath, 1995, 1998):

- Think in terms of how experts differ from nonexperts: For example, what did your three best teachers do that was different from the rest of your teachers? What did your best teachers have in common?

- Think in terms of how people develop and show their expertise in daily life: For example, how can students be motivated when they are already burdened with work from other teachers of other subjects? How do expert teachers handle teaching gifted students in the same classroom with average students and students with learning problems?

You can use these two ways to think about teaching expertise practically in day-to-day teaching to improve your performance:

- Reflect on your progress at teaching, and attempt to understand what you are doing right and doing wrong and why. This type of **reflective thinking** has been shown to contribute to the development of expertise.
- Develop a personal and informal list of differences between experienced and less experienced teachers: For example, Nancy (an expert teacher) always raises her finger in the air to signal her class that she is going to say something important for them to write down; Dominic (a novice teacher) mixes important definitions with less important information, so his students do not always know what is important to write down.

Both of these ways of thinking about teaching expertise—as a tendency toward reflective thinking and as a practice of developing a list of behaviors used by successful teachers—are useful, although neither one alone provides the entire picture. Clearly, teaching expertise is more than simply "a tendency to reflect on what works." Teaching expertise is also more than just a catch-all list of behaviors that work in the classroom. Reflecting on how to be an expert is essential, but it is not the whole story. You also need practical strategies for teaching and accurate, comprehensive content knowledge so that students see you as "knowing your stuff." Nor is simply copying the behaviors of the most effective teachers a magic recipe: You must understand and reflect on what works and what does not. Integrate teaching techniques into your own approach, but remember that what works for Maria Campos in Room 211 might not work for you. Each teacher has a unique style, and part of capitalizing on this style is knowing what you do best—and worst—and playing to your strengths as you lead a class.

For example, imagine you sometimes lose the main point when you lecture for more than ten minutes. You know you go off on tangents until the students' eyes glaze over, and only the sound of snoring jolts you back into reality. If lecturing at length is not your strength, you *can* help yourself out. For example, to keep yourself on track, speak from main outline points you write on the board or concentrate on demonstrations or activities that require student participation to keep the class involved while you get your point across. Or imagine you become flustered when students whisper or pass notes while you are teaching. Reflect on how the students' behavior unsettles you and select two or three calming strategies, such as correcting the misbehavior as soon as it occurs and smiling at the rest of the class to show appreciation for their good behavior and attentiveness.

THINKING PRACTICALLY

When was the last time you used reflective thinking to better understand your success or failure in an endeavor? How did it work?

SUGGESTION: A teacher might reflect on how her own level of frustration made her act overly harshly to a misbehaving student and then make a plan regarding how to respond more effectively in the future.

THINKING ANALYTICALLY

What if we were to try to understand what makes an expert teacher only by focusing on what people remember about expert teachers from their past? What if we were to study teaching expertise only by reading students' descriptions of their best teachers? What are the pros and cons of different ways of evaluating teaching expertise?

SUGGESTION: Memory can be valuable, but it can also play tricks on us. Sometimes, the longer we hold events in our memory the more we recraft these events—and the more we rewrite history. Although student descriptions are valuable, experienced teachers sometimes more accurately see the true value in someone's teaching approach. Multiple approaches toward understanding expertise are best.

DEVELOPING EXPERTISE IN TEACHING: A PROCESS

Throughout this book, we focus on developing expertise in teaching—the gradual accumulation of knowledge that prepares teachers to do their jobs effectively and solve the daily problems they encounter on the job. We want to show you how to become an expert teacher. The word "become" is critical here. As Sandy in the opening vignette learned, becoming an expert teacher is a process, not a sudden insight or "aha" experience. This book will give you the tools you need to gradually develop into an expert teacher.

What are the characteristics of expert teachers? How do they differ from novice teachers? What made Danielle different from Sandy? Research has shown that expert teachers share three qualities. First, experts have expert knowledge: Expert teachers know more strategies and techniques for teaching, and they use their knowledge more effectively to solve problems than do novices. Second, experts are efficient: Expert teachers do more in less time than do novices. Third, experts have creative insight: Expert teachers are more likely to arrive at novel and appropriate solutions to problems than are novices.

Let us consider each of these distinctive characteristics in detail, so you have more specific ideas about what you are working to develop in your quest to become an expert teacher. Table 1.1 summarizes seven skills that make an expert teacher.

TABLE 1.1 Seven Skills That Make an Expert Teacher

1. Expert teachers have content knowledge.
2. Expert teachers have pedagogical knowledge.
3. Expert teachers have pedagogical-content knowledge.
4. Expert teachers have well-organized knowledge.
5. Expert teachers have interrelated knowledge.
6. Expert teachers are efficient.
7. Expert teachers have creative insight.

EXPERT TEACHERS HAVE EXPERT KNOWLEDGE

Experts have and use more knowledge to solve problems on the job than do novices. Experts also solve these problems more effectively. This difference may seem obvious, but it is worth exploring exactly what this "expert knowledge" consists of and how experts use this knowledge to perform successfully on the job.

When you have the good fortune to work alongside an expert teacher, or even when you are being taught by one, you may think to yourself, "Jim is just so much smarter than I am. He knows everything—he must have a better memory than I do. I could never remember all that stuff." But is this true? Are expert teachers blessed with better memories and more intelligence in general? Is there hope for all of us whose memories are not stellar and who are not the best students in our classes?

■ **MORE KNOWLEDGE, NOT BETTER THINKING AND MEMORY** A classic study in psychology provides some answers to these questions. This study looked at differences between expert and novice chess players in memory for particular configurations of chess pieces on chess boards (Chase & Simon, 1973a, 1973b; Gobet & Simon, 1998). The researchers showed different configurations to both experts and novices, then assessed their memory for the configurations. As expected, experts showed superior memory—but only when the chess pieces were arranged in a sensible configuration (i.e., a configuration that might logically evolve during the course of a game). When chess pieces were placed on the board in random configurations, both experts and novices showed poor memory for these configurations.

What does this finding mean? First, it shows that the advantage of chess experts over novices was related to chess configurations and did not reflect superiority in general memory or thinking ability. Experts' advantage was in having more knowledge: The chess experts had stored thousands of sensible configurations in memory, and this stored knowledge allowed them to memorize the chess pieces' patterns more easily, giving them an advantage over novices. Expert performance has been studied in a number of domains, and as a group, these studies have yielded the same general findings as the studies of chess experts—namely, that experts' main advantage over novices is in having more knowledge about their domain of expertise (Bransford, 2000; Chi, Glaser, & Farr, 1988; Ericsson & Charness, 1999; Glaser, 1996; Glaser & Chi, 1988).

■ **TYPES OF EXPERT KNOWLEDGE.** What are the specific types of knowledge necessary for expert teaching?

- First, and most obviously, expert teachers must have content knowledge—knowledge of the subject matter to be taught. You will develop content knowledge from taking content-based courses and from experiences outside of school. For example, if you intend to teach math, your content knowledge will come from your experience in math courses as well as from using math, reading about math, and talking about math with others outside of school.
- Expert teachers need pedagogical knowledge—knowledge of how to teach (Shulman, 2000). Pedagogical knowledge of the general variety includes knowledge of how to enhance student motivation, how to manage groups of students in a classroom setting, and how to design and administer tests. The purpose of this book and of your educational psychology course is to provide you with pedagogical knowledge.

THINKING PRACTICALLY

What knowledge do you possess that you will be able to apply in your teaching?

SUGGESTION: Think of activities in which you have excelled, outside of school interests and hobbies. Think of subjects and topics you know the best. All of this knowledge and information will be useful in your teaching.

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The school environment can vary enormously, from a highly sophisticated classroom equipped with computers, televisions, DVD players, and other technology, to a simple classroom with few such aids. Expert teaching can take place in any environment.

- Expert teachers need pedagogical-content knowledge—knowledge of how to teach what is specific to the subject that is being taught (Staub & Stern, 2002). A math teacher, for example, needs to know how to explain particular concepts (for example, negative numbers) and how to demonstrate and explain procedures and methods (Leinhardt, 1987; Marion, Hewson, Tabachnick, & Blomker, 1999). A science teacher must know how to correct students' naive theories and misconceptions about subject matter (Gardner, 1991; Liggitt-Fox, 1997). You will develop pedagogical-content knowledge as you apply the pedagogical knowledge you learn from this book and from your course to your particular content area of focus (for example, math).

FORUM

CONTENT KNOWLEDGE OR KNOWLEDGE ABOUT TEACHING?

Is in-depth content knowledge the most important skill for expert teachers to possess? Or is detailed knowledge of teaching and motivational strategies more important than content knowledge?

FIRST VIEW: Content knowledge is more important for the expert teacher. According to this view, detailed and thorough knowledge of the area they teach is what makes teachers experts. This detailed knowledge enables teachers to plan creative lessons that motivate and illuminate the subject matter for their students. Thorough knowledge also allows teachers to answer student questions accurately and to link clearly various subtopics within the area they teach, showing students the overarching themes in the area. Content knowledge enables teachers to plan classroom activities that extend what they are learning to other disciplines. Equally importantly, thorough content knowledge makes a teacher appear to be an expert in the eyes of students, which helps create and maintain an atmosphere of leadership in which students respect the teacher's knowledge and authority.

SECOND VIEW: Knowledge about teaching is more important for the expert teacher. This view states that no matter how well a teacher knows the area being taught, the teacher will be ineffective if he or she lacks direct knowledge about how to teach, also called pedagogical knowledge. Many experts in a content area are unable to give a lecture to novice students on what the experts do for a living—these experts may be unable to explain to beginners the importance of their domain. Good teaching requires the ability to capture students' attention, motivate students to learn, and distill the subject matter to reveal key points and issues for the beginner. Good teaching also entails knowing how to structure assignments to be challenging but not overwhelming, and knowing how to assess students' progress so that the right balance and amount of material are presented. No amount of expert content knowledge provides teachers with these insights.

THIRD VIEW: A SYNTHESIS. Both content knowledge and knowledge about teaching are essential to the expert teacher. Research has shown that not only are both content knowledge and pedagogical knowledge important for effective teaching, but a combined type of knowledge called pedagogical-content knowledge is also important (Shulman, 1987, 2000; Warren & Ogonowski, 1998). It is difficult for a teacher to become truly expert without having thorough knowledge of the area being taught. It would also be difficult for a teacher to instruct and control a class without having knowledge of teaching strategies and methods. In addition, specific knowledge about how to teach a given subject—pedagogical-content knowledge—is essential in the development of teaching expertise. For example, a math teacher may need to know specific strategies that work to teach math. These strategies might not work to teach English—an English teacher would need a separate set of specific content-area-related strategies. Thus expert teachers require each one of these three basic types of knowledge.

■ **ORGANIZATION OF EXPERT KNOWLEDGE** Do experts and novices organize and store knowledge differently? This question may at first seem unanswerable, because the knowledge is mental and its organization cannot easily be seen. Psychologists can study how experts and novices use knowledge during problem solving and see what differences emerge. For example, numerous studies have explored how experts and novices solve physics problems (Chi, Feltovich, & Glaser, 1981; Chi et al., 1988; Chi, Glaser, & Rees, 1982; Chi & Van Lehn, 1991; Kozhevnikov, Hegarty, & Mayer, 1999; Larkin, McDermott, Simon, & Simon, 1980a, 1980b; Rochelle, 1998; Slotta, Chi, & Joram, 1995).

One study found that expert and novice problem solvers sorted the same physics problems differently (Chi et al., 1981). In general, experts were sensitive to the deep structures of the problems they sorted—they grouped problems together according to the physics principles that were relevant to problem solution (for example, gravitational attraction). By contrast, novices were more sensitive to surface structure—they sorted problems according to things mentioned in the problem (for example, inclined planes). These results suggest that experts and novices differ not only in the amount of knowledge they have, but also in how they organize that knowledge in memory.

THINKING ANALYTICALLY

Describe a situation in which you were able to analyze the deep structure of a problem.

SUGGESTION: Your best friend starts doing poorly in school, blaming his failure on the fact that he is just not smart enough. However, you are able to understand that problems in the home are causing him stress and are responsible for his poor performance.

For a teacher, being sensitive to deep structure might mean recognizing that an economically disadvantaged child with a speech impediment and a more affluent and inappropriately outspoken child share feelings of low self-worth that lead to different types of undesirable classroom behavior. A teacher tuned in to only the surface structure might see the children's problems as due entirely to more obvious causes (the speech impediment and a lack of discipline, for example), so this teacher might fail to deal with the problems effectively.

LESSON PLANS. Several studies of expert teaching have concluded that expert and novice teachers differ in the organization of their teaching knowledge (Berliner, 1991, 2004; Borko & Livingston, 1989; Borko, Livingston, & Shavelson, 1990; Leinhardt & Greeno, 1986, 1991; Livingston & Borko, 1990; Moallem, 1998; Sabers, Cushing, & Berliner, 1991; Strauss, Ravid, Magen, & Berliner, 1998). These studies suggest that expert teachers' knowledge is more thoroughly integrated (with bits and pieces of knowledge being more interrelated) than the novices' knowledge. How can we tell that experts' knowledge is more integrated? To answer this question, psychologists have looked at teachers' lesson plans (Berliner, 1991; Borko & Livingston, 1989; Collins & Stevens, 1991; Leinhardt, 1987; Leinhardt & Greeno, 1986; Sanchez & Valcarcel, 1999). The lesson plan integrates knowledge of content to be taught with knowledge of teaching methods.

According to Leinhardt and Greeno (1986), a lesson plan includes global plans not related to specific lesson content or subject matter (for example, "Begin with an example that shows the importance of the lesson topic to students' lives outside of school"), local plans related to content and subject matter (for example, "Before discussing the specifics of the Civil War, ask students to brainstorm what it would have been like to be an African American child or a white child around 1860"), and decision elements that make the lesson plan responsive to expected and unexpected events (for example, "If the students do not want to move forward with the lesson, start reading the Civil War diary passage to engage

them in the next step," "If the students do not seem interested in the passage, ask them to imagine what soldiers' lives were like").

Global parts of the lesson plan might include routines for checking homework, presenting new material, and supervising guided practice. These global parts of the lesson plan apply regardless of the content being taught. Local parts of the plan might include routines for presenting particular concepts or for assessing student understanding of particular concepts. Local parts of the plan are tailored to the content being taught. Decision elements in the plan tell the teacher what to do when typical types of questions are asked, and they allow for unanticipated circumstances, such as times when students do not understand the material as quickly as usual.

EXPERT VERSUS NOVICE PLANS. A good lesson plan enables the expert teacher to teach effectively and efficiently (see Figure 1.2). General teaching knowledge, such as knowledge of class-management routines, maximizes the amount of time that students spend learning (rather than locating materials and supplies or switching activities, for example). Knowledge related to teaching content, such as explanations keyed to specific student questions, enables the expert teacher to connect student feedback to lesson objectives, thus keeping the lesson on track.

By contrast, novice teachers have less complex, less interconnected lesson plans. Because they lack knowledge of general routines, novice teachers tend to spend more time with their classes off-task—getting organized, accessing materials, and trying to discipline students and capture their attention (Leinhardt & Greeno, 1986). Because their content-related teaching knowledge is not as developed as that of experts, novice teachers tend to have difficulty generating examples and explanations if the examples and explanations have not been prepared in advance (Borko & Livingston, 1989). Because their plans are less likely to anticipate student misconceptions, novice teachers tend to have difficulty relating student questions to lesson objectives (Borko & Livingston, 1989). Novices' teaching plans often do not include the types of examples and explanations they need to teach effectively (see Figure 1.3).

For example, in a lesson on photosynthesis, if a student asks if green plants need soil to survive, an expert teacher answers that soil supplies only water and minerals, but the food that plants need is made within them as plant cells transform sunlight into chemical energy. In this way, the expert teacher refocuses the student's misconception—that plants get food from soil—into a more appropriate conception—that plants get food from photosynthesis. Novice teachers, in contrast, are more likely to answer the same student question by saying simply that plants get necessary minerals from soil. Novices would not be as likely to refocus the question back onto the main lesson theme of photosynthesis.

THINKING PRACTICALLY

In day-to-day classroom teaching, how important do you believe teachers' knowledge is in accomplishing their goals? How important do you believe teachers' level of commitment is in daily teaching? Finally, how important do you believe teachers' motivation is to their classroom performance?

SUGGESTION: Knowledge of subject matter and teaching strategies is absolutely essential. But commitment to the daily tasks of teaching is what keeps a teacher coming back to the classroom day in and day out. Motivation is what gives a teacher a spark and the energy for teaching that students respond to.

■ **KNOWLEDGE ABOUT THE TEACHING CONTEXT** In addition to well-organized and interrelated knowledge of content and pedagogy, expert teachers need knowledge of the social and political context in which teaching occurs (Berliner, 2000). In fact, knowing how to work effectively with people with diverse interests is an essential part of being an expert teacher, often just as important as knowledge of how to teach.

Expert teachers need to know how to package curricular innovations to convince other teachers, parents, and administrators of the worth of these innovations. They also need to know how to compete effectively for limited school resources so their own students get necessary materials, supplies, equipment, and other tools. Frequently, in an era of shrinking school budgets, expert teachers need to be proficient at "working the system" to obtain needed services for their students. For instance, the expert teacher might befriend other teachers and administrators by serving on committees and by doing others favors when asked in anticipation of reaping later rewards. These rewards might include loyalty of co-workers and the promise of help when the expert teacher needed it. Such practical ability, or savvy, is an essential part of teaching expertise.

In summary, expert teachers have extensive, well-organized knowledge that they can draw on readily during teaching. In addition to knowledge of subject matter and of how to teach, experts have knowledge of the political and social contexts in which teaching occurs. This knowledge allows expert teachers to adapt their teaching to practical constraints in their field, including the need to become recognized as expert teachers.

An Expert Teacher's Lesson Plan

Lesson Title: The Importance of Using a Variety of Resources

WHAT

An activity and discussion designed to show students the diversity in available sources of information, the fact that many sources are interesting and fun to pursue, and the relevance of specific sources to specific subjects.

WHAT TO DO

1. Ask students to name as many different sources of information as they can. If they need help, start them off by suggesting that a textbook is a source of information. List responses on the board.
2. As a class, determine how many different kinds of sources have been listed. Some (perhaps most) will be printed matter (e.g., books, newspapers, magazines) or sources of printed matter (e.g., libraries, bookstores); others might include the World Wide Web, television, and movies.
3. Now lead students to consider more unusual resources:
   - Does this list include any people? Which kind of person could be a source of information? Does a person have to be a "certified expert" to be a source of information? (Polling and oral histories are two important sources precisely because they do not consult "experts.")
   - Does this list include any places? What kind of place might be a source of information (e.g., travel destinations, museums, stores, factories, historical sites)? Does a place have to offer or have printed materials to be a source of information?
   - Does this list include any "things" that are not printed matter or other modern media? What kinds of things can be considered a source of information (e.g., any artifact, such as an arrowhead or a collection of old photos)?
4. As a class, brainstorm another list of sources of information. This time try to focus on sources that are not composed largely of printed matter. The list might include any of these items:
   - Your mom
   - An old graveyard
   - An archaeologist at the local college
   - A moon rock
   - A foreign embassy or consulate
   - An old record album
   - Your oldest living relative
   - A neighbor who immigrated to the United States
   - Any museum (e.g., natural history, art, sports, transportation)
5. Once the brainstorm is over, go over the list and ask students to explain why they think the items are sources: What can you find out from each (e.g., your mom might be a source of information about what life was like when she was your age; a really old graveyard might be a source of information about how long average lives used to be and what kinds of names were popular years ago)?
6. To make the point more forcefully, ask students to reflect on times when they actually encountered alternative sources of information:
   - Who in the class remembers a field trip that he or she took someplace?
   - Where was it, and how was that place a source of information?
   - Does anyone ever remember having a guest speaker in the classroom?
   - How was that person a source of information?
   - Has anyone ever brought an object into class to use as a source of information (an aquarium, an exotic pet)? What was it, and what did it provide information about?
7. Explain to the students that using alternative sources requires information-gathering techniques that might be different from what they are used to. When you get information from the encyclopedia, you just look up the subject and read the articles that discuss it—not much of a challenge. But getting information from other sources is more like detective work: You have to poke around a little, ask a lot of questions, jot down clues, and consult as many different sources as you can. It takes more imagination than just reading one article, but it is also a lot more interesting. The encyclopedia is not a waste of time, though—often it is the first place you should look to find out about other possible sources of information.

(continued on next page)

FIGURE 1.2 An Expert Teacher's Lesson Plan

8. Choose a current topic on which a written assignment will be based. Have each student think of or locate three possible sources of information, and write how they would realistically go about getting information from these sources. For example:
   - Schedule an interview with a local person or expert.
   - Write to a distant person or organization and ask for a written or taped response to a written interview.
   - Visit a local site and take pictures and gather available literature.
   - Write for information about a distant site.
   - Consult a reference librarian.
   - Conduct searches using the World Wide Web.
   - Rent a pertinent video and take notes.
9. As a class, share ideas and discuss other ways of getting information from a variety of resources.

QUESTIONS TO CONSIDER

- What if you are studying an ancient civilization? Because what you are studying happened so long ago, are you restricted to sources such as books and articles? What kinds of people, places, or things can you consult if your topic is ancient?
- If you do schedule an interview with a person, what will you need to think about or do before actually conducting the interview? Examples: Is the person just going to talk? Are there any questions you specifically want answered? How will you remember what the person says—will you take notes? Tape the interview? What if you cannot get to the person? Could a telephone interview work?

10. Finish the lesson by asking the students to help you list the benefits and problems of using a variety of sources. Talk with students about how to solve or minimize the problems students anticipate.

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FIGURE 1.2 *(continued)*

A Novice Teacher's Lesson Plan

Lesson Title: Using Resources

1. Ask students which types of information they usually use to do their schoolwork, projects, and assignments.
2. Discuss with the class the range of types of information that are available. Mention the three types of information teachers most often use when researching a topic for a lecture.
3. Ask students to suggest some unusual and not frequently used types and sources of information. Sort these items into categories on the chalkboard. Ask students how they have used these sources in the past, and what they have done specifically with these sources.
4. Choose a topic for the day's assignment. Students can contribute their ideas about which topic should be chosen. Once a specific topic has been agreed on, ask each student to gather three different types of information on the topic. Stress that at least one of the types of information should be as unusual as possible. Ask students to do the assignment at home and be prepared to present their results in class tomorrow.

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FIGURE 1.3 **A Novice Teacher's Lesson Plan**

EXPERT TEACHERS ARE EFFICIENT

The second important difference between experts and novices is that experts are able to solve problems more efficiently than novices. Experts can do more in less time (and usually with less effort) than can novices. (This ability explains why Sandy was exhausted after one day on the job, but not Danielle.) How do experts accomplish this feat? First, experts automatize well-learned skills. By **automatize,** we mean that experts develop the ability to perform important tasks without thinking much about them—like the way experienced teachers know how to silence a student who is talking in the back row during a lesson without disrupting other students' concentration. Second, experts effectively plan, monitor, and revise their approach to problems.

■ **AUTOMATIZING WELL-LEARNED SKILLS** How do experts perform better than novices, and with less effort? The accepted explanation for this difference is that mental processes may be divided into those that take up a lot of thought and energy and those that are relatively easy and **automatic** (Schneider, 1999; Schneider & Chein, 2003; Schneider & Shiffrin, 1985). Certain types of mental skills may become automatic with extensive practice: What is initially difficult becomes, with practice, second nature and doesn't demand much thought or energy (Anderson, 1982; Lee & Anderson, 2001; Schneider, 1999; Sohn & Anderson, 2003). Thus, because of their extensive experience, experts are able to perform tasks effortlessly that novices can perform only with effort.

THINKING PRACTICALLY

Which automatic skills do you possess that you might apply to teaching?

SUGGESTION: Examples include driving, cooking, typing or word processing, athletic activities, dancing, drawing, and speaking different languages.

The expert driver does not need to think about fundamental driving skills such as steering, shifting, and braking. Most adults who have been driving for a few years are expert drivers and can plan their day while they drive to work. The novice driver, however, can apply driving skills only with conscious effort—to let one's thoughts turn to another event could add new complications to the day's schedule, such as completing police accident reports and filing insurance claims!

Expert teachers routinely deal with potential discipline problems before they erupt: Almost without realizing it, they mention students' names as they notice the students' attention drifting. The students' attention is thereby refocused on the lesson, but no one else even notices. In contrast, novice teachers may not perceive a problem until it becomes disruptive—as when drifting students begin talking about last night's game. By this point, the teacher has to divert time and energy from the lesson to correct the problem; the students whose attention has drifted feel exposed and possibly humiliated; and the rest of the class has been interrupted.

Remember that a teacher's ability to automatize well-learned routines goes along with having organized teaching knowledge. Consider a study of the ways expert and novice teachers monitor ongoing classroom events (Sabers et al., 1991). Expert teachers in this study did a better job than novices of monitoring fast-paced classroom events. Experts also interpreted what happened in the class in a richer, more insightful, and more meaningful way than did novices. Expert teachers made proportionately more interpretations and evaluations of what they saw and made more coherent interpretations and evaluations. For example, consider one expert's interpretation of a videotaped lesson: "I haven't heard a bell, but the students are already at their desks and seem to be doing purposeful activity, [so] they must be an accelerated group because they came into the room and started something rather than just sitting down and socializing" (Sabers et al., 1991, pp. 72–73). By contrast, a novice's interpretation was "I can't tell what they're doing. They're getting ready for class, but I can't tell what they're doing." What might explain the superior performance by the expert teacher?

Imagine that we want to emphasize the role of automatic skills in experts' superior performance. We could argue that the experiences of the expert teachers enabled them (1) to handle more information per unit time than did novices, or (2) to handle the information with less effort, or (3) to do both. This freeing up of mental energy would explain the experts' superior ability to see meaningful patterns in the events.

Now imagine that we want to emphasize the role of organization of knowledge. We could argue that the experts' experience provided them with a store of meaningful patterns corresponding to classroom situations, and that having these patterns stored in their minds made it easier for expert teachers to recognize similar patterns. For example, in the Sabers et al.

study excerpted here, the expert teachers may have had mental patterns and images of how students in an accelerated program behave when they arrive at class. Thus these experts were better able than novices to recognize what was happening in the videotape. Obviously, having both well-organized knowledge and well-learned automatic routines is helpful to a teacher who is in charge of 25 or more students.

■ **PLANNING, MONITORING AND EVALUATING** Experts also differ from novices in terms of the expert's tendency and ability to

- Plan what to do,
- Monitor students' progress, and
- Evaluate students' performance.

These types of thinking processes are sometimes called **metacognitive processes,** meaning processes in which one "thinks about thinking." When expert teachers confront a problem, they think about thinking before jumping in and starting to solve the problem. They might think about which plan or approach is more likely to work, or they might think about how one plan compares to another plan they had tried previously that failed. An expert social studies teacher deciding on a topic to assign for a book report, for example, would be likely to review past years' choices and evaluate how those choices worked, asking questions such as these:

- Which topics got students most interested?
- Which topics led to the best reports, and why?
- What can I do to make this year's reports the best ever?

This expert teacher might also ask other teachers for their input and read teaching magazines for ideas and advice on spicing up the book-report-writing process.

Research on expertise has shown that experts and novices differ in metacognitive control of thinking—in other words, experts and novices "think about thinking" differently as they solve problems on the job. How? For one thing, experts spend more time trying to understand the problem to be solved. Novices, in contrast, invest less time in trying to understand the problem and more time in actually trying out different solutions (Lesgold, 1984; Sternberg, 1981b, 1981c). Experts are more likely to monitor their ongoing solution attempts, checking for accuracy ("Am I getting closer to the correct answer?") (Ertmer & Newby, 1996; Larkin, 1985; Larkin & Rainard, 1984; Sternberg, 1998d). Experts are also more likely to update or elaborate problem representations as new constraints emerge ("I didn't realize that would happen—that changes things . . .") (Sternberg, 1998d; Voss & Post, 1988).

In one study, expert teachers were found to plan their approach to classroom discipline problems in greater depth than did novices. Experts tended to emphasize defining discipline problems and evaluating alternative explanations for the problems. In contrast, novices tended to be more solution oriented and less concerned with understanding the discipline problems (Swanson, O'Connor, & Cooney, 1990). Borko and Livingston (1989) studied how expert and novice mathematics teachers plan their lessons. In their study, the expert teachers did much more long-term planning than the novices, and the experts' plans fit the day's teaching into the overall goals and organization of a given chapter and the course in general. Experts' plans were more flexible and responsive to the different directions the class discussion might take, whereas novices' plans were more rigid—with the result that novices became more flustered when events in the classroom did not exactly follow their plans.

A great deal of interest has been expressed in "reflective practice in teaching" and its role in the process of becoming an expert teacher (Copeland, Birmingham, de la Cruz, & Lewin, 1993; Dinkelman, 2000, 2003). This focus on reflective practice in teaching is actually a focus on "thinking about thinking.: Researchers describe expert teachers as having a disposition toward reflection, which is defined as "continuous learning through experience" (Schon, 1983). Reflective teachers are considered to be those who use new problems as opportunities to expand their knowledge and competence. A number of studies have reported beneficial effects of fostering a "reflective stance" in teachers (Bean & Zulich, 1989, 1993; Bolin, 1988, 1990; see also Pollard, 1996).

THINKING ANALYTICALLY

When was the last time you "thought about thinking" as you debated in your own mind about how to solve a problem? Did it help?

SUGGESTION: Perhaps you recognized your own tendency to focus on negative outcomes of a situation. By noting this mechanism in your thinking, you became able to redirect negative thoughts. Thus thinking about thinking allowed you to improve problem solving.

One expert teacher's experience illustrates reflective practice in teaching. When this teacher, who headed the students' school magazine, forbade students to publish artwork, poems, and stories he considered in bad taste, students protested and challenged the school. Students believed their right to free speech had been violated and that the school was engaging in censorship. Parents even came in to complain. Instead of digging in his heels, this expert teacher reflected on the situation and turned it around, using the situation to advantage. He set up a series of debates for which students prepared in social studies class. He also set up an election to decide the issue, and had students practice opinion polling for credit as math projects. When it became clear his views on morality were not shared by the majority, he allowed a second school magazine to be created, giving each student the choice of whether to see and read the material he considered offensive. Had this teacher not reflected on the problem before him, his students would have lost extremely valuable learning opportunities.

■ **THE RELATIONSHIP BETWEEN AUTOMATIZING WELL-LEARNED SKILLS AND PLANNING, MONITORING, AND EVALUATING** Experts' ability to make skills automatic is related to their ability to be reflective and to think about thinking during problem solving. When skills become automatic, the saved mental resources do not simply make problem solving easier for the expert. The saved resources are not lost; instead, they become available for higher-level thinking that is beyond the capacity of the novice. Scardamalia and Bereiter (1996; see also Scardamalia & Bereiter, 2003) have found this "reinvestment" of energy and mental resources is essential to being and becoming an expert. They propose that true experts differ from experienced nonexperts in that true experts reinvest mental resources to better understand problems. Whereas novices and experienced nonexperts seek to reduce problems to fit what they already know, true experts are undaunted by complications, viewing them instead as challenges that allow them to work on the leading edge of their knowledge and skill.

THINKING PRACTICALLY

Name three ways a teacher's efficiency—or lack thereof—can affect her or his performance. Now name three ways a teacher might become more efficient.

SUGGESTION: Ways you might include, but are not limited to: time management in the classroom, quality of lesson preparation, scheduling of activities and hands-on work, and personal organization of notes, grade books, and materials.

Consider an example of an expert and a novice fourth-grade teacher confronted in September with students who seemingly will do anything to avoid math. The novice teacher may analyze the problem and conclude that the third-grade teacher last year disliked teaching math and, consequently, the students were not given much practice in math and were not shown that math can be enjoyable. The novice teacher's analysis of the problem might end here, and she or he would then use all available personal energy to review math and try to coerce the students to pay attention. The expert teacher, by contrast, would perform a far richer analysis, made possible by his or her ability to deal quickly and easily with what was obvious about the math problem (for example, that the kids hated math) while reinvesting mental energy to think more deeply about the causes for the problem.

The expert teacher would review second- and third-grade math to determine how far behind the students were. At the same time, the expert teacher would assess individual students' progress to see if everyone was far behind, or whether only the most vocal students were far behind. The expert would see that three children apparently had learning disabilities in math, and others were actually ahead for their age but too embarrassed to show it for fear of being labeled "math nerds." The expert would also notice that the talented math students apparently had not been complimented on this ability in the past, possibly because last year's teacher did not sufficiently emphasize math. This far richer and deeper analysis happens because the expert teacher is able automatically to teach her or his subject with less effort, thus having mental resources freed to develop a more complete picture of the problem, and ultimately a more effective solution.

TABLE 1.2 How Expert Teachers Learn to Be Efficient

1. Expert teachers *plan*. They *think* before they *act*.
2. Expert teachers *monitor*. They ask themselves, "How am I doing?"
3. Expert teachers *evaluate*. They identify what works and what doesn't.
4. Expert teachers *automatize*. They practice daily routines until those routines become second nature.

In summary, expert teachers are efficient problem solvers (Table 1.2). By virtue of their extensive experience, experts are able to perform many of the activities of teaching rapidly and with little cognitive effort. These automatic skills enable experts to devote attention to high-level reasoning and problem solving. In particular, experts plan and are self-aware in approaching problems—they do not jump into solution attempts prematurely. Beginning teachers must learn these behaviors with practice, just as Sandy had to learn from Danielle.

EXPERT TEACHERS HAVE CREATIVE INSIGHT

Both experts and novices alike apply knowledge and analysis to solve problems. Yet somehow experts are more likely to arrive at creative solutions to these problems—solutions that are both novel and appropriate. Identifying that a problem exists and taking the perspective that problems are meant to be solved is often called "problem finding."

■ REDEFINING PROBLEMS Experts do not simply solve the problem at hand. Instead, they often redefine the problem—that is, they do not take the problem at face value but rather cast it in a new light or see it from a new perspective. By redefining problems, experts reach ingenious and insightful solutions that somehow do not occur to others. These solutions are called insightful because they see into a problem deeply (Davidson, 1995; Mayer, 1995; Sternberg, 1996a; Sternberg & Davidson, 1995).

Consider an example of an expert math teacher in a high-pressure high school in New York City. Dan repeatedly caught a small number of students cheating on class tests. He warned the cheaters at first, but he then caught others cheating. Most teachers would probably have thought about applying discipline-oriented methods for stopping the cheating or finding ways to make tests more cheat-proof. But Dan redefined the problem. He asked himself, and the students, why they believed the cheating was going on. The answers surprised him. It turned out that parental pressure and competitiveness among students were increasing as the need to get scholarships to colleges was becoming more acute. Parents sometimes put unreasonable levels of pressure on their kids, who became pitted against one another in an "only 20 percent of us can get A's in math" game.

What did Dan do? He changed his grading system. He formulated a performance standard that he believed merited an A in his subject, and he cleared this standard with the principal and other math teachers. He announced that he did not care if every student in the class earned an A: What mattered was that the students showed mastery of the material at the level he defined. In other words, there would be no more grading on a curve. Although the students still had to know their math, Dan's strategy reduced competitiveness and increased students' tendencies to work collaboratively and study in groups for their tests. The new policy also encouraged students to ask more candid questions in class, because they no longer feared "giving away the answers and insights" to their peers. Cheating was no longer endemic in the classroom.

Thus, by redefining the problem, Dan helped shift the emphasis in his classroom away from beating out the other kids, and toward meeting a performance standard by achieving highly as a group. Compared to previous years, a higher percentage of students ended up earning A's in the class, and the average level of performance was higher than in the past. Furthermore, when the class took the statewide math examination in June, it outperformed the other classes in the school. By redefining the problem, this expert teacher had a positive impact on every student in his class.

■ THREE KEY WAYS EXPERTS THINK ABOUT PROBLEMS How and what do experts think about problems that makes their solutions more insightful than novices' solutions? Research has shown that three skills contribute to experts' arriving at more insightful solutions than do novices (Davidson & Sternberg, 1984a, 1984b, 1998). These skills are summarized in Table 1.3.

First, experts distinguish information relevant to solving a problem from information that is not relevant. For example, an expert sees that a given piece of information—which others deem unimportant—is, in fact, important. Or just the opposite occurs: An expert sees that information everyone else thinks is important really does not matter.

THINKING CREATIVELY

Describe a recent time when you had a meaningful insight.

SUGGESTION: Perhaps you recall an occasion when the solution to a problem came to you all at once—for example, noting the price per square foot for tile, you remembered from math class how to compute the area of your bathroom floor and were able to compute the cost of new tile.

THINKING CREATIVELY

Where do you think experts' insightful ideas come from? Might certain activities help teachers develop inventive ideas? Which activities might hinder the development of insight in a teacher?

SUGGESTION: Experts report obtaining insights in multiple ways: from reading unrelated materials across a range of subjects, from seeing movies, from talking to other teachers, friends, or family, and so on. Activities that place a person into a new situation or context can stimulate insightful ideas, such as taking a course on a totally new topic, whereas those that are boring or overly repetitive can hinder insights by shutting down creative thoughts.

TABLE 1.3 Three Ways Experts Think about Problems

1. Experts distinguish information relevant to solving a problem from information that is not relevant.
2. Experts combine information in ways that are useful for problem solving.
3. Experts apply to a teaching problem information acquired in another context.

THINKING ANALYTICALLY

Drawing on your own experiences as a student, suggest three ways an expert teacher for elementary school differs from an expert teacher for high school or middle school. What do you remember about your own teachers that is relevant to your answer?

SUGGESTION: Expert elementary teachers have to know about arts and crafts and the types of activities that appeal to young children. They need to know how to teach basic skills such as reading. Expert middle school teachers must deal with adolescents; they need to understand the confusion of growing into an adult in a challenging society. Expert high school teachers must be able to motivate students for the world beyond school—possibly helping them choose among different careers, vocations, or colleges. High school teachers must handle students who are becoming independent of their parents.

For example, an expert teacher can distinguish topics and patterns of discussion that will help students learn the material from ones that will merely complicate matters or take everyone off on a tangent. The expert teacher lecturing about photosynthesis sees a question about why plants need soil as an opportunity to point out that plants do not get food from soil, but rather from the air; however, this same teacher sees a question about why plants have flowers and fruits as being off-track for present purposes. This ability to know what really matters and what does not when solving problems is one reason experts tend to develop more insightful solutions to problems than do novices.

Second, experts combine information in ways that are useful for problem solving. Experts can see that two pieces of information that seem irrelevant when considered separately can become relevant if combined.

For example, an expert teacher recognizes that expensive new clothes, when combined with a drop in grades, may signal that a student is working too many hours at an after-school job. This ability to combine information to get new meaning from it is another reason experts have more insightful solutions to problems.

Third, experts apply information acquired in another context to a teaching problem. Obviously, to apply acquired knowledge, you have to acquire it first. Thus this aspect of expert thinking shows why having more and better organized knowledge is essential to being an expert. Expert teachers are adept at observing and applying an analogy to solve a problem.

For example, an expert teacher may notice a similarity between a current classroom problem, such as managing a group of bright but disruptive students, and a problem she has seen solved earlier—perhaps in a business magazine article on the shareholder rights movement. The article may have noted that heads of corporations sometimes try to assuage volatile shareholders by listing the reasons why the corporate leaders are better equipped to make decisions about the organization's future than are the average shareholders, ultimately stressing that everyone comes out ahead if the best interests of the corporation are served.

The expert teacher remembering this article borrows a few suggestions. She asks the class to brainstorm about why having someone in charge of the class is helpful to each one of them—particularly if they want to be admitted to college one day and must pass yearly examinations and get good grades. Or she asks the class to nominate the person they believe is best prepared to decide what the class should learn, with the person's qualifications being listed in terms of training and experience. Or she stresses that she and her class members all share a common interest and that by working together they can best achieve their goals.

Expert teachers frequently exploit analogies between things that are familiar to their students (for example, a crowd of people moving through a set of turnstiles) and things that are new to their students (for example, electrical resistance in DC circuits). Expert teachers are able to explore the analogy between the two items, and their ability to explore the analogy means they can come up with insightful solutions that would never occur to a novice. Again, having a lot of well-organized knowledge is essential to an expert's ability: The more knowledge a teacher has, and the better this knowledge is organized, the more likely the teacher is to see meaningful analogies between problems and to arrive at more insightful solutions.

ADVANTAGES OF EXPERTISE

In summary, expert teachers are insightful in solving problems. When solving a problem, they are able to identify information that is promising and can combine that information effectively. Expert teachers are also able to develop and refine their thinking about a problem by observing and applying relevant analogies. As a result of these types of processes, expert teachers enjoy an advantage over novice teachers. More importantly, they are able to arrive at solutions to problems that are both novel and appropriate.

There are as many different ways to be an expert teacher as there are expert teachers themselves: Expert teachers differ in their personalities and specific gifts. However, all expert teachers have more knowledge, are generally more efficient, and have more insights than novice teachers. To become an expert teacher, you will need to develop knowledge, efficiency, and insights into problems. You can develop these three skills through your work in your educational psychology course, through your work in your other courses, and through hands-on practice in teaching—and especially in student teaching working alongside experienced role models. These skills are also developed through interactions with friends, colleagues, and families.

As you develop these three expert attributes, you will become better able to show and build on your personal strengths in the context of the classroom. Depending on the level of students you will teach, the exact skills you will require may differ: An expert teacher of elementary school students may differ from an expert teacher of middle or high school students. Similarly, in the later grades and in postsecondary education, experts may differ as a function of subject taught. The social studies teacher, the art teacher, and the mathematics teacher may need to use somewhat different strategies to be expert. Nevertheless, all teachers—regardless of level or subject taught—need the features of expert teachers just discussed.

AT EVERY SCHOOL LEVEL, TEACHERS FACE SPECIAL CHALLENGES.

Katelyn Metzger/Merrill

Elementary teachers teach basic skills such as reading, but they also must know about arts and crafts and other types of activities that appeal to young children. A kindergarten teacher explains the daily schedule to her class.

Index Open

Middle school teachers deal with adolescents, so they must understand the confusion of growing into an adult in a challenging society. Here, this middle school teacher explains anatomy to a small group of students.

Anthony Magnacca/Merrill

High school teachers must be able to motivate students for the world beyond school—helping them to choose among different vocations, careers, or colleges. Here, a teacher motivates students by engaging them in analyzing newspaper coverage of a current event.

iMPLICATIONS FOR TEACHING

- **Teachers become experts by learning from experience about the content of the subjects they teach, about general methods for teaching, and about specific methods that work to teach their content areas.** There is no one magic recipe for becoming an expert: Instead, many pieces of a large puzzle must be assembled individually by each person wishing to become an expert.
- **Teachers become expert by growing in efficiency as they "think about thinking" and learn to make daily tasks and routines automatic.** Most important skills start out by seeming harder than they will appear in the future. Expertise grows over time.
- **Teachers become expert by developing their insight and ability to solve problems by understanding the important aspects of problems, understanding how other solutions in the past can be used to solve problems in the present, and understanding how to reorganize problems to make them easier to solve.** These are skills you can develop, as long as you are willing to put in the work.

What Do We Know About Expert Learners?

The discussion of what it takes to become an expert teacher is incomplete without our considering the other side of the teaching–learning cycle—what it takes to be an expert learner. Right now, as you read this book, you are striving to be an expert learner. Later, as you lead a class, you will want to help each of your students be as expert at learning as possible. What does research in educational psychology say about the characteristics of expert learners in the classroom and expert learners everywhere? Table 1.4 summarizes the seven skills exhibited by expert learners.

USE OF EFFECTIVE LEARNING STRATEGIES

One important attribute of expert learners is their use of strategies to help them learn, remember, and use information. They may acquire these strategies through direct instruction from their classroom teachers. Alternatively, expert learners may learn strategies from other students and friends by studying in groups. Parents can provide a source of strategies, as can other adults such as librarians, tutors, and even child-care professionals. Often, expert learners even invent strategies on their own. One study found that a person's level of expertise largely determines the use of learning strategies. Experts typically use strategies that aim at a deep understanding of the learning materials. In contrast, novices use weak and sparse content-related strategies that lead them to a basic understanding of the contents (Lind & Sandmann, 2003).

TABLE 1.4 Attributes of Successful Students

1. Expert learners use effective learning strategies.
2. Experts learners possess an incremental view of intelligence.
3. Expert learners have high aspirations.
4. Expert learners have high perceived self-efficacy.
5. Expert learners pursue a task to completion.
6. Expert learners take responsibility for themselves and their actions.
7. Expert learners are able to delay gratification.

■ **MEMORIZATION STRATEGIES** You have probably heard of the memorization strategy. Table 1.5 presents some of the memorization strategies found most helpful by college students. Research has shown that memorization and other learning strategies are learned in the first place; thus you can learn more and more effective strategies today for use in your adult life (Carr, Kurtz, Schneider, Turner, & Borkowski, 1989; Jones, Levin, Levin, & Beitzel, 2000; Schneider & Sodian, 1997). For example, Carney and Levin (2003) found that by cementing lower-order connections, mnemonic strategies facilitate students' learning of higher-order information.

If your own memory skills are not what you would like, you might consider taking a brief study skills course. These kinds of courses are offered at many colleges. You might also consult a textbook such as *Teaching Study Skills: A Guide for Teachers* (Devine, 1987), which reviews many effective study skills.

When you learn a new strategy for studying, through whatever means, you must work to maintain the strategy. In other words, you must use the strategy to remember it. If you are preparing for a test in history, actually use a couple of the memory strategies in Table 1.5 to learn these strategies thoroughly and keep them fresh.

Another goal of the expert student is to watch for ways to transfer strategies by using those skills with new material and in new contexts. Thus memory strategies you use to remember history facts can help you remember foreign language words, for example. Memory strategies can also help you keep track of guests' names the next time you are at a party, or remember what you need at the grocery store so you do not have to make a list.

■ **EVALUATING STRATEGIES' EFFECTIVENESS** A key point for expert students is that they will use strategies more effectively and more often if they know the strategies work (Borkowski, Levers, & Gruenenfelder, 1976; Ringel & Springer, 1980). Expert students monitor the effectiveness of their strategies by testing them to see which ones lead to increases in performance. For example, one study compared the performance of adults and children using two different strategies while learning foreign vocabulary words (Pressley, Ross, Levin, & Ghatala, 1984; see also Pressley, Levin, & Ghatala, 1988). Only after being tested on their ability to remember the words, and after being given feedback on how well they did, did the adults and children truly recognize the value of the better of the two strategies. Once they knew a given strategy worked well, these individuals continued to use it in the future. Thus the expert student must be attentive and keep tabs on gains in performance associated with different strategies. In general, students who become expert learners frequently ask themselves, "How is my current approach to studying working, and how could it be improved?" (Pressley et al., 1984).

THINKING PRACTICALLY

Name three learning strategies you have used in the past, and evaluate how well each one worked and why.

SUGGESTION: Mnemonic devices are successful tools to aid memorization. Underlining key terms helps in processing information and in studying for exams. Think-aloud protocols help in developing understanding of processes and aid in avoiding errors in reasoning.

TABLE 1.5 Memory Strategies and Their Use

- Categorical clustering: Organize a list of items into a set of categories (for example, memorizing the dairy items separately from the fruits on a grocery list).
- Interactive images: Create images that link the isolated words in a list (for example, to remember the words "car," "blister," and "tornado," picture a car with blistering paint being blown by a tornado).
- Pegwords: Associate new words with words on a previously memorized list, using interactive images (for example, the nursery rhyme, "one is a bun, two is a shoe, three is a tree," and so on).
- Method of loci: Link well-known landmarks in an area to items to be remembered (for example, visualize a car in your driveway, a tornado on the edge of your yard, and a blister in the porch paint).
- Acronym: Create an abbreviation (for example, people in therapy are counseled not to allow themselves to become HALT: hungry, angry, lonely, or tired).
- Acrostic: Form a whole sentence made out of words beginning with the letters that start the words you wish to remember (for example, Hang And Look Tough).
- Keywords: Form an interactive image linking the sound and meaning of a foreign word with the sound and meaning of the familiar word (for example, the Spanish word for cat is "gato"—you might picture a cat sitting on a gate, and later when you hear "gato" you will think of the cat sitting by the gate and remember that "gato" means "cat").

FOCUS ON: BECOMING AN EXPERT TEACHER

JANET L. PINKERTON: EASLEY ELEMENTARY SCHOOL, DURHAM, NORTH CAROLINA, GRADE 2

Jan Pinkerton has 24 years of experience teaching second grade. She received board certification as an Early Childhood Educator in 1998 from the National Board for Professional Teaching Standards, and now advises and supports other teachers as they complete the challenging certification process.

What are some characteristics of an expert teacher?

The teachers I've always looked up to have a lot of knowledge. They know children and child development, and they use age-appropriate strategies to teach. They know their curriculum well. They also know the process of learning. Elementary school teachers, for example, need to know how students learn to read and write. Expert teachers use all this knowledge to teach at the right level for the students.

The expert teachers I've known also freely display affection and kindness to the students. I believe it's important to treat students the way you would want to be treated. I still give my students hugs, although some teachers are not very comfortable doing that. I believe school should be a safe, warm, loving, encouraging place for children. The academic learning will come, but first students need to feel welcome in school.

Expert teachers model good academic behavior to their students, as well as appropriate personal and social behavior. They always behave professionally. As a board-certified teacher, I've also come to believe that it's important for teachers to be leaders in their communities, and advocates for their profession. Expert teachers make the time to talk to and encourage future teachers and to supervise student teachers, for example.

Have you noticed any characteristics that distinguish expert from novice teachers?

One of the key characteristics of an expert teacher seems to be efficient organization. Efficiency involves several aspects. First, teachers need to be constantly watching and assessing students' progress in all areas. If they are efficient, teachers find a way to record and reflect on these observations regularly. If a parent or another teacher asks a question about a student, the expert teacher has the information she needs at her fingertips.

Efficiency also means making wise use of time. Efficient teachers organize the day so that students transition easily from one activity to another. There are not a lot of ten-minute "down" times, when the teacher has nothing planned for the children to do.

These kinds of efficiency did not come naturally to me, and I don't think they come naturally for most teachers. I recommend that new teachers do everything they can to learn organizational "tricks of the trade" from experienced mentors.

Expert learners use a variety of strategies to excel. This expert learner works in a dedicated home environment in which she can study without distraction, enhancing her use of these strategies and thus her learning.

Anthony Magnacca/Merrill

An important benefit of using learning strategies is that they can sometimes help compensate for lack of knowledge. For example, beginning readers who lack a knowledge base of vocabulary words must rely more heavily on strategies such as sounding out words than do advanced readers (Forsyth, Forbes, Scheitler, & Schwade, 1998; Pressley & Afflerbach, 1995). For the college-level student who is working to build a knowledge base, effective study skills and strategies can also be helpful in overcoming a temporary lack of knowledge and in acquiring needed knowledge.

One way you can tell which strategies you are now using is through **think-aloud protocols.** Think-aloud protocols are just what they sound like: You think aloud and methodically state your steps in solving a problem or doing a task. By thinking aloud and verbalizing your steps and reasoning, you may find places where your reasoning is not sound or your strategy could be improved. Pritchard (1990) used the think-aloud technique to show that students reread and paraphrase more when they try to understand texts with unfamiliar versus familiar material.

Presumably, these strategies (rereading and paraphrasing) helped students process and understand unfamiliar material. Even when students have knowledge relevant to a task, use of strategies can improve their performance. Prior knowledge definitely enhances learning on a topic, but strategy use can enhance learning still more (Woloshyn, Pressley, & Schneider, 1992). Table 1.6

What can readers of this textbook do to become expert students and preservice teachers?

There are several ways students might begin preparing for their teaching careers. First, collect every bit of information that comes your way. Experience will tell you later what you can safely discard, but in the meantime, you should prepare for anything. For example, I would recommend that elementary school teachers read all the children's literature they can find. Get the American Library Association's list of award-winning books, and read them.

College is also the best time to study the experts in the field where you'd like to work. It's vital to understand theories of learning, and read the most recent research available in your field. As a practicing teacher, you may not have as much time to study the research in detail, so it's important to have thorough background knowledge that will help you follow new directions in education.

Finally, keep an open mind about what kind of school you want to go to. Don't be biased by preconceived ideas. You may have heard a lot about the difficulties of teaching in underfunded schools, or in inner-city schools, but an inner-city school may actually end up being a wonderful teaching experience for you.

What other advice do you have for new teachers?

I would advise new teachers to seek out their colleagues. There is a big danger of isolation in the first year. New teachers may feel that they are all alone in their classroom and that only the principal knows if they are sinking or swimming. This is a horrible situation to be in. Other teachers are usually willing to help you, but they have a lot to do. They may not come to you, so you have to go to them. Don't be afraid to do it.

My hope at the end of the year is that every child feels it has been a special year with a teacher who thinks they were wonderful in some way.

Even more important is how you relate to the children. Sometimes, teachers start their first year with a very idealistic feeling that they will love every child they teach. Then, they may be distressed when they find a child that they just do not like. It can be difficult to love a child who misbehaves a lot or one who is socially awkward. Teachers need to know that they won't love every child, and that it's okay to feel that way. But they also need to learn to ignore those feelings. Teachers must go into the classroom committed to treating every child fairly and justly. I also strive to find something positive about every child, something special that makes that child stand out from the others. A teacher can build on that. My hope at the end of the year is that every child feels it has been a special year with a teacher who thinks they were wonderful in some way.

describes some helpful general learning strategies, adapted from research by Williams, Blythe, White, Li, Sternberg, and Gardner (1996).

INCREMENTAL VIEW OF INTELLIGENCE

Many students believe that intelligence is something they are born with, that some students have more intelligence than others, and that there is not much they can do to increase their intelligence. (Maybe you are one of these students.) Fortunately, research has shown that intelligence can be increased (Nickerson, 1994; Nickerson, Perkins, & Smith, 1985; Sternberg, 1997a, 1997b, 1998b, 1998c, 1999c, 2003, 2006; Wagner & Sternberg, 1984). Obviously becoming an expert student is easier if one believes that intelligence can be increased through training and effort. In fact, some researchers have shown that motivation to achieve is linked to the belief that intelligence can be increased—an **incremental view**—as opposed to the belief that intelligence is fixed—an **entity view** (Brophy, 1998; Dweck & Leggett, 1988; Henderson & Dweck, 1990).

Carol Dweck (e.g., 1999a, 1999b, 2002) argues that feedback teachers give to students can mold their beliefs about their intelligence and, in turn, their motivation and achievement. Dweck focuses on students' "theories" about their intelligence. She contrasts two theories: the belief that intelligence is a fixed trait that cannot be developed versus the belief that intelligence is a malleable quality, a potential that can be cultivated. Dweck suggests that these theories of intelligence can be changed to increase motivation and achievement.

THINKING ANALYTICALLY

What type of evidence would you require to believe your own intelligence in an area had improved?

SUGGESTION: Higher test scores, better understanding of teachers' and other students' classroom comments, enhanced interest in subject matter, improved writing about the topic, recognition from teachers and peers that performance has improved.

Why is an entity view unproductive for students? Students who believe intelligence is fixed tend to take negative evaluations of their abilities and performance very personally, seeing these evaluations as signs that they simply are not intelligent enough to succeed. As a consequence, students with an entity view tend to avoid situations in which they might get

TABLE 1.6 General Strategies for Improving Learning and Performance

Knowing Why	Knowing Self	Knowing Differences	Knowing Process	Reworking
Why does school exist? Why should students learn to read, write, do homework, or take tests? To succeed in school, students need to know what the purposes of various school tasks are, how learning is relevant to their lives now, and how they can use it to improve their lives later. Students and teachers should ask: ■ What are the purposes of reading in and out of school? ■ How is reading more or less effective than other ways of getting information? ■ What are the purposes of writing in and out of school? ■ What are the differences between written information and other types of information? ■ What is the purpose of homework? ■ How does homework relate to other work in and out of school, now and later? ■ What are the roles of tests in and out of school? ■ How does testing relate to other class work?	What are the student's personal strengths, weaknesses, habits, and interests? Self-assessment techniques can help students understand their own work habits and intellectual preferences, and then focus on how to capitalize on strengths and compensate for weaknesses. Students should: ■ Recognize current reading patterns and preferences. ■ Identify personal strengths and weaknesses in terms of reading. ■ Recognize current reading practices. ■ Recognize current writing practices. ■ Identify personal strengths and weaknesses in terms of writing. ■ Know how to incorporate personal interests and expertise into writing assignments. ■ Recognize current homework practice. ■ Identify personal strengths and weaknesses in terms of homework. ■ Recognize current study strategies and test-taking practices. ■ Identify personal strengths and weaknesses in terms of testing.	How do school subjects differ from one another in content, learning process, and typical testing format? How is studying for a math test, for example, different from studying for social studies? How are the demands of schools similar to and different from life outside of school? As students recognize the connections and distinctions among these different kinds of work, they can begin to vary their strategies and working styles appropriately. Students should: ■ Understand the different kinds of written material, and their different purposes, and know reading approaches that are appropriate for each. ■ Know how to write for different types of assignments and audiences. ■ Know different styles of and strategies for writing. ■ Know the homework requirements for different classes. ■ Understand the different kinds of homework and the different approaches that are appropriate for each. ■ Recognize different kinds of tests and test questions, within and across subjects. ■ Know what each test can and cannot determine about the test taker. ■ Know different strategies that are appropriate for each test.	What should a student do when stymied? Which steps (such as making plans and using resources) are involved in completing school tasks? As students focus on process—that is, recognizing and defining problems for themselves—they can plan effective strategies, locate and allocate resources, and use what they know to accomplish their work. Students should: ■ Know strategies for reading actively. ■ Know how to get unstuck. ■ Understand how writing involves planning and organization. ■ Know strategies and resources to overcome difficulties in writing. ■ Get organized. ■ Know and use resources. ■ Incorporate personal interests, talents, and past experience into the work. ■ Understand that long-term preparation is necessary to prepare for tests. ■ Know both long-term and short-term strategies for test preparation, as well as strategies for solving problems during actual test taking.	Is the first draft of an assignment the best one? Probably not. Taking time to go over work does not always seem worth it, but successful students recognize the importance of self-monitoring and reflection. Reworking pays off. Students should: ■ Understand the purpose of rereading. ■ Develop strategies for rereading effectively. ■ Understand the importance of revision. ■ Know how to revise. ■ Understand the purpose of reworking homework. ■ Develop strategies for going over homework and checking for errors. ■ Use the results of tests as an opportunity for self-reflection and a stepping-stone toward more productive learning and test taking.

Source: From *Practical Intelligence for School* by W. M. Williams, T. Blythe, N. White, J. Li, R. J. Sternberg, and H. I. Gardner. Copyright © 1996. Reprinted by permission of Addison-Wesley Educational Publishers, Inc.

negative feedback; thus they tend to avoid challenges. Failure is often debilitating for these students. They are left feeling, "Why bother? I'm just not smart enough to do any better."

Consider, however, the perceptions of students with an incremental view. These students see corrective feedback as an indication that more work and effort are needed to remediate the weakness. They respond to failure by working harder in the future. They seek out challenges because these challenges represent learning experiences. This pattern of findings about the consequences of entity versus incremental views of intelligence has emerged from the work of many researchers (Blackwell, Trzesniewski & Dweck, 2007; Dweck, 1999a, 1999b, 2002; Dweck & Leggett, 1988; Elliott & Dweck, 1988; Henderson & Dweck, 1990; Meece, Blumenfeld, & Hoyle, 1988; Wood & Bandura, 1989).

One particularly interesting study of the role of students' conceptions of intelligence in their performance was conducted by Ames and Archer (1988). Ames and Archer called incremental beliefs **mastery-oriented beliefs,** because the students with these beliefs were concerned with mastering material. Entity beliefs were called **performance-oriented beliefs** because students with these beliefs were concerned with performing well. Students with mastery-oriented beliefs, as compared with students having performance-oriented beliefs, used more strategies and more effective strategies in their schoolwork, were more open to challenging tasks, had a more positive attitude, and were more likely to believe that effort was the key to improvement in performance. Thus mastery-oriented beliefs were clearly superior to performance-oriented beliefs.

Consider some of the statements mastery-oriented students agreed with: "Making mistakes is a part of learning"; "I work hard to learn"; and "Students are given a chance to correct mistakes." Now consider some of the statements performance-oriented students agreed with: "Only a few students can get top marks"; "I really do not like to make mistakes"; and "I work hard to get a high grade" (Ames & Archer, 1988, p. 262). Perhaps it is not surprising that adolescents' implicit theories about the nature of intelligence (entity versus incremental) predict their achievement over time, with those believing that intelligence is malleable improving their school grades over time, and those believing intelligence is unchangeable not gaining or even decreasing their academic performance over time (Blackwell et al., 2007).

Happily, research has shown that priming students holding entity views of intelligence with mastery goals (as opposed to social comparison goals) improves these students' performance (Thompson & Musket, 2005). A substantial body of research indicates that focusing on effort and hard work as a route to mastering material is the hallmark of the expert student. From the point of view of the teacher, success for all students becomes possible only in a learning environment focused on mastery of material.

HIGH ASPIRATIONS

Markus and Nurius (1986) have pointed out that our beliefs about what we can become in life are important motivators that propel us toward future accomplishments or, conversely, limit our efforts and accomplishments (see also Elliot & Thrash, 2001). Expert students have high aspirations: They believe they can achieve highly in life, and they work to make these achievements happen. Expert students believe they can succeed in life if they work hard. Although it is true that aspirations have to be realistic—not all of us can become astronauts or star professional athletes, for example—high aspirations tend to be positive motivators in students' lives.

Even when discrimination, poverty, or immigration status might limit students' participation in education, students can be encouraged to develop realistically high aspirations to increase their chances for success. For example, in one study (Day, Borkowski, Dietmeyer, Howsepian, & Saenz, 1992), researchers stressed to Mexican American students the steps involved in making it through the educational process, as well as the rewards, such as good jobs and steady income, that result from completing school. The researchers taught the students that paths to success are always full of obstacles that must be overcome. The students in this study earned higher grades and had greater expectations of future success than did students who were not part of the study. As these results demonstrate, teachers need to stress to their students the many steps involved in making it through school. Students espe-

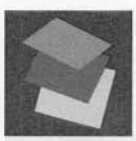
cially need to know that paths to success are always full of obstacles. In addition, they should know the rewards of completing school, such as good jobs and income.

Another interesting study on this topic looked at educational aspirations of Palestinian high school students in Israel. The results showed that, despite being disadvantaged, this group of students had high educational aspirations. In other words, they were not doomed due to their low socioeconomic status (SES) and minority status. These students' perceptions of the importance of education and of the available opportunities for success within the education system and the job market determined whether they developed high educational aspirations or adopted low ones (Khattab, 2003).

HIGH PERCEIVED SELF-EFFICACY

Expert students have high perceived **self-efficacy:** They believe they are capable of succeeding in school (e.g., Bandura, 1986a, 1986b, 1995; Bandura et al., 1996; Zimmerman, Bandura, & Martinez-Pons, 1992). The feelings of competence that define self-efficacy are very important. For example, Albert Bandura and his colleagues (Bandura, Caprara, Barbaranelli, Gerbino, & Pastorelli, 2003) have found that self-efficacy to regulate positive and negative emotions and feelings is accompanied by high efficacy to manage one's academic development, to resist social pressures for antisocial activities, and to engage oneself with empathy in others' emotional experiences.

Dale Schunk (e.g., 1991a, 1991b, 1995; see also Schunk & Pajares, 2002; Schunk & Zimmerman, 2007; Zimmerman & Schunk, 2001) argues that perceived self-efficacy—that is, students' personal beliefs about their capabilities to learn or perform behaviors at designated levels—plays an important role in their motivation and learning. Self-efficacy affects choice of tasks, effort, persistence, and achievement. Students' self-efficacy is influenced by their personal accomplishments, direct and indirect or observed experiences, social interactions, and physiological factors. When beginning to learn something new, students have goals and a sense of self-efficacy for attaining them. Over time, students' self-evaluations of learning progress sustain their self-efficacy and motivation. In general, students who believe they are capable of succeeding in school attempt more challenging tasks and achieve more academically as they progress through school (Schunk, 1996a). Students with high self-efficacy are more likely to engage in activities, work harder, persist longer when they encounter difficulties, use effective learning strategies, and demonstrate higher achievement (see Pintrich, 2004; Wolters, 2004; Wolters & Daugherty, 2007). Happily (for teachers and students alike), self-efficacy can be



THE FLEXIBLE EXPERT

DEVELOPING TEACHING AND LEARNING EXPERTISE

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Sam sits down at the end of the week and evaluates which lessons worked the best for his students, which did not work well, and why.

THE CREATIVE TEACHER: Sam cuts the teacher of the week profile out of his teaching newsletter, and he adapts three ideas from the profile to use in his own classroom.

THE PRACTICAL TEACHER: Sam watches and listens to his colleagues, and listens to what students say about his colleagues, in order to learn from his colleagues' accomplishments and mistakes.

THE ANALYTICAL STUDENT: When Jamal recognizes his work is slipping, he reviews a list of key study habits (handed out by his teacher) in order to determine what he is doing wrong.

THE CREATIVE STUDENT: Jamal challenges himself by writing down and striving to meet different goals on a day-to-day basis to keep his study time from becoming boring and repetitive.

THE PRACTICAL STUDENT: Jamal organizes study groups with his friends, in which they help one another and push each other to work harder.

positively influenced through effective intervention (Schunk & Ertmer, 2000; Schunk, 2003). As you would expect, previous success at an activity increases perceived self-efficacy—nothing succeeds like success. In addition, positive social role models can have an effect on perceived self-efficacy, especially encouraging role models who demonstrate how to succeed at a given activity (Schunk, 1990, 1991a, 1991b).

Self-efficacy tends to be found in particular domains, however (Bong, 2004). In other words, it is rarely experienced for everything one might possibly attempt. For example, students often have high self-efficacy in one subject (such as math) and low self-efficacy in another subject (such as English), and this self-knowledge tends to be accurate and reflective of students' areas of strong and weak performance (Marsh, 1992; Marsh & Craven, 1991; Wolters & Pintrich, 1998). A practical suggestion for students seeking to become more expert in a particular area is to focus on good performances in areas already mastered to bolster confidence and enhance effort when confronting a weaker area.

Another important finding about self-efficacy is that people tend to tolerate failures better when they have a previous record of success in an area—but that failure can be devastating to self-efficacy when it accompanies a first try at a new goal (Bandura, 1986; Schunk, 1991). These findings about self-efficacy make sense: Students tend to be more vulnerable to failure and criticism when they try something new compared with when they try to move up a level in doing something they can already do well. For this reason, it is important to create a record of success for yourself when you work at developing proficiency in an area. Taking on too much too soon can lead to early failure and the belief that you just are not capable of succeeding, when, in fact, if you had taken on a smaller portion of the task, you would have succeeded.

What about long-term effects of high self-efficacy? One study looked at academic self-efficacy beliefs and grades in school at the ages of 12–15 as predictors of unemployment and job satisfaction at age 21. Individuals with high self-efficacy beliefs and better grades were less likely to become unemployed and more likely to be satisfied with their jobs (Pinquart, Juang, & Silbereisen, 2003). Increasing students' self-efficacy should be at the top of the list for every expert teacher.

THINKING PRACTICALLY

Name three things you can do to improve your perceived self-efficacy.

SUGGESTION: Study, work hard, achieve more. Keep records of achievements. Seek out feedback—work for good results, and keep reminding yourself of past successes.

PURSUIT OF A TASK TO COMPLETION

We have just finished explaining that expert students have high perceived self-efficacy. One reason is that they see tasks through to completion: These students get things done without getting stuck in the middle. Often, students know how to get started on a task, but then, in the middle of the task, they lose momentum—perhaps because of frustration, inability to find necessary information, slow rates of progress, or other factors—and fail to finish. Expert students use many different methods to help them navigate these stumbling blocks and see tasks through. Let us consider some of these methods.

Lyn Corno (1994, 2000, 2001) studied student **volition,** which she defined as the tendency to continue to pursue a goal once the student began to take action to reach that goal. Corno studied how students could increase their rate of completion of tasks to ensure that they met their goals. She noted that, to increase their volition, students need to know how to control and monitor their attention to tasks and to eliminate distractions. One way for students to control attention and eliminate distractions is to generate their own verbal self-instructions to keep on task (Pressley, 1979; see also Rath, 1998). For example, students can tell themselves to ignore distractions at the first sign of these distractions. Expert students must also know how to manage their study time: They must know when to take breaks and when to push on (Corno, 1989). Knowing when a break is needed to improve effectiveness of learning comes with experience; however, it is important for students not to confuse needing a break with being lazy.

To see tasks through, expert students must also know how to control anxiety and regulate themselves (Boekaerts & Cascallar, 2006; Boekaerts & Corno, 2005). Students can control anxiety by reminding themselves to remain calm and focused on a given task (Corno, 1989). Another skill that expert students need is knowing how to motivate themselves. Self-motivation is enhanced if students visualize successful completion of a task and focus on the

THINKING PRACTICALLY

Name five strategies you can use to increase your ability to see tasks through to completion.

SUGGESTION: Make a list of all steps necessary to complete the task; set aside a specific amount of time each day to work on the task; visualize yourself being successful; gain motivation by talking to others who have done the task before; decide on a tangible reward you will allow yourself once the task is completed.

rewards successful completion will bring. Students can also rehearse positively affirming statements, such as "I know this material, and I'll succeed next time," "I am capable of doing well on this task," "I can do as well as anyone else if I try hard," and so on.

In general, to become expert learners, students must develop strategies for improving performance and then try out these strategies. If we ask expert students about the types of learning strategies they use, we find these strategies share certain aspects, such as knowing oneself and, particularly, knowing one's preferred working conditions; knowing how to motivate oneself; knowing how to overcome roadblocks and obtain assistance from others when necessary; knowing how to locate information and resources; and knowing how to gauge when work is ready to be handed in. Expert students must also learn to control their environments as much as possible and to remove or reduce distractions—even creating specific environments explicitly designed to enhance their learning and use of strategies (Corno, 1989, 1992; Pressley, 1995). In summary, expert students can learn strategies to help them succeed and, by applying these strategies, increase their ability to see tasks through to completion.

THINKING ANALYTICALLY

Do you have a more internal or a more external responsibility pattern?

SUGGESTION: Ask yourself if you tend to respond better to others' demands and expectations and to outside forces such as school deadlines or, rather, to your own push to excel and succeed and your own list of goals.

RESPONSIBILITY FOR SELF AND ACTIONS

Part of being an expert student is taking responsibility for yourself—both for your successes and for your failures. Expert students must be willing to take control of a task, to criticize themselves, and, conversely, to take pride in their best work. Unfortunately, many students fail to become expert learners because they always look for outside causes for their failures (for example, teachers, other students, or illnesses).

People differ widely in the extent to which they take responsibility for the causes and consequences of their actions. In classic work that is still influential today (e.g., Smith, Trompenaars, & Dugan, 1995), Rotter (1966) distinguished between two personality patterns, which he refers to as **internal** and **external.** Internals are people who tend to take responsibility for their lives. When things go well for them, they take credit for their efforts; when things do not go well, they tend to take responsibility and try to make things go better. Externals, in contrast, tend to place responsibility outside themselves, especially when things do not go well. They are quick to blame circumstances for their failures (and often to attribute their successes to external circumstances as well). Expert students tend to be more oriented toward the internal side of Rotter's continuum.

One study looked at how students evaluated a fellow student who was caught cheating on an exam (Wallis & Kleinke, 1995). The cheater was looked upon more favorably when he accepted responsibility for his actions rather than offering an excuse, and harsher punishment was recommended by raters who had an internal locus of control. Another study found that between 1960 and 2002, young Americans increasingly believed their lives to be controlled by outside forces rather than by their own efforts (Twenge, Zhang, & Im, 2004). The implications of this study are disheartening, because external locus of control is associated with poor school achievement, helplessness, ineffective stress management, decreased self-control, and depression.

Of course, almost no one is purely internal or external. Moreover, all of us know people who accept credit for their successes but who blame others for their failures, or who never credit themselves for their successes but who do blame themselves for their failures. The most realistic people recognize that both success and failure come about as an interaction between our own contributions and those of others.

THINKING CREATIVELY

How good are you at delaying gratification? What inventive strategies might you use to help?

SUGGESTION: Ask yourself how long you can wait for a reward—whether a chocolate bar if you are hungry and crave candy, a new pair of athletic shoes once your best friend buys some, or a merit recognition award from your school that requires months of work to earn.

ABILITY TO DELAY GRATIFICATION

Part of being an expert student is being able to work on a project or task for a long time without immediate rewards. Students must learn that rewards do not always come immediately: To be expert, they must learn to delay gratification, because there are clear benefits of doing so. Many students believe they should be rewarded immediately for good performance. However, the greatest rewards in life are often those that come in the distant future, and expert students understand this fact.

In a series of studies extending over many years, Walter Mischel has found that children who are better able to delay gratification are more successful in various aspects of their lives, includ-

ing their academic performance (see, for example, Mischel & Ayduk, 2004; Mischel, Shoda, & Rodriguez, 1989; Peake, Hebl, & Mischel, 2002;). Mischel and his colleagues (Mischel, Ayduk, & Mendoza-Denton, 2003) have conducted a program of research both to demystify and to elucidate the psychological mechanisms involved in long-term goal commitment and the pursuit of temporally delayed but valued outcomes or goals. Much work has been done on children's willpower—another way of referring to the ability to delay gratification. Mischel speaks in terms of the interaction between two systems operating within all of us: a hot, impulsive, "go" system and a cool, cognitive, "know" system. Such systems allow us to control impulsive behaviors and pursue worthwhile but far-off goals by putting in hard work in the present. Interestingly, Mischel also believes that these systems control delay of gratification in social, interpersonal contexts.

In a typical study, Mischel places young children in a room and gives them a choice between an immediate but smaller reward and a later but larger reward. He puts various temptations in their paths. It is harder to resist temptation if the immediate reward (for example, a chocolate bar) is visible than if it is hidden. The ability of children to delay gratification can even predict their scores on the SAT when they are much older. Thus we see that rewards for delaying gratification can sometimes surface years in the future. The lesson for expert students is clear: It is essential to learn to see tasks through without immediate rewards.

iMPLICATIONS FOR TEACHING

- **Expert teachers work to help their students become expert learners.** They recognize that development of expertise in any area is a process that takes time, patience, and hard work.
- **Expert students use strategies to help them learn, know that intelligence can be increased, have high aspirations and see themselves as capable of achieving these aspirations, see tasks through to completion, take responsibility for themselves and their actions, and understand the value of delaying gratification.** These are some of the many characteristics that distinguish the most effective from less effective students.

How Educational Psychology Helps Create Expert Teachers and Learners

This book contains much information about how to become an expert teacher in your career and an expert learner right now as you take this course and study this book. But the things we write about are not simply our own beliefs about what works in the classroom. Instead, we focus on what the broad field of research in **educational psychology** has revealed over many years of systematic study and observation of effective teachers and learners. The goal of the science of educational psychology is to take knowledge from the discipline of psychology that is relevant to education and to apply this knowledge to improve the quality and outcome of the educational process. Research in educational psychology seeks to find scientific answers to questions about the best ways to educate people. For example, educational psychologists might study whether special classes for talented and gifted students are the best way to educate these students, or they might study whether peer tutoring (when one student helps another) improves the performance of the students. Thus research in educational psychology answers questions asked by teachers and other education professionals about the best way to do their jobs.

Educational psychologists begin by posing questions of interest to them and coming up with possible answers or explanations. These explanations, which are sometimes called hypotheses, are then tested in a systematic way to find out which ones are accurate. An important part of a fair testing process is that a person's hypotheses may be shown to be

wrong. By studying the hypotheses that turn out to be on target, educational psychologists develop guiding **principles.** Such principles answer groups of questions on the same topic, thereby describing well-known and established relationships between events. For example, a principle you are probably familiar with is that home preparation and study time are important to reinforce material learned in the classroom.

Once several principles have been uncovered regarding a particular topic, researchers sometimes develop a **theory** from these principles. Theories are scientific explanations for why events happen the way they do; theories also allow us to predict events in the future. An example of a theory in educational psychology is the idea that external rewards and punishments are important in shaping students' studying behavior and subsequent performance on tests.

Theories developed by different researchers may differ in their explanations and predictions. Thus one person might conclude that rewards and punishments are what makes a student work hard, whereas another person might conclude that the student's inner need to achieve and excel are what makes the student work hard. Theories are different ways of seeing the world and explaining events; thus competing theories often explain the same events, but do so in different ways.

Some educational psychologists conduct individual studies that try to answer specific questions. Other educational psychologists synthesize the results of many such studies and try to unite the outcomes of these studies into a coherent whole with a unified explanation. Conducting individual studies and compiling overviews of other scientists' studies are both important mechanisms in the development of effective principles and theories.

Educational psychologists conduct directly two types of studies to answer specific questions: descriptive research and experimental research. Both descriptive research and experimental research provide answers to questions about how best to educate students, and both types of research are valuable and important ways to gain information about how to become an expert teacher and how to help students become expert learners.

DESCRIPTIVE RESEARCH

In **descriptive research,** the scientist observes and describes what is happening in a situation without changing the dynamics of the situation. For example, a researcher might observe a class of students with learning disabilities who are receiving specialized instruction in reading in an attempt to uncover which specific approaches by the teacher result in better learning, and whether students with mild, moderate, or severe learning disabilities benefit similarly or differently from the various teaching approaches. The researcher might, for example, watch the class one day per week over a period of several months. Descriptions of individual students' disabilities and progress, the students' test scores, and information about what programs the teachers used can then be analyzed to determine if any patterns or relationships exist.

The researcher might be interested in whether students with severe learning disabilities respond to specialized instruction differently from those with mild learning disabilities. To answer this question, the researcher assesses whether a correlation exists between the student's degree of learning disability (mild, moderate, or severe) and his or her score in reading. A **correlation** is a relationship between two measured things. A **positive correlation** means that when one of the things increases, the other also increases. A **negative correlation** means that when one of the things increases, the other decreases.

In the example of the children with learning disabilities, a positive correlation would indicate that as a child's degree of learning disability increases, so does his or her score in reading (in other words, a student with a severe learning disability would score higher in reading than would a student with a mild learning disability). A (more likely) negative correlation would indicate that as a child's degree of learning disability increases, his or her score in reading decreases (in other words, students with severe learning disabilities would score lower in reading than would students with mild learning disabilities). When researchers compute correlations on the data they collect, they try to determine whether the results are **statistically significant;** that is, the results are unlikely if only random or chance variation were operative.

Some descriptive research can take the form of a **case study,** an in-depth observation of one individual. For example, many classic case studies describe highly gifted inner-city teach-

THINKING ANALYTICALLY

How would you study the effects of students' aspirations on their ultimate success? What are the important factors to consider in studying the effects of students' aspirations on what happens to these students later in life?

SUGGESTION: Chart the progress of a large group of students while regularly having them complete questionnaires about their aspirations and goals. Assess whether students with high aspirations are more successful. Remember that high aspirations may be the result of early success and demonstrated ability, which in turn leads to further success. Thus looking at the future success of students who have been equally successful so far but who have different levels of aspirations will tell more about the role of aspirations in the future.

ers who, despite a lack of money and resources, nevertheless consistently produce outstanding and highly motivated students who go on to great achievements.

EXPERIMENTAL RESEARCH

Experimental research differs from descriptive research in that the scientist designs a test to answer a question and actually changes what happens to people so the effects can be observed. For example, a researcher might separate the students with learning disabilities at random into two groups; the teacher would then be asked to use his usual approach with one group and another, experimental approach with the other group. By comparing the test scores of the students in the two groups, the researcher can determine whether the experimental method of instruction worked better than the usual approach.

To say that one method worked better, the two groups of students must be roughly equivalent at the beginning of the experiment. One way to ensure this equivalency is to use **random assignment** for all students into both groups in the study. In random assignment, a student's likelihood of ending up in one group is equal to her or his likelihood of ending up in the other group. The students or people in experiments are sometimes called **subjects** (or participants).

The important thing to remember about experimental research is that scientists get actively involved and change what happens to people as part of their attempt to assess the effects of these changes. The groups of people who undergo such change by researchers are sometimes called **experimental groups.** Groups of people for whom nothing experimentally relevant is changed are called **control groups.** The purpose of including control groups in a study is to compare their outcomes with those of the people in the experimental groups (for whom something experimentally relevant was changed).

THINKING ANALYTICALLY

Which types of questions are better answered by descriptive research? By experimental research?

SUGGESTION: Experiments work best when it is both ethical and feasible to assign subjects—in the case of educational psychology, students—to different classrooms, methods of instruction, textbooks, activities, and so on. Then the students' progress can be compared. Descriptive research works best when we wish to understand the subtleties and methods of a single great teacher or other working system that cannot be manipulated.

*i*MPLICATIONS FOR TEACHING

- **Educational psychology uses science to uncover information that helps teachers solve problems and teach effectively.** Educational psychology is not simply folk wisdom or people's intuitions about teaching.
- **Educational psychology uncovers trends in how teachers teach and how students learn, and develops explanations for these trends so teachers can understand what happens in the classroom and why.** It can be a powerful tool for anyone wishing to develop teaching expertise.
- **Teachers can learn from descriptive research and case studies as well as from experimental research performed by educational psychologists and other scientists.** Many useful sources of valuable information are available about how to teach.

SUMMING IT UP

WHAT IS AN EXPERT TEACHER?

- We know a lot about what makes teachers expert. Expert teachers use reflective thinking to understand what they do right and wrong and how to improve. They have expert knowledge and more insight, although they do not necessarily have better memories or greater intelligence than novice teachers. Expert teachers also identify pertinent information that can help in solving a problem, and they combine this information effectively and use analogies to develop and refine their thinking.
- Three types of knowledge are important to expert teachers: content, pedagogical, and pedagogical-content knowledge. Also essential is the ability to automatize well-learned skills; having automatic skills allows teachers to get more done in less time and with less conscious thought. Finally, teachers who are experts plan what to do, monitor their progress, and evaluate their performance toward a goal.

WHAT DO WE KNOW ABOUT EXPERT LEARNERS?

- We also know something about what makes students expert. Expert students use and evaluate learning strategies to help them achieve their learning goals. Students with high self-efficacy believe they are capable of succeeding in school.
- According to the incremental view of intelligence, intelligence can be increased. In contrast, the entity view claims that intelligence is fixed or unchangeable. Expert students believe intelligence can be increased, and they focus on mastering material instead of on performing well by pleasing the teacher and getting high grades. These students' beliefs are called mastery-oriented beliefs. Students whose main concern is performing well on tests and in class are said to have performance-oriented beliefs.
- Expert students have high aspirations and high expectations of their ability to succeed in school. They also have volition: They see tasks through to completion. In addition, expert students are characterized by an internal personality pattern, meaning that they take responsibility for themselves and their actions. This pattern contrasts with the external personality pattern, in which people blame circumstances for their failures. Finally, expert students understand that they must delay gratification and work to achieve goals in the future.

HOW EDUCATIONAL PSYCHOLOGY HELPS CREATE EXPERT TEACHERS AND LEARNERS

- Educational psychology draws from the general discipline of psychology to improve the quality and outcome of the educational process. As a science, educational psychology develops principles and theories about learning and instruction.
- Both descriptive research and experimental research are important ways to collect information. Subjects are the people who participate in scientific experiments. In sound scientific experiments, the subjects for each group or condition are chosen at random.
- Correlations show relationships between measured things. Statistical significance means the relationship is unlikely if only chance variation is operative. In a positive correlation, when one of two things increases, the other also increases. In a negative correlation, when one of the things increases, the other decreases. Control groups and experimental groups enable a researcher to test the effect of a specific change in the teaching environment.

KEY TERMS AND DEFINITIONS

- **Automatic** Mental processes that have become well learned and require little effort. Page 14
- **Automatize** Learn to perform important tasks without devoting much thought to them. Page 14
- **Case study** In-depth observation of one individual. Page 30
- **Control groups** Groups of people in an experiment for whom nothing experimentally relevant is changed. Page 31
- **Correlation** Relationship between two measured things or attributes; more exactly, the extent to which two or more measurements tend to vary together. Page 30
- **Descriptive research** Research in which the scientist observes and describes what is happening in a situation without changing the dynamics of the situation. Page 30
- **Educational psychology** Science that draws from psychological knowledge that is relevant to education and applies this knowledge to improving the quality and outcome of the educational process. Page 29
- **Entity view** Belief that intelligence is fixed. Page 23
- **Experimental groups** Groups of people for whom the scientist changes what happens. Page 31
- **Experimental research** Research in which the scientist gets actively involved and changes what happens to people so as to assess the effects of these changes. Page 31
- **Expert learner** Student who uses strategies to learn efficiently and who is open to challenges and willing to overcome problems to achieve learning goals. Page 5
- **Expert teacher** Teacher who uses a broad base of organized knowledge and experience efficiently and creatively to solve the many kinds of problems that occur in educational settings. Page 4
- **External personality pattern** Tendency to place responsibility outside of oneself (i.e., to blame outside circumstances). Page 28
- **Incremental view** Belief that intelligence can be increased. Page 23
- **Internal personality pattern** Tendency to take personal responsibility for events. Page 28
- **Mastery-oriented beliefs** Focus on meaningful learning and understanding of material. Page 25
- **Metacognitive processes** Processes used in deliberately thinking about how one thinks, often in an effort to improve one's thinking. Page 15
- **Negative correlation** Relationship between two measured things such that as one increases, the other decreases. Page 30
- **Performance-oriented beliefs** Beliefs that focus on performing well and obtaining good grades on tests and in class. Page 25
- **Positive correlation** Relationship between two measured things such that as one increases, the other also increases. Page 30
- **Principles** Well-known and established relationships between events. Page 30
- **Random assignment** Process in which experimental subjects are placed in groups with every person having an equivalent chance of being placed into a given group. Page 31
- **Reflective thinking** Thinking about one's actions and attempting to understand what one is doing right and wrong and why. Page 7
- **Self-efficacy** Belief that one can accomplish what one desires to accomplish. Page 26
- **Statistically significant** Relationship between measured quantities that is unlikely if only chance variation is operative. Page 30

- **Subjects** People who participate in scientific experiments. Page 31
- **Theory** Systematic statement of general principles that explains known facts or events. Theories state the relations among sets of events so one can predict events in the future. Page 30
- **Think-aloud protocols** Output of a procedure in which a person thinks aloud and methodically states the steps in solving a problem or doing a task. Page 22
- **Triarchic** Having three parts, like the three sides of a triangle. Page 5
- **Volition** Motivation to continue to pursue a goal. Page 27

BECOMING AN EXPERT: QUESTIONS AND PROBLEMS

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

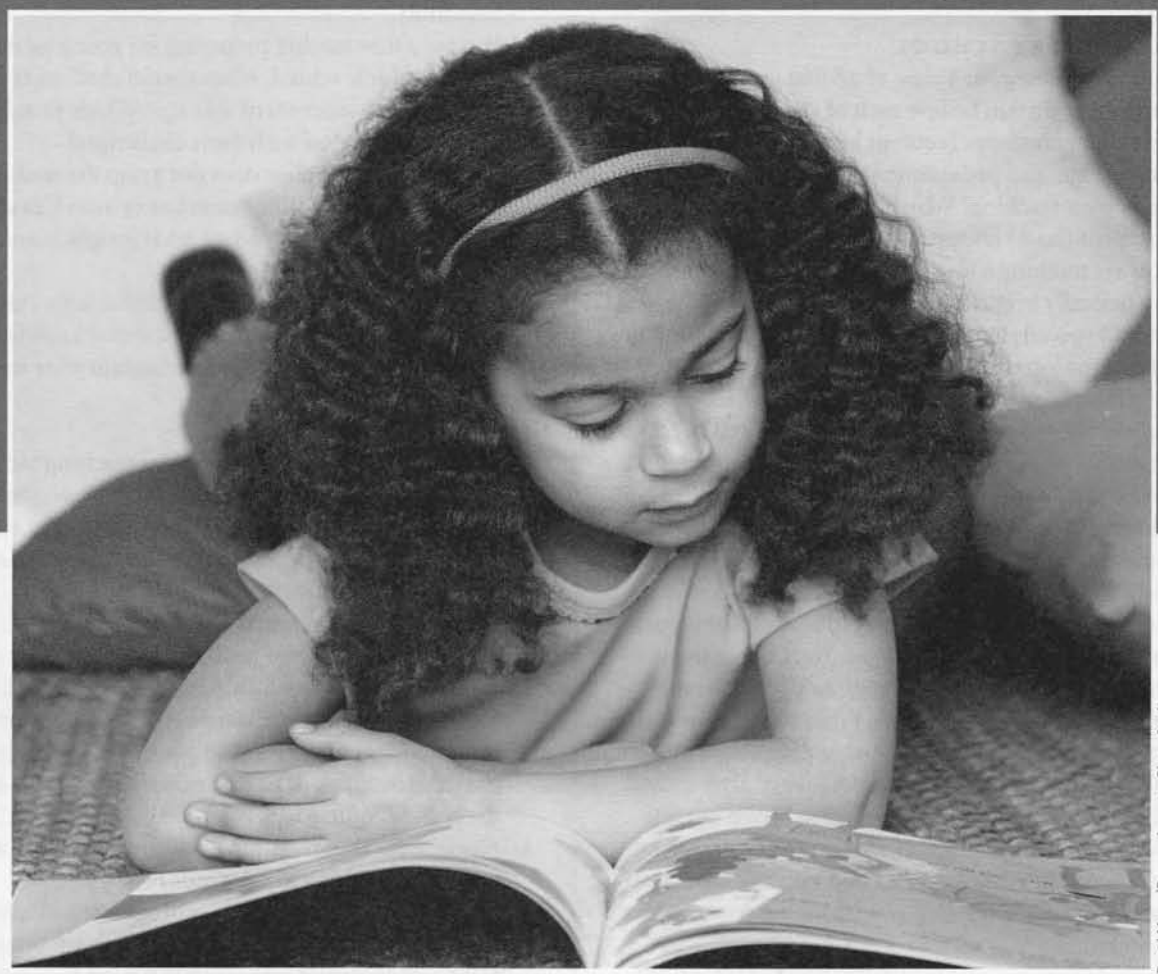
1. You are in charge of a class of 18 first graders. How important do you believe each of the three types of teaching knowledge (content knowledge, pedagogical knowledge, and pedagogical-content knowledge) will be in your teaching? Which type of knowledge will be the most (least) important to you?
2. You are teaching a fourth-grade class. Your students are basically bright and do well in school. Which skills should you attempt to automatize to make your daily life on the job easier?
3. Several students in your third-grade class seem to believe they were born too stupid to do well in school. How can you show these students that their intelligence can be increased? What is the advantage of convincing these students that intelligence increases as a result of effort?
4. Your sixth-grade class is filled with students who set their sights low when it comes to accomplishments and expectations of themselves. You believe many of the parents of these students do not provide much encouragement in the home. What steps can you take to encourage your students to have high aspirations? Why should you work to raise students' aspirations?
5. Your second-grade students tend to blame outside events for their failures on tests and poor grades on assignments. What steps can you take to encourage your students to develop more internal responsibility patterns?

IN MIDDLE SCHOOL

1. Students in your class of eighth graders often complain about having poor memories, and they act as if they can do nothing about it. How can you encourage these students to use memory strategies? How can you convince these students of the value of memory strategies? Which strategies will be likely to work best with students of this age?
2. A troubled boy in your ninth-grade class refuses even to try to do his schoolwork. He believes nothing he does will make any difference, and he sees himself as doomed to fail in school. What steps can you take to help him?
3. You are a new teacher preparing for your first day of class in middle school. What special challenges might you face with students of this age? Which strategies can you use to deal with these challenges?
4. Your ninth-grade class does not grasp the meaning of the term "insight." What exercises or activities can you use to make them appreciate what insight is and why it is important in learning?
5. How do you conceptualize the relative importance in your middle school teaching of content knowledge versus pedagogical knowledge? Explain your answer.

IN HIGH SCHOOL

1. You are excited about trying a new teaching technique with your twelfth-grade classes, but you wonder whether the technique will get through to the students. How can you tell whether the new teaching technique is working? Be specific.
2. Your tenth graders are obsessed with achieving performance-oriented goals, such as getting an A, instead of with accomplishing meaningful learning. You want them to focus on mastery of important concepts and material. How can you show your students the shortcomings of having performance goals and the benefits of mastery-oriented goals?
3. Name three situations in which you can use an analogy when teaching ninth-grade biology.
4. How do you envision the role of reflective thinking in the life of a high school teacher? Which situations in a tenth-grade class might result in a need for a teacher to think reflectively?
5. Your eleventh-grade class does not seem to understand the benefits of delaying gratification. They are often unable to muster the energy to work on assignments that are due in the future: They all want good grades and positive feedback in response to the effort they invest every day. Why is it important to communicate with high school students the value of delaying gratification? What specific examples can you use to do so?



David Mager/Pearson Learning Photo Studio

The Development of Cognitive, Learning, and Language Skills

2

CHAPTER OUTLINE

Cognitive Development: Concepts for Teaching

The Importance of Cognitive Development to Teachers

Maturation versus Learning

Canalization: A Key to Teaching

Cognitive Development: Continuous Versus Stagelike

Domain-General versus Domain-Specific Cognitive Development

Piaget's Stage Theory of Cognitive Development

Explaining Different Levels of Performance in Different Skills

Mechanisms of Cognitive Development

Stages of Cognitive Development

Evaluating Piaget's Theory

Neo-Piagetian Views

Teaching Beyond Piaget

Vygotsky's Sociocultural Theory of Cognitive Development

Internalization

The Zone of Proximal Development

Scaffolding

Evaluating Vygotsky's Theory

Information-Processing Theories: Examining Learning and Memory Skills

Verbal Skills

Quantitative Skills

Memory Skills

Three Major Approaches to Cognitive Development: A Comparison

Theory of Mind

Language Development

What Makes a Language a Language?

Stages of Language Acquisition

Theories of Language Acquisition: A Comparison

The Relationship Between Language and Thought

Bilingualism and Education: An Introduction

Brain Development

Expertise and Cognitive Development

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this chapter:

- Why do children seem to struggle at a certain level for months, and then show a big jump in performance over a couple of weeks? What can teachers do to hasten these jumps in performance?
- Why do some children at a certain age pick up skills easily, while others work hard but just do not get it?
- Why do children who have picked up a skill in one area have trouble doing similar tasks in other areas?

Joan Carlin sat grading what seemed to be the 500th paper in her foot-tall stack. "Another C–!" she thought, worrying about the number of usually good students who had done poorly on the test. "What's going on with these kids?" she wondered.

In September, Joan had left teaching at an elementary school and had begun teaching at a middle school. At her new school, Joan quickly came to realize that teaching her seventh-grade math class would not be easy. Some of the students who paid attention in class and worked hard just didn't seem to get a lot of the material. Others caught on more quickly—even though they seemed not to care. And when it came to tests, some kids breezed through them while others struggled. Joan had taught math for eight years. But she had never seen such a mixture of kids at different levels of performance, all in the same classroom. This move from elementary to middle school teaching was proving to be a real eye-opener.

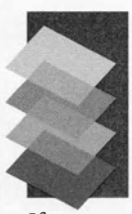
It was not until she attended a refresher course during the November in-service day that Joan gained insight into her problem. The workshop was entitled "Is Age Appropriate Always Appropriate? How to Assess Cognitive Readiness." The classes that Joan had sat through in college, with the instructor droning on about Piaget and Vygotsky and other people, flooded back to her mind. Suddenly they seemed relevant. "It has to do with students' minds—with how they think and what they are able to think about at this age," she mused. "I am following the textbook, but some seventh graders are not yet fully able to think abstractly. They work hard, but they cannot make the leap from numbers on a chalkboard to word problems about trains traveling in opposite directions at different speeds. Others are able to think in terms of my examples, even though they do not study or do their homework. This was not a problem for me with my fourth-grade classes. Those students were more similar in their levels of cognitive development. It is not just motivation and practice that's important at this age—it is whether the students are able to think about the problems the way we do."

Joan still had to figure out how she was going to put her newly remembered knowledge into practice. "It drives me crazy that my students are at many different cognitive levels," Joan confided to an expert middle school teacher during the coffee break at the workshop. "Some of the students sit and talk to themselves as they draw little pictures of the word problems in the margin. During tests it makes me wonder if they are cheating! Meanwhile, others do not even know where to start with the word problems. When their grades go down, their parents want conferences with me, and I don't know what to say! Most difficult are the ones who do not pay attention and do not do their homework but seem to pick up the material anyway. I want to grade fairly, but I do not know how to."

"Believe me, I know," replied the expert instructor. "Welcome to the world of middle school teaching! Let me tell you about some of the strategies I have tried with my classes. They made a big difference for me. I think they will for you, too. . . . "

Joan Carlin was frustrated, and with good reason. What would you do in her situation? You were quite good—even something of an expert—at teaching children at one grade level. But now you are floundering with students who are just a little different in age. You are doing your best to teach a large class. It seems now as though each pupil is from a different planet, as far as his or her readiness to tackle the material is concerned. You are motivated to do a good job. But you are not at all sure what you can do to help your students.

Educational psychology can help answer many of these questions, such as why some of your students "get it" and others who work hard do not. Educational psychology can also give you ideas for dealing with the type of class Joan was facing. The part of educational psychology that deals with these issues is called the study of **cognitive development**—the changes in mental skills that occur through increasing maturity and experience.



Cognitive Development: Concepts for Teaching

THE IMPORTANCE OF COGNITIVE DEVELOPMENT TO TEACHERS

If you are training to be a teacher or a researcher, or if you just want to understand how children—and even adults—learn, you need to know the basics of cognitive development. Expert

teachers know what level of cognitive development they can expect from most of the students in their classes. They use that knowledge to plan lessons, activities, and assessment, as well as to manage the classroom. Understanding the general level of thinking that can be expected from their students helps expert teachers recognize when a student is lagging behind in cognitive development or needs extra help. Expert teachers know how to challenge their students in ways that spur cognitive development without frustrating them. This is the lesson that Joan Carlin, the teacher described at the beginning of the chapter, is just starting to learn.

To understand cognitive development and to apply your new knowledge to teaching, you should become acquainted with a number of key concepts about cognitive development. The important differences among some of the major theories of cognitive development are often based on how the theorists viewed development in terms of these key concepts. An example of a difference would be whether development is mostly from the inside, outward, or mostly from the outside, inward. According to the former view, children's development is largely biologically determined, but the environment also has some effect on this biological development. According to the latter view, children's development is largely socially determined, with biology interacting with these social factors. From your point of view as a teacher, the important thing is to remember that both biological and social factors are important, and that neither is immutable. That is, a person's biology may affect the kind of social environments he or she seeks out, but these social environments may also cause biological changes. The brain is not rigid. Rather, it is plastic and highly responsive to the effects of the environment (Greenough & Black, 2000; Uylings, 2006). The bottom line is that biology and the environment always operate in an interactive fashion (Bornstein, 1999; Chaudhari, Otiv, Chitale, Hoge, Pandit, & Mote, 2005; Plomin, 2001a, 2001b; Wexler, 2006).

We usually think in terms of children being influenced by their environment. It is important as well to remember that children influence their environment (Goodnow, 1999), especially in the context of their families and friends. To some extent, the opportunities they find are ones that they themselves create through this influence on the environment. For example, the child might get music or art lessons not because the parents decide on them, but rather because the child insists on having them. In this way, the child's musical, artistic, or other learning and development emanate from the child's own influence on the environment in which he or she lives.

Interestingly, it appears to be nonshared environments—rather than shared environments—within families that most affect cognitive development (Gunther, Drukker, Feron, Korebrits, & van Os, 2005; Harris, 1995; Plomin, DeFries, Craig, & McGuffin, 2003a, 2003b; Plomin & McGuffin, 2003). In other words, when siblings grow up in the same family, what seems to matter most in terms of their development is not the common aspects of the environment that the siblings share. Instead, those aspects of the environment that matter most are those unique to each sibling, such as the idiosyncratic ways the parents treat each of the siblings and the particular friends outside the family whom each sibling acquires. Individual differences between children, therefore, appear to be due in part to differences in environments within the same family of origin (Bjorklund, 2000). Moreover, although this chapter will emphasize individual cognition, it is important to keep in mind that much of cognition is collaborative, with people's learning as a result of a group effort to learn and understand (Rogoff, 1998).

MATURATION VERSUS LEARNING

Cognitive development can take place through maturation, through learning, or through a combination of the two. **Maturation** is any relatively permanent change—be it cognitive, emotional, or physical—that occurs as a result of biological aging, regardless of personal experience. In this chapter, we primarily discuss cognitive maturation. Maturation is preprogrammed—that is, it occurs regardless of the interactions a child has with the environment. For example, an infant knows how to cry at birth without the benefit of any experiences or instruction in how to cry. Extensive changes in cognitive abilities occur during adolescence. Many of these changes are due to maturation. Specifically, an increase in volume in the prefrontal cortex, an area notably involved in advanced cognitive functions, is observed in adolescence (Yurgelun-Todd, 2007). This change occurs in an area relating to

THINKING ANALYTICALLY

How might you tell whether a child's ability to distinguish faces from other kinds of visually presented stimuli is a result of maturation or of learning?

SUGGESTION: See whether infants just a few days (or even hours) old show discrimination between faces and other kinds of visually presented stimuli. If so, face discrimination is probably a result of maturation because the infant would not yet have had the opportunity to learn to make this discrimination.

attention, response inhibition, and reward evaluation (Yurgelun-Todd, 2007). Therefore, improved functioning in each of these areas is to be expected throughout adolescence.

Expert teachers know that they cannot force a student to think or to do what he or she is not biologically old enough to do. Thus, as a teacher, you must know how old is "old enough" for the skills you need to teach. For example, Joan Carlin, the middle school math teacher, must determine whether her students have the cognitive maturity to understand the math problem hidden in a description of a ladder leaning against a wall. (We return to this point later in the chapter, when we discuss different researchers' ideas about cognitive development.)

But what about changes in thought or behavior that do not happen automatically? These changes are the result of learning. **Learning** is any relatively permanent change in thought or behavior that occurs as a result of experience. Learning is not preprogrammed, and it cannot occur in the absence of stimulation. For example, you know your name and the name of the country in which you live, but only because you have learned these facts. You were not born with this knowledge. Indeed, learning is what education is all about. The theme of this entire book is how to go about teaching so students are able to learn as much as possible.

Clarifying the distinction between maturation and learning is important. As a teacher you need to know which kinds of abilities and behavior you can expect from children of a certain age, regardless of their particular childhood experiences. Teachers also need to know which kinds of abilities and behavior depend on experience. Knowing what almost all children of a certain age can be expected to do helps a teacher plan good lessons and know when to push. At the same time, understanding the role of learning allows an expert teacher to recognize when a child's experiences have not prepared him or her for a lesson. In this case, pushing will do little good—the child needs more experiences to become ready to move forward.

CANALIZATION: A KEY TO TEACHING

The difference between maturation and learning is not as clear as it might seem. In the world around us, it appears that the environment affects much of the development of behavior. The concept of **canalization** describes the extent to which a behavior or an underlying ability develops *without* respect to the environment (Waddington, 1956).

- A highly canalized ability is one that develops in nearly all children, despite widely varying environments. Canalization is closely related to the concept of innateness (Ariew, 1999). For example, perceptual abilities, such as the ability to see and to hear, are relatively highly canalized (Bertenthal & Clifton, 1998; Kellman & Banks, 1998). So are simple memory abilities, such as those used in learning a list of vocabulary words (Perlmutter & Lange, 1978; Woodward & Markman, 1998). We develop simple memory abilities in almost any environment, regardless of whether we are urged to do so (Schneider & Bjorklund, 1998).
- A weakly canalized ability develops only if the environment supports it. The interpersonal skills children use with one another and with teachers are relatively weakly canalized (Evans, 2006; Gardner, 1983, 1999); in other words, children need support and direction from parents, teachers, and their peers to learn how to deal with others in an appropriate way. Thus a child's environment affects social skills more strongly than it affects simple memory skills. Teachers are most easily able to help students develop weakly canalized skills.

The concept of canalization is key to teaching because children come into classrooms with widely differing experiences. It is helpful for teachers to know how much these different experiences have influenced the various kinds of academic and social behavior expected in the classroom. Almost all of your students can be expected to show highly canalized abilities, such as simple memory skills, but only some are likely to show weakly canalized abilities, such as working cooperatively on a team project (Rogoff, 1998). Within the context of their overall objectives, expert teachers match their expectations to what is possible and what is likely for their students to accomplish, while bearing in mind the difference. How do children's abilities, whether strongly or weakly canalized, develop? Developmental theorists tend to be divided into two different camps regarding this question, as we see in the next section.

COGNITIVE DEVELOPMENT: CONTINUOUS VERSUS STAGELIKE

Is cognitive development continuous, occurring in a smooth, ever-increasing pattern of cognitive skills? Or is it discrete, occurring in discontinuous, stagelike patterns with sharp gains at some points of development and virtually no gains at others?

■ **CONTINUOUS DEVELOPMENT** Theories that suggest development proceeds continuously assume cognitive abilities are acquired gradually, such that each new accomplishment builds directly on those that came before it. Continuous-development theories propose that a person's thinking is not fundamentally different at any one age or level of development than it is at any other age. As Figure 2.1 shows, the process of development proposed by these theories can be compared to the progress of a person walking up a slope or ramp. Just as the person on a ramp gradually gets to a higher level of ground, continuous-development theories propose that people gradually progress to higher levels of cognitive ability.

■ **STAGELIKE DEVELOPMENT** In contrast, stage theories make three major assumptions about development (Amsel & Renninger, 1997; Brainerd, 1978; Flavell, 1971).

- Each stage is associated with a qualitatively distinct set of cognitive structures, or mental patterns of organization that influence our ways of dealing with the world. For example, in Piaget's stage theory, which we explore later, older children are able to arrange their mental patterns, and to interact with the world, in ways that younger children, who have not reached that stage, cannot. That is, the thinking of children in later stages of cognitive development is said to be fundamentally different from the thinking of children in earlier stages.
- Behavior unfolds in a one-directional, invariable sequence. In other words, development always moves forward, never backward; likewise, it always moves in the same way for everyone, although the rate at which the stages unfold may differ from one person to another. One example can be seen in the acquisition of language. Infants move forward through the following stages: cooing, babbling, one-word utterances, two-word utterances, and adult grammar (Locke, 2006; Oller, 2000). The order of this progression is the same for all infants. A frequently used metaphor for stagelike development is climbing a staircase, as shown in Figure 2.1. At each step on the staircase, a person is at a different height. Similarly, a person's level of development at each stage proposed by a stage theory is assumed to be clearly different from his or her level of development at any other stage.
- Later stages build on earlier stages. As the child grows older, he or she consolidates previously developed skills and develops new ones. Consider the language-development example: It would not be possible to reach the stage of two-word utterances without first using single-word utterances.

THINKING CREATIVELY

Give an example of one highly canalized skill and one weakly canalized skill that would be important in the classroom. How might you help children develop these skills?

SUGGESTION: Highly canalized: perceptual-motor skills such as hand–eye coordination in inputting text into a computer. Weakly canalized: number skills. You might help children develop perceptual-motor skills by giving them opportunities to interact with their physical environment—for example, in after-school computer classes or clubs. You might help children develop number skills by creating games that involve using numbers in various ways.

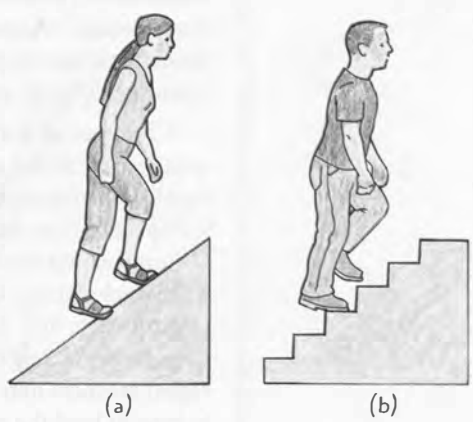


FIGURE 2.1 Continuity theories contrasted with stage theories. (a) Continuous-development theories propose that a person's thinking is not fundamentally different at any one age or level of development than it is at any other age. Just as the person on a ramp gradually gets to a higher level of ground, so continuous-development theories propose that people gradually progress to higher levels of cognitive ability. (b) A frequently used metaphor for stagelike development is climbing a staircase. At each step on the staircase, a person is at a different height. Similarly, a person's level of development at each stage is assumed to be clearly different from his or her level at any other stage

Teachers need to recognize all the skills available to youngsters, and should challenge the use of new skills without being overwhelming in their demands.

DOMAIN-GENERAL VERSUS DOMAIN-SPECIFIC COGNITIVE DEVELOPMENT

Theorists of cognitive development also differ as to whether they believe such development is domain general or domain specific (Frensch & Buchner, 1999; Gelman & Williams, 1998; Kray & Frensch, 2002; Roberts, 2007).

- **Domain-general development** occurs more or less simultaneously in multiple areas.
- **Domain-specific development** occurs at different rates in different areas.

If cognitive development proceeds in a domain-general way, for example, arithmetic and language abilities develop together. In contrast, if cognitive development is domain specific, arithmetic and language abilities may develop independently of each other. In sports, for example, if we expect domain-general development we can expect Little League baseball players to learn the skills of throwing, hitting, and catching all at about the same rate. If we support domain-specific development, we expect a Little Leaguer to learn to throw, hit, and catch at different rates. Throwing might come before catching, for example.

The domain distinction is very relevant to you as a teacher: Can you expect a child with strong writing skills to perform well in math? What does it mean if a child does not perform well in both? Should you push the student harder? Is it possible that the child's weak performance in math may be due not to lack of effort but rather to a slower rate of development in the mathematical area? According to the domain-specific view, a child can be an expert in one domain of schoolwork and a novice in another.

For example, a child can get an A in art yet fail English, or vice versa, thereby showing domain-specific development. But a child is unlikely to get an A in reading and an F in English, an example of domain-general development. The skills used in some sets of domains overlap weakly (they are domain specific). In other sets of domains they overlap strongly (they are domain general), as in the case of reading and English.

THINKING PRACTICALLY

In what ways is the issue of domain generality versus specificity important to the teacher of young children? How might a teacher's approach be affected by the one kind of development or the other?

SUGGESTION: The teacher needs to know whether the level of performance shown in one subject matter area can be expected to generalize to another subject matter area. The teacher needs to teach at a more basic level if skills shown in one area are not necessarily shown in the area now being taught.

iMPLICATIONS FOR TEACHING

Understanding the concepts of cognitive development helps effective teachers to better understand the development of skills in their students. Some teachers are justifiably concerned that the absence of final and definitive answers to some questions in cognitive development may make it harder for them to do their jobs. For example, to what extent is cognitive development domain general versus domain specific? The best way to handle these issues is to be flexible and to seek appropriate answers for yourself. For example, if a child is having problems in reading, you should not assume the child will have problems in mathematics, because some degree of domain specificity is likely. At the same time, many mathematical assignments, and especially word problems, require reading. If you find that students are having problems with math, you might want to be alert for the possibility that a reading difficulty may, at least in part, underlie those problems.

A number of skills, including many academic and interpersonal skills, develop only with respect to the environment. Expert teachers are able to recognize these weakly canalized abilities and provide support and direction for them. They also know what to expect of their students by understanding their environmental experiences.

Some expert teachers subscribe to stage-like views of development—they assume that largely inborn factors determine the unfolding of a child's abilities over time. As a consequence, they do not push students into development or force them to skip a stage, because they think that nonenvironmental forces determine development. Other expert teachers may support a continuous view of development—they expect children to have at least the rudiments of adult thinking at relatively early ages.

Our experience suggests that a sound way of teaching is always to challenge students at a level right beyond what they find comfortable doing, but not at a level that frustrates them so that they withdraw from learning. In this way, the goal is attainable but the student must work to attain it. The concept of domains helps expert teachers assess why a student's performance in one area, such as math, is not up to par with that in another area, such as reading. According to the domain-specific view, differences in development can be expected because learning rates vary from one area to another.

Piaget's Stage Theory of Cognitive Development

Jean Piaget (1896–1980), a Swiss psychologist, proposed what is still considered to be the most influential single theory of cognitive development. Piaget based his theory on the premise of "the child as scientist." That is, at all ages, children actively seek to explore the world and to come to terms with it. At younger ages, the child's scientific exploration is limited by cognitive abilities that have yet to develop. In some respects, Piaget's theory is incomplete, and in other respects it has been shown to be incorrect. However, despite its flaws, Piaget's theory remains the most nearly complete (Bennett, 1999), influential theory to date, although it is certainly not the only theory of cognitive development (e.g., Chen & Siegler, 2000; Demetriou, Christou, Spanoudis, & Platsidou, 2002; Keil, 1999; Demetriou & Raftopoulos, 2004).

Piaget's theory is a stage theory of cognitive development. It specifies qualitative changes in cognitive development with each successive stage. Although a child's accomplishments at each stage build on those in the previous stage, these accomplishments are also distinct from the ones the child demonstrated at the previous stage. Thus people who accept this theory believe teachers should expect sudden bursts in the development of cognitive abilities rather than a smooth progression of development over time.

Piaget's theory is also largely domain general. It predicts that children who show cognitive development in one area generally should show comparable cognitive development in other areas.

EXPLAINING DIFFERENT LEVELS OF PERFORMANCE IN DIFFERENT SKILLS

Clearly, children do not seem to develop expertise evenly in all of their abilities. Piaget proposed that although abilities in all areas generally develop concurrently, the spread of an ability to various areas of performance takes place over time. Piaget called this concept **horizontal décalage,** the temporary difference in levels of performance that a child shows between various cognitive domains or activities within a given stage of development (Knight & Sutton, 2004). In other words, development is domain general—almost. The child who can perform at comparable levels in arithmetic and language may nevertheless lag slightly behind in one of these areas until the developed ability has had time to catch up. Thus teachers cannot expect students to show exactly comparable performance when what appears to be the same cognitive skill—such as understanding differences between concepts—is applied to different domains, such as words and numbers.

Piaget's theory contains many aspects—in fact, too many to be described here. However, we will consider three key concepts that describe specific mechanisms of cognitive development: equilibration, assimilation, and accommodation.

THINKING ANALYTICALLY

To what extent might horizontal décalage be viewed as a fudge factor in Piaget's theory—that is, an attempt to account, after the fact, for data showing an unevenness in domain development that do not really fit the domain-general theory?

SUGGESTION: It does appear to be a fudge factor, to some extent. Nevertheless, it is plausible to expect the existence of some level of horizontal décalage in a stage theory.

MECHANISMS OF COGNITIVE DEVELOPMENT

According to Piaget, cognitive development is driven by a mechanism called **equilibration,** which is the balancing of cognitive structures with the needs of the environment (see Feldman, 2003; Rogoff, 1998). As children interact with the world, they encounter situations that do not match their preconceived notions of the way the world is or should be. For example,

an adult may use the word "cat" to refer to an animal that the child thinks is a dog. This process is included in a number of theories of cognitive development (Mortola, 2001). Piaget called this mismatch between the state of the world and one's preconceived notions a state of **disequilibrium** and suggested it is good for children because it is the impetus for developing expertise. Thus teachers should not hesitate to provide novel situations for children, as long as the children are just about to reach the point where they can make sense of that novelty (Kuhn, Garcia-Mila, Zohar, & Anderson, 1995). For example, a child who has recently acquired a solid understanding of addition is likely to be ready to understand subtraction, but is less likely to be ready to understand division. Children, like everyone else, are uncomfortable with disequilibrium, and they attempt to restore equilibrium.

Two processes can be used to achieve equilibration (see Figure 2.2). Both involve changes in the child's cognitive **schemas**—that is, cognitive frameworks that provide a way to understand and organize new knowledge. For example, a child's schema about a dog may include facts such as that it is an animal, has four legs, and barks.

THINKING CREATIVELY

How might a teacher create disequilibrium for a child who does not yet understand that a bat is not just another kind of bird?

SUGGESTION: Think about the types of questions the teacher might ask to encourage the child to recognize the differences between a bat and a bird. For example: Which one sleeps at night? Which one sleeps hanging from its feet?

- **Assimilation.** In the first process, called assimilation, the child attempts to fit new information into the schemas he or she has already formed. If, for example, a young child has a schema for "dog" and sees a previously unknown dog, such as a cocker spaniel, the child is assimilating the experience when she incorporates the cocker spaniel into the schema for dogs.
- **Accommodation.** In the second process, called accommodation, the child creates new schemas to organize information that he or she cannot assimilate into existing schemas. For example, suppose the child sees a raccoon, and realizes it is like a dog in being alive and walking on four legs. But because it is unlike a dog in being wild, in being a creature of the night, and in not barking, the child may create a new schema representing her accommodation of this information.

STAGES OF COGNITIVE DEVELOPMENT

Piaget (1969, 1972) proposed four stages of cognitive development: sensorimotor, preoperational, concrete operational, and formal operational. Much of his description of these stages emerged from his observations of his own children. As with other stage theories of development, Piaget's theory posits that children pass through all four stages in a fixed, one-directional order. In other words, all children pass through the stages in the same order. Once they enter a stage, they never go back to a previous one. Subsequent stages build on previous ones, so full development of one stage becomes the basis for the equilibrations that lead to the next stage.

FIGURE 2.2 How the processes of assimilation and accommodation combine in the mechanism of equilibration. (1) Banging as a scheme. (2) Assimilation occurs when the child includes the new object in the scheme. (3) Accommodation occurs when the child cannot fit the new object into the scheme

(1) (2) (3)

■ **SENSORIMOTOR STAGE** The **sensorimotor stage,** occurring between birth and about age 2, is primarily characterized by the development of sensory (simple input) and motor (simple output) functions. Sensory input includes, for example, seeing and hearing. Motor output includes moving and experimenting—grasping at or playing—with objects in the environment. During this stage, infants respond largely in reflexive, or inborn, ways. But as they develop, they modify these reflexes to suit the demands of the environment.

The two main accomplishments of this stage are object permanence and representational thought.

Object permanence is the realization that an object continues to exist even when it is not immediately visible (Cohen & Cashon, 2003). For example, if you show a 5-month-old infant a rattle and then hide the rattle behind a cardboard barrier, the infant is likely to gaze at the rattle while it is being shown. But once the rattle is hidden, the child will act as though the rattle never existed. For the young infant, out of sight truly means out of mind. At about 9 months, however, a transition takes place. Thus, if you were to show an 11-month-old infant the rattle and then hide it, the infant would be likely to look for the rattle behind the barrier. If you move the rattle from one location to another while the infant is not looking, an 18-month-old will look for the rattle even in places he or she has never seen it before. The rattle has acquired a permanent identity for the infant—its existence continues even after it is out of sight.

Doug Goodman/Photo Researchers, Inc.

A 5-month-old gazes with interest at a toy placed within his view (top). When the toy is hidden behind a barrier, a 5-month-old will act as though the toy never existed (bottom).

Recent evidence suggests that the development of this understanding begins very early. In one study, 4-month-old infants showed memory for a hidden item after 2 seconds (Ruffman, Slade, & Redman, 2005). After 8 seconds, this memory completely disappeared, suggesting that the development of object permanence begins early as a fleeting representation (Ruffman et al., 2005).

Representational thought consists of well-formed mental representations, or ideas, of external stimuli (Mandler, 1998). For example, an infant with representational thought might have in her head a well-formed image of a favorite toy rattle. She can call the rattle to mind, or think about it, whether it is visible to her or not. This accomplishment is associated with the end of the sensorimotor stage, usually after the eighteenth month of life and not later than the twenty-fourth month.

■ **PREOPERATIONAL STAGE** The **preoperational stage** occurs for most children between approximately 24 months and 7 years of age. In this stage, the child begins to actively develop the mental representations that were just starting to form near the end of the sensorimotor stage (Lutz & Sternberg, 1999). Children in this stage of development begin to communicate by way of words, both with other children and with parents. Their use of words opens up many new possibilities for them. The use of words as symbols for concrete objects is made possible by the child's ability to think about the objects. The communication of preoperational children is often **egocentric,** centered on the self without understanding how other people perceive a situation. For example, the preoperational child does not understand that someone else looking at an object from a different point of view sees the object (such as a toy) differently (e.g., from the back rather than the front of the toy).

Children in the preoperational stage often also seem to be unaware of the art of conversation: They speak their minds without taking into account what the other party or parties to a conversation have said. The teacher of a child in this stage might get a response such as "I went to a restaurant last night" when asking whether the child would like blue or brown paper for an art project.

As children grow older, they become less egocentric and more focused on others. This development begins largely during the preoperational stage, although even in the sensori-

motor stage, we can see the bare beginnings of movement away from egocentrism. Taking into consideration what others have to say then continues to develop throughout childhood and even into adulthood. The emergence of the ability to take others' points of view develops gradually, over a lengthy period of time. Teachers working with preoperational children must realize that these youngsters, when they fight over toys, playground equipment, or other resources, may have difficulty understanding the points of view of other children who wish the same resources. Teachers cannot merely assume that the children will automatically wish to share. Instead, teachers may need to help the children try to understand the need to share and to try to meet everyone's needs, not just their own.

Although this ability develops at the preoperational stage, facility with this skill seems to continue to advance as we age. In one study, children and adults were asked questions either in first person (e.g., using *I, me*) or third person (e.g., using *he, she*) (Choudhury, Blakemore, & Charman, 2006). All participants took longer to answer the third-person questions compared to the first-person questions. However, this time difference decreased as the participants' ages increased (Choudhury et al., 2006).

THINKING CREATIVELY

Can you think of another object to use to measure conservation, in addition to those mentioned here?

SUGGESTION: You might pack together a stack of cotton balls so they appear smaller than the original pile. Children who conserve will realize the same amount of cotton is in the second, denser pile.

■ **CONCRETE OPERATIONAL STAGE** In the **concrete operational stage,** which generally occurs from about ages 7 (or even 6) to 12 years, children become able to manipulate mentally the internal representations they started to form in the previous stage. In other words, they not only have mental representations but also can act on and modify these representations. They can think logically as long as the logical thinking applies to concrete objects (such as blocks) rather than to abstractions (such as the concept of truth).

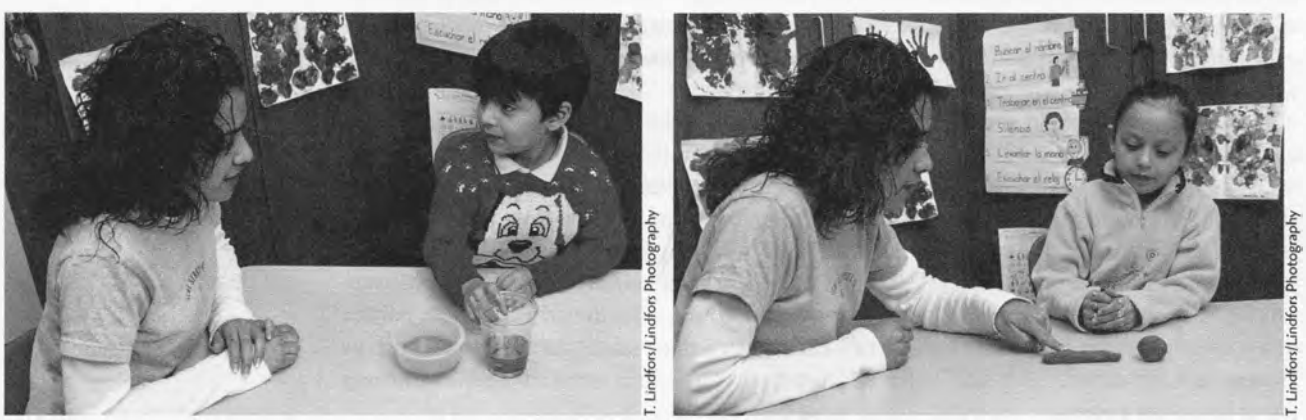
The best example of how children in this stage acquire the ability to manipulate internal representations is probably through their development of **conservation,** the recognition that even when the physical appearance of something changes, its underlying quantity (how much there is of it—number, size, or volume) remains the same—or in other words, is conserved.

The various types of conservation occur at slightly different ages during the stage of concrete operations. Probably the best known is the conservation of liquid quantity. In this type of conservation, a child recognizes that an amount of liquid quantity remains the same, even when the form the liquid takes is varied.

In a typical experiment, a child is shown two short, stout beakers with equal amounts of liquid in them. The child is asked to verify that the amounts of liquid are indeed the same. Then, with the child watching, an experimenter pours the liquid from one of the short, stout beakers into a third beaker, which is tall and thin. The shape of this third beaker produces a column of liquid that reaches a higher level than the liquid did in the short, stout beaker. The experimenter asks the child whether the same amount of liquid is in each of the two beakers. Whereas the preoperational child will report more liquid in the tall, thin beaker—where the liquid has reached a higher level—the concrete operational child will report that both beakers contain the same amount of liquid. (See Figure 2.3a.)

FIGURE 2.3

Conservation is the recognition that even when the physical appearance of something changes, its underlying quantity remains the same. According to Piaget, this ability develops at the concrete operational stage.



(a) (b)

In general, the concrete operational child has reached a level at which thinking is **reversible**—that is, the child can mentally reverse a physical operation. For example, such a child sees the higher level of liquid in the tall, thin beaker. By reversing, in his or her mind, the set of actions performed by the experimenter, the child can go back to the original point before the pouring, when the amounts of liquid in the two short, stout beakers were the same. In the conservation of mass, a clay snake can be rolled into a ball and then back into a snake. (See Figure 2.3b.) Similarly, the concrete operational child can understand subtraction as the inverse of addition and division as the inverse of multiplication; the preoperational child cannot. At the same time, the operations are still concrete, because what is reversed is a concrete physical operation, such as pouring liquid from one beaker to another, rather than an abstract formal operation, such as giving people freedom or taking it away from them.

Concrete-operational children can be taught in a way that enables them to reverse what they have done. For example, they can go from the terms of a problem to its solution. If they get a wrong answer, they can also review their problem solving by going back from the solution to the terms of the problem.

THINKING PRACTICALLY

Suppose you had to divide a single candy bar between two children. Why might a child who has not yet developed conservation believe that if the candy bar is cut in half "the long way" (i.e., along the length of the bar), he or she will get more candy than if it is cut "the short way" (i.e., dividing the width of the bar)?

SUGGESTION: The child who has not yet mastered conservation may believe that the longer the piece he or she gets, the more candy there is, with little or no regard for width.

■ **FORMAL OPERATIONAL STAGE** The **formal operational stage** begins at about 11 or 12 years of age and extends through adulthood. People in this stage form and operate on—that is, reverse—abstract as well as concrete mental representations (Inhelder & Piaget, 1958). In this stage, for example, children can see **second-order relations,** or relations between relations, as required by analogical reasoning. Analogical reasoning is based on the perception of the similarity of like features of two things (DeLoache, Miller, & Pierroutsakos, 1998; Gentner, Loewenstein, & Thompson, 2003). An example of a second-order relation is this question: In what ways that a cat and a dog are alike are a robin and a sparrow also alike?

Joan Carlin, the middle school math teacher described at the beginning of the chapter, realized that one reason many of her students had trouble was that they had not yet developed formal operational reasoning abilities. These students had trouble recognizing the geometry problem posed in the description of a ladder leaning against a wall because they were not able to see the similarities between the triangle made by the ladder and a triangle in a math problem.

Another important ability that develops during the formal operations stage is the ability to think abstractly—that is, to think about concepts, such as justice or inner peace, that do not have any concrete, physical equivalents (Lutz & Sternberg, 1999). Formal operational children can also think systematically. For example, if told that some unknown subset of four colored chemicals will be clear in color when combined, the child systematically can go through all possible subsets to find the one that produces the solution that is clear in color.

Obviously, formal operational thinking is important for both scientific and mathematical expertise, as well as for other kinds of expertise (Kuhn, Schauble, & Garcia-Mila, 1992). Although Piaget originally believed that children become formal operational in the age range between roughly 8 and 12 years, research suggests that even some college students are not fully formal operational (e.g., Mwamwenda, 1999).

Piaget's theory makes a number of predictions about cognitive development from birth through adulthood. There are many ways for you as a teacher to make use of your knowledge about the level of cognitive development of your students.

First, do not underestimate children's skills. Piaget's theory gives a rough guide to when students become able to think in various ways. Nevertheless, some children reach Piagetian stages before Piaget would have predicted they do. Piaget's theory applies on average—not to *all* children.

Second, some children will not have reached the levels Piaget's theory would have predicted. For example, not all students older than age 12 will find abstract thinking comes readily to them.

Third, use Piaget's theory as a guide to challenge each student to his or her own individual level of learning, rather than assuming that "one size fits all."

THINKING ANALYTICALLY

Before reading the next section, evaluate (1) the strengths and weaknesses of Piaget's theory and (2) how you might apply Piaget's theory in the classroom.

SUGGESTION: You will be given answers to these questions in the next section!

CONSTRUCTING YOUR OWN LEARNING

Now try a problem yourself that is sometimes used to assess whether someone has become formal operational: List all possible orderings (permutations) of the numbers 1, 2, 3, and 4. How many different ways can you find to arrange these four digits? If you are currently working in a practicum, you might also ask some of the children you are working with to try this same test. (Be sure to discuss this exercise first with your cooperating teacher.) Observe their strategies for solving the problem. We will reveal the number of possible arrangements, as well as the implications of tests such as these, in the next section when we evaluate Piaget's theory.

EVALUATING PIAGET'S THEORY

What are the strengths and weaknesses of Piaget's theory? Let us consider some of the main aspects of each.

Piaget's theory is the most nearly complete theory of cognitive development to date, although it is heavily oriented toward developing expertise in scientific modes of thinking. The theory offers fewer ideas about the development of expertise in other modes—for example, aesthetic modes, as would apply in the arts. Piaget's theory has also been useful in generating a tremendous amount of research and in suggesting to teachers what children at given ages can and cannot do.

However, the validity of Piaget's theory—the extent to which it is accurate in describing children's cognitive development—has been questioned on a number of grounds (e.g., Feldman, 2003; Gelman & Williams, 1998; Kail, 2000; Lutz & Sternberg, 1999):

- The limitations of the stagelike nature of development (Chen & Siegler, 2000)
- The ages at which children can first perform various kinds of tasks
- Whether children's failures to perform certain tasks are actually due to the reasons Piaget gave (Thomas, 2000)
- Whether all adults ever become fully formal operational
- Whether the theory can be generalized across cultures

■ THE STAGELIKE NATURE OF DEVELOPMENT Charles Brainerd (1978) has argued that the available evidence does not support the stagelike characterization of development proposed by Piaget. The concept of horizontal décalage that Piaget added to the theory suggests at least some continuity to development. In fact, no full consensus has been reached among cognitive developmentalists as to whether development is stagelike (i.e., discrete) or continuous. Some theorists, such as Robbie Case (1984; Case, Demetriou, Platsidou, & Kazi, 2001; Case & Okamoto, 1996) and Kurt Fischer (1980; Fischer & Grannott, 1995; Grannott, Fischer, & Parziale, 2002), have continued to argue for the existence of stages. Feldman (2004) has suggested that redefining the transitions between stages could make the theory more widely accepted.

■ THE AGES AT WHICH CHILDREN CAN FIRST PERFORM TASKS Piaget seems to have overestimated the ages at which children are really capable of performing various kinds of cognitive tasks (Chen & Siegler, 2000; Siegler, 1998). The general trend in research in this field (e.g., Baillargeon, 2002; Goswami & Brown, 1990; Singer-Freeman & Goswami, 2001) has been to suggest that children can do many tasks at ages earlier than Piaget thought, as long as the children are familiar with the content domain in which they are working. For example, children can solve analogies well before they are 11 or 12, the age at which formal operational thinking supposedly begins (see, for example, Goswami & Brown, 1990; Richland, Morrison, & Holyoak, 2006; Singer-Freeman & Goswami, 2001; Sternberg & Rifkin, 1979).

Expert teachers do not assume their students are unable to perform sophisticated reasoning tasks. They know that, in their ability to reason, children sometimes surprise not only researchers but also teachers (Sternberg & Grigorenko, 2000).

■ REASONS FOR FAILURES TO PERFORM Bryant and Trabasso (1971) showed that in one task, called transitive inference, what Piaget had taken to be a reasoning failure was

actually a memory failure. For example, if you tell children in an arithmetic lesson that a first object costs more than a second object, and the second object costs more than a third object, children will often be able to solve the problem if they can remember the original premises—here, the cost relations. In other words, their failure to solve the problem is more likely due to forgetting the relations described by the premises than to any inability to reason with the givens of the premises. Thus, when children fail in a reasoning task, teachers should not immediately conclude that the children lack reasoning ability. Perhaps the children simply cannot remember the givens of the problem.

THINKING PRACTICALLY

How could a theory like Piaget's be helpful in the classroom if it were largely correct? How could it be harmful if it were largely incorrect?

SUGGESTION: The theory would specify when children would or would not be able to use particular cognitive operations. If it were wrong, teachers using the theory would be teaching skills at inappropriate times.

■ **CROSS-CULTURAL GENERALIZATION** Teachers need to learn as much as they can about the cultural backgrounds of their students, and to treat the children in a way that is respectful of their cultural diversity (see Mistry & Saraswathi, 2003). Sometimes children from diverse cultures do not even understand tests developed in Western cultures (Greenfield, 1997; Serpell, 2000; Suzuki & Valencia, 1997). In one study emphasizing this point, school children in rural areas of Tanzania performed substantially better on cognitive tests when the examiner made a deliberate effort to explain the testing situation and what was expected of the children in solving the kinds of sorting and spatial visualization items with which they were presented (Sternberg, Grigorenko, et al., 2002).

A review by Werner (1972) of more than 50 studies suggests that infants in non-Western societies such as sub-Saharan Africa can often perform certain psychomotor accomplishments before Piaget postulated they could. However, cross-cultural research also suggests that many adolescents and even adults in non-Western cultures never acquire formal operations (Dasen & Heron, 1981). When you teach culturally diverse children, therefore, do not make assumptions about the cognitive readiness of members of one group on the basis of knowledge about the cognitive readiness of members of another group. Also be careful in testing: Some children accept and respond better to testing situations than do others. (We discuss testing in detail in Chapter 13, "Standardized Testing.")

■ **REACHING THE FORMAL OPERATIONS STAGE** Many adolescents and adults in Western cultures also may not reach formal operations (Sutherland, 1999). For example, consider a test in which you try to determine the number of possible permutations of order for the numbers 1, 2, 3, and 4. If you are fully formal operational, you probably devise a systematic strategy for listing the possible ordering: starting with 1, 2, 3, 4, perhaps; then reversing the last two digits to produce 1, 2, 4, 3; then reversing the middle two digits to produce 1, 3, 2, 4; and so on. If you are not fully formal operational, you probably list the possible ordering in a much less systematic way, rather than using a system that guarantees you will list all 24 possible orderings.

Tests like this typically show that many adults are not fully formal operational. In fact, Piaget (1972) eventually modified his theory to recognize that formal operations may be more a function of domain-specific expertise (e.g., practice with the various types of thinking that are involved) than of general cognitive maturation. In other words, a child's accomplishments in reasoning in one domain, such as language arts, do not guarantee comparable accomplishments in reasoning in other domains.

The weaknesses of Piaget's theory do not make it useless for educators. However, the challenges to Piagetian theory do indicate that teachers should be careful when they attempt to apply the theory in their classrooms. So what can you gain from Piaget's theory for your classroom use?

NEO-PIAGETIAN VIEWS

When theorists recognize that a theory is wrong in some respects or incomplete in others, they have two options:

- They can reject the theory as a whole and seek to understand things in a completely different way.
- They can build on the strengths of the theory and to let go of its weaker parts.

Shirley Zeiberg/PH College

PH College

In a typical performance, a young girl practices her instrument at home (left). In an optimal performance, orchestra members practice together for a concert (right).

Neo-Piagetians are a group of psychologists and educators who have built on Piaget's theory while disowning the parts of the theory that have not held up to close scrutiny. Although the label "neo-Piagetian" suggests these psychologists have similar views, individual psychologists have taken a variety of approaches to build on Piaget's work.

■ **PROPOSING DIFFERENT STAGES** One neo-Piagetian approach is to propose alternative sets of stages (e.g., Demetriou et al., 2002; Fischer & Pipp, 1984; Parziale & Fischer, 1998). Fischer and Pipp have suggested somewhat different stages from those of Piaget. These psychologists have also made a useful distinction between optimal and typical levels of performance. The optimal level is the best performance an individual is capable of making on a given task; the typical level is the level of performance at which the individual typically operates. Fischer's theory builds on that of Piaget by showing that just because people are optimally capable of performing at a certain level (e.g., Piaget's formal operations), it does not mean they will typically perform at that level in their everyday lives.

THINKING PRACTICALLY

When in the course of doing schoolwork do you think you were performing at your own optimal level? What were the circumstances that induced you to work at that level?

SUGGESTION: Working at the optimal level involves performing a task at an appropriate level of challenge.

■ **PROPOSING MORE STAGES** Another approach that neo-Piagetians have taken is to propose one or more stages beyond the four originally suggested by Piaget. Theorists who believe in such stages are basically suggesting the possibility of **postformal thinking,** or thinking that goes beyond that of formal operations in some way. Theories of postformal thinking suggest that cognitive development does not stop at age 12. Instead, a great deal of cognitive development goes on during adolescence and adulthood. As more and more adult students become involved in various aspects of education—going back to finish high school or college degrees, doing advanced graduate work, and becoming involved in on-the-job training—it is important for teachers to consider the cognitive development of adults (Baltes, 1997; Baltes & Staudinger, 2001; Berg, 2000; Brody, 1997; Ceci & Williams, 1997; Moshman, 1998; Schaie, 1996; Sternberg, 1997a).

For example, Patricia Arlin (1975, 1990) has suggested that a fifth stage of cognitive development is one of **problem finding,** in which an individual becomes able not just to solve problems, but also to identify the important problems to solve. In this view, as adolescents grow into adults, their development deals not so much with how well they solve problems, but rather with how well they recognize which problems are worth solving. The ability to find good problems to solve may be viewed as the most important and perhaps the most basic skill involved in scientific reasoning.

THINKING PRACTICALLY

Give an example of a thesis, antithesis, and synthesis in the development of your or others' thinking about an educational practice (e.g., homework, testing, teaching, reading, or grade retention).

SUGGESTION: Here is an example. Thesis: IQ is the only measure of ability that matters. Antithesis: IQ does not matter at all. Synthesis: IQ matters, but so do other measures of ability.

Klaus Riegel (1973), Gisela Labouve-Vief (1980, 1990), Juan Pascual-Leone (1984, 1990), Robert Sternberg (1998b), and others have proposed a stage beyond formal operations called **dialectical thinking** (see also Moshman, 1998; Peng & Nisbett, 2000). According to these investigators, as we mature through adolescence and into early adulthood, we recognize that most real-life problems do not have only one correct solution. Rather, our thinking about problems evolves so that we first propose one solution to a problem (the **thesis**). Sooner or later, we or someone else proposes a directly contradictory solution (the **antithesis**). Eventually, someone proposes a solution (the **synthesis**) that somehow integrates what had appeared to be two completely irreconcilable points of view. Truly expert thinking in any domain requires an appreciation of the dialectic.

For example, consider the issue of grouping in the classroom by ability levels. In the 1950s and 1960s, grouping was widely practiced and hardly questioned (thesis). There then came a period in which many argued that grouping was always wrong and was an injustice to all children (antithesis); indeed, some still argue this way. Today, many educators believe that grouping, such as putting good readers together in one group and slower readers together in another, can be helpful if it is used selectively and in limited and flexible ways (synthesis) (see, for example, Spear-Swerling & Sternberg, 1996; Sternberg & Grigorenko, 1999). To provide you with practice in this form of thinking, the Forum feature in each chapter of this text presents the dialectical progress of research or public opinion about a key topic in education.

TEACHING BEYOND PIAGET

Piaget's theory was sometimes off the mark. Here we consider related ideas that go beyond Piaget on the basis of current information (Kuhn & Siegler, 1998).

Piaget defined some of his stages—especially the preoperational stage and, to a lesser extent, the stage of concrete operations—in terms of what children *cannot* do. For example, preoperational children cannot conserve; concrete operational children cannot think in highly abstract ways. A focus on what children cannot do may set up negative expectations, which in turn can become self-fulfilling prophecies. We recommend a focus on what children *can* do. For example, a teacher should not focus on a 5-year-old's inability to conserve. Instead, the teacher should give the child as many opportunities as possible to strengthen his or her quickly developing communication abilities.

Piaget was concerned with what he referred to as the "American problem"—the desire to hurry along the child's development. David Elkind (1981), in *The Hurried Child*, wrote of just this obsession among Americans. We now know that children are often unable to think at a high level not because they don't yet have higher-order cognitive skills, but rather because they lack relevant experience. For example, students cannot design good experiments to study the effects of gravity if they do not have a basic understanding of what gravity is. Once children acquire a knowledge base in an area, they can often think at a higher level in that area than in other areas in which they do not have the same amount of knowledge (Wellman & Gelman, 1998).

We should not assume too much about what children cannot do. With knowledge, they can often do more than we suspect. Expert teachers know they can expect, and ask for, students to show higher levels of thinking in subjects in which the students have expertise. For example, a 9-year-old may be very active in a competitive sport. If the 9-year-old's coach shows the team many examples of what it means to display good sportsmanship, the 9-year-old may be able to understand this abstract concept—even though he is still in the concrete operational stage of development. It is important for children to learn what they are capable of doing. They need to understand their own minds (Perner, 1999; Perner & Dienes, 2003).

Finally, Piaget may have overemphasized the scientific side of development at the expense of other sides of development, such as the aesthetic. A balanced education means teaching children to think in many different modes, not just in the scientific mode that Piaget tended to emphasize in his theory of cognitive development. Schools should appreciate and acknowledge the importance of artistic skills.

*i*MPLICATIONS FOR TEACHING

PIAGET'S THEORY

Piaget's theory suggests many sound ideas for instruction and assessment:

- **Mix assimilations and accommodations.** Expert teachers balance assimilation and accommodation to help their students develop the schemas they have as well as create new schemas. In particular, you want to provide instruction that goes just a little bit beyond the level of children's thinking at a given point. As a simple example, reading

THINKING PRACTICALLY

What are some criteria you can use to decide whether a problem in education—such as whether to group children by ability levels—is an important problem?

SUGGESTION: You might ask whether solving the problem will affect the lives of many students rather than just a few, and whether the impact itself is a major rather than a minor one.

THINKING CREATIVELY

How might you measure a person's ability to see the importance of problems, whether educational or otherwise?

SUGGESTION: You might ask students to judge the importance of a specific problem and then compare their responses to those of experts.

material should be challenging but not overwhelming. It should contain a level of vocabulary and should involve a level of conceptual complexity that engages the student, but not at a level that frustrates the student and makes him or her want to put the book down. One of many reasons for the success of the *Harry Potter* series of novels has been that the level of writing and even the sheer length of the novels challenge children who pick the books up. Nevertheless, the novels engage the children sufficiently that they are willing to accept and surmount the challenges that the books present.

- **Take into account children's level of cognitive development.** A thorough introduction to Piaget's theory may help you develop expertise in recognizing the signs that students have reached the necessary cognitive level to master certain content, such as algebra. Such signs include (1) understanding of the task, (2) acceptance of the task, (3) subsequent intellectual engagement with the task, and (4) demonstrable signs of learning the content embedded in the task. An expert teacher does not set expectations that students are developmentally unable to meet.
- **Teach children in a way that reflects their nature as natural-born scientists.** Expert teachers respond to and celebrate children's need to discover and master the mysteries of nature, such as the importance of photosynthesis for the development of plants.
- **Pay as much attention to understanding and correcting the bases of children's errors as to rewarding their correct answers.** Rather than simply putting a big "X" next to errors, a teacher needs to understand why students make the errors they do and how he or she can help the children correct the thinking that led to these errors.
- **Teach children in a way that allows new cognitive structures always to build on old ones.** Incorporate what the children already know into your lessons so that they can build on this knowledge to construct new knowledge. Piaget's theory stresses the cumulative nature of cognitive development. In teaching, you need to *build carefully on what students already know.* It is only in this way that students can integrate new knowledge with the old, and see in some cases how to correct misconceptions they may have had. For example, teaching decimals can build on what children already have learned about fractions.

NEO-PIAGETIAN VIEWS

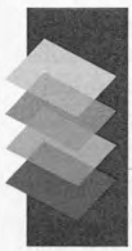
Neo-Piagetian theories have implications for instruction and assessment that go beyond Piaget's. Generally, neo-Piagetian views for education imply that cognitive development extends beyond a formal operations stage. As a consequence, we can expect more sophisticated forms of thinking in, say, college students than we can in middle school students. Consider the following teaching ideas that come from the work of neo-Piagetians. (In this discussion of the implications of neo-Piagetian views for education, we are drawing on a variety of neo-Piagetian views held by researchers.)

- **Problem finding is at least as important as problem solving, and becomes more important in adolescence and beyond.** Arlin (1990) and others have shown that students need to develop good judgment in the selection of problems (see also Sternberg, 1997c). Expert teachers do not always give students the problems to solve. Rather, the older students get, the more these teachers should assume the role of guide or mentor, urging students to develop their own sense of what problems are worth solving (Rogoff, 1990).
- **Students, as they become adolescents, need to be encouraged to think dialectically.** Dialectical thinking, you will recall, is the recognition that in many issues of importance, we do not have final answers. Students need to come to appreciate knowledge not only as a product, but as part of a process of development that is ever ongoing. Consider an example: "Which European countries might be considered strong allies of the United States?" A reasonable answer might be "Great Britain." But this answer would have been looked upon in amazement during the American Revolution or the War of 1812. A "correct" answer depends on the flow of historical events, and cannot be provided independently of historical context.

BEYOND PIAGET

Recent work updating the views of Piaget suggests the following teaching techniques:

- Expert teachers focus on what children of a given age *can* do.
- Children can be pushed just a bit beyond their current level of cognitive development.
- Children should be taught as multifaceted human beings, not just as developing scientists.



Vygotsky's Sociocultural Theory of Cognitive Development

The thinking of Piaget and of the neo-Piagetians has been important to our understanding of cognitive development and its interface with education. In Piaget's theory, the direction of development is from the inside, outward. In other words, abilities mature, and the child then applies these abilities to the tasks he or she faces in the world. An alternative theory, however, emphasizes exactly the opposite direction of development.

In the theory of Lev Vygotsky, cognitive development occurs largely from the outside, inward (Vygotsky, 1978). Vygotsky's major premise was that a person's internal processes have their roots in interactions with others. Children watch the interactions between the people in their world, interact with others themselves, and use these interactions to further their own development. This theory is sometimes referred to as a **sociocultural theory.**

Although he lived in the early part of the twentieth century, and died of tuberculosis at the age of only 38 in 1934, for many cognitive developmentalists Lev Vygotsky is among the most influential of theorists. Whereas Piaget's thinking dominated the field of cognitive development in the 1960s and 1970s, Vygotsky's theories dominated the thinking of the field in the 1980s and 1990s. The increasing importance of Vygotsky's thinking is due largely to his recognition that developmental accomplishments depend as much on the influence of social and other environments as they do on sheer maturation.

In general, Vygotsky's theory is less detailed than Piaget's. Nevertheless, many of its main assertions appear to be valid. Vygotsky formulated three particularly important ideas about cognitive development—the concepts of internalization, the zone of proximal development, and scaffolding.

INTERNALIZATION

Internalization is the process of taking in knowledge or skills from the social contexts in which they are observed (see Vygotsky, 1962, 1978). For example, imagine a child who is watching two adults argue for their respective beliefs (for example, on religion, politics, the relative merits of chocolate and vanilla ice cream, or which television program to watch). Seeing such arguments, the child can learn how to argue for her own beliefs, both in the context of discussions with others and in the context of thinking through issues for herself. In school, a first grader might learn how to get a playground game started by watching how the third graders play. A high school freshman might begin to form sexual mores by observing the male–female interactions between seniors in the hallways and after school. In essence, children recreate within themselves the kinds of interactions they observe in the world so they can profit from the interactions they have observed. The more interactions a child observes, the more likely he or she becomes expert at extracting information from them.

Vygotsky believed that language development is the key to being able to internalize complex ideas (Vygotsky, 1962). Developing children's language skills helps children develop their thoughts. For example, when children learn about classifications of animals, the words used in the classification can help children understand the concepts themselves. They learn, for

THINKING ANALYTICALLY

If internalization is key to learning, to what extent are interactions in school—students questioning their teachers, for example, or waiting in line at a water fountain—critical to learning?

SUGGESTION: From a Vygotskian point of view, interaction is key because it is the basis of internalization. By listening to other students, students can learn how to ask questions when they are unsure of the meaning of a concept being taught. They can learn patience and civility (or the lack of these) by waiting with others in a line.

example, that a robin and a blue jay are birds, and that, even though a turkey or a penguin does not look like a bird in the same way that a robin and blue jay do, each is nevertheless a bird.

Learning about the concepts through words helps children refine and sharpen their understanding of the concepts in a way that would be difficult without words. As another example, if their language skills are strong, children can understand adult conversations better, and learn more from those conversations, than they can if they do not understand many of the words the adults are using.

Bilingual children have a special advantage in that they can understand conversations in two languages. But they also face special challenges, in that the language in which they are more comfortable may not be the language in which instruction occurs in the school. They may have the conceptual skills needed to understand the material, but not the linguistic skills needed to support and demonstrate their understanding. One of the worst things a teacher can do is to undermine a child's first language. It is important that a second language add to—rather than subtract from—the child's first language. The advantages of bilingualism extend to adults as well as to children. Teachers who are bilingual may be able to understand more children, and understand the children more comprehensively, than teachers who speak just a single language.

Many misconceptions about bilingualism permeate the thinking of laypeople and even some teachers (Brice, 2002). One source of confusion is the notion that learning a language is something that can be done fairly easily, especially by children. In reality, language learning is a challenge for individuals of any age. For example, learning English as a second language easily can take as long as 7 years. A second source of confusion is the fact that knowing a first language will make learning a second language much easier. Although knowing a first language can certainly help in this regard, it can also hurt in some ways. Often, patterns that apply in a first language do not apply in a second language, which may increase (rather than decrease) the difficulty of learning the second language. For example, Spanish makes heavy use of the subjunctive case, whereas English does not. A third source of confusion is the belief that just exposing oneself to a new language will be enough to learn it. On the contrary, without motivation to learn the language, one may have large amounts of exposure to the language and never learn it.

THE ZONE OF PROXIMAL DEVELOPMENT

Vygotsky's second major idea is called the **zone of proximal development (ZPD):** also called the zone of potential development). The ZPD is the difference between a child's level of independent performance and the level of performance a child can reach with expert guidance. It generally occurs when the expert aims to guide and support the child's own initiative to learn (Zuckerman & Shenfield, 2007). In conventional assessments of children's ability, we typically observe what children can do on their own. What they can do is based on the experiences they have had, and the interaction of the effects of these experiences with the children's inherited characteristics. Vygotsky's idea was to provide a way to measure the distance between this independent performance and the child's guided performance. This difference, in turn, can give educators an idea of the level of performance a child is nearly ready to reach on his or her own.

Vygotsky argued that the ZPD could be assessed by testing children in a **dynamic assessment environment.** In this setting, the examiner not only gives the child problems to solve, but also gives the child a graded series of hints when the child is unable to solve the problems. The examiner then observes the child's ability to profit from this systematic instruction (Sternberg & Grigorenko, 2001).

Suppose a child's reading comprehension is being tested in a dynamic assessment environment. One of the questions might require the child to figure out the meaning of a word in the reading passage. If the child cannot figure out the meaning of the word, the tester provides the first in a series of hints. For example, the examiner might give a hint about the part of speech, or about a function the underlying concept performs, or about a related word nearby in the reading passage. In each case, the examiner observes whether the child is able to profit from the hint (Lidz & Elliott, 2000). Thus, for Vygotsky, the key to understanding what a child is truly capable of is through the examiner's serving not only as a tester, but also as a teacher.

THINKING CREATIVELY

How can aspects of the theories of Piaget and Vygotsky be synthesized to better account for the whole picture of a child's cognitive development?

SUGGESTION: Both maturation and interactions with the environment through internalization are key aspects of cognitive development.

THINKING PRACTICALLY

What risks would you run in trying to assign a number or a score to a student's zone of proximal development?

SUGGESTION: Your evaluation might set a spurious limit on the student's perceived ability to profit from experience.

This dynamic assessment environment contrasts sharply with familiar conventional testing, which takes place in a **static assessment environment.** A static assessment environment gives the child problems to solve, but provides little or no feedback about the child's performance. The last thing the examiner wants to do is to give hints, which would be viewed as invalidating the conventional test.

Tests of the zone of proximal development have been developed (see, for example, Allal & Ducrey, 2000; Brown & Ferrara, 1985; Day, Engelhardt, Maxwell, & Bolig, 1997; Feuerstein, 1979; Grigorenko & Sternberg, 1998), and they do seem to measure something other than general cognitive abilities. These tests hold promise for helping teachers understand children's readiness to profit from instruction.

SCAFFOLDING

Many psychologists have used and expanded on Vygotsky's ideas to better understand how children learn and think. For example, Reuven Feuerstein (1980) has suggested that children learn primarily in two different ways, through direct instruction and through mediated learning experiences.

- **Direct instruction** is the teaching situation in which a teacher, parent, or other authority imparts knowledge to a child by teaching it. When a middle school teacher says, "Today, we'll be learning about Brazil," he or she is embarking on direct instruction.
- A **mediated learning experience (MLE)** is one in which an adult or older child indirectly helps a child learn by explaining events in the environment, but without directly teaching some lesson. MLE is a form of **scaffolding**—competent assistance or support, usually provided by a parent or teacher. Scaffolding supports cognitive, socioemotional, and behavioral forms of development. For example, an adult might go with a child to a museum and explain what the exhibits mean, or an adult might watch a television program with a child and explain what is happening. In this way, the adult serves as an expert model for the child.

THINKING CREATIVELY

How might you apply mediated learning experience to help a child understand mathematical concepts used in everyday life?

SUGGESTION: You might work with the child by modeling the processes of deciding whether the purchase of a toy is worth the price.

Feuerstein believes MLE is the stronger of the two kinds of learning for the development of advanced cognitive skills. Teachers can create MLEs for students by explaining ideas or events, while allowing the students to see for themselves the connections among the ideas and their logical conclusions. A teacher might say, "As you can see, polar bears are white. They live in the Arctic, which is covered with snow." The students might then have the insight that being a white animal in a white environment is an integral aspect of the situation. If the students bring up this point, the teacher could offer further ideas, such as "Being white and blending in makes the polar bear hard to see. The polar bear must hunt seals for food," from which the students may conclude, "It is easier for a camouflaged animal to capture food." This kind of learning is more interactive than direct instruction.

Joan Carlin, the math teacher profiled at the beginning of the chapter, might say to her students, "When a ladder leans against a wall, it forms one side of a triangle. Can you see the triangle in this picture?" She might then add, "The formula we learned for calculating the size of one of the angles of a triangle works for all triangles." At this point, students might be able to see the relationship between the triangles in the math book and the triangle made by a ladder leaning against a wall.

In general, scaffolding is a centrally important technique for stimulating cognitive development. In addition to the strategies described previously, scaffolding strategies include questioning students, modeling behaviors, and providing feedback on student performance (Sanders & Welk, 2005). The main element in many programs that focus on early cognitive development is teaching parents to respond to their infants and young children in ways that provide scaffolding for the children (Anderson & Sawin, 1983; Barrera, Rosenbaum, & Cunningham, 1986; Sternberg & Grigorenko, 1997a, 1997b). Teachers who use scaffolding can respond not only to the developed and developing cognitive abilities of children, but also to their developed and developing behaviors and socioemotional needs. Scaffolding can also be a successful tool for instructing adults (Sanders & Welk,

EXPERT TEACHER INTERVIEW

FOCUS ON: DEVELOPMENT AND STUDENT INTERACTION

GRETCHEN MURPHY: UNIVERSITY PARK ELEMENTARY SCHOOL, FAIRBANKS, AK: GRADES K–6

Gretchen Murphy has been teaching for 22 years. She often uses Vygotsky's zone of proximal development to encourage her students' progress to the next level of understanding.

What do you consider to be a sound educational foundation?

Students need basic understanding in the primary grades: reading, writing, number sense, problem solving, spelling, and geography. These are things we all need to know.

Teaching children how to ask and research their own questions is critical because children need affirmation that life is dynamic, not static. Finding answers to their own questions is very empowering for learners.

How do you guide students to the next level of learning?

I keep in mind zones of proximal development, as described in Vygotsky's theory. Learning must have a comfortable foothold in what the learner already knows. Each of us learns through her or his strengths, and a teacher's job is to identify students' strengths to facilitate their learning. The art of teaching is to open learning pathways for students.

The decision of what methods to use is determined by the needs of my students. I enjoy investigations and open-ended activities, so there is no limit to where our learning can go. I like to let the children discover rules for themselves, rather than plopping them down "from the top." I encourage students to reach out to more complex ideas. A child's curiosity is boundless.

For example, after learning the strategy of a favorite boardgame, some of my fourth-grade students wanted to create their own smaller, travel-sized versions of the game to take home. I saw this as an excellent opportunity for them to learn about proportions, so I asked groups of students to reduce the rectangular game board size without changing its shape.

Each group discovered a different way, not all of which were successful. After listening to each other's proposed methods, they realized that they needed to modify their investigations to discover a workable pattern rule. My students were not discouraged by a "wrong" answer. They realized that they learned from their first incorrect methods and were anxious to keep searching for different patterns.

They need my guidance to reach a correct solution, so I developed a set of lessons using cubes, graph paper, and a blank factor chart. The original game board was a 30-inch by 42-inch rectangle. Since the children had not studied formal division, they used the cubes to find factors of 30 and 42 that "fit" the patterns we were developing. Choosing pairs that "fit," the students drew arrays on graph paper and cut them out so they had a visual representation with which to compare their new shape to that of the original game board. The smallest possible rectangle represented the ratio, so all the rectangles in that set "grew" by the same pattern. Experimenting with different rectangular proportions and "growing" rectangles with specific ratios led my students to discover the importance of proportion.

This is just one example of a lesson that grew with the students so that they created their own meaning and

2005). This chapter's Flexible Expert feature shows how expert analytical, creative, and practical teachers and students use scaffolding.

Recent work has identified a number of subtypes of scaffolding. These types vary along two dimensions—namely, scaffolding agency and scaffolding domain (Holton & Clarke, 2006). Researchers have identified three scaffolding agents: expert, self, and peer (Holton & Clarke, 2006). They have also identified two domains of scaffolding: content and heuristic. This work has suggested that scaffolding can occur between teachers and students, between students and other students, and by working independently. Further, the focus can be on either content or process, or both, during the process of scaffolding.

Three converging lines of evidence demonstrate the importance of scaffolding for cognitive development. First, evidence suggests that appropriate cognitive, socioemotional, and behavioral scaffolding has positive effects on cognitive development (Sternberg, Grigorenko, & Nokes, 1997). Instruction based on this aspect of Vygotsky's theory results in increased reports of student autonomy (Harland, 2003). A child whose parents provide appropriate early scaffolding, for example, may be more likely to develop the cognitive abilities needed to succeed later in school.

Second, scaffolding is a crucial part in planning **interventions** intended to improve a child's cognitive, socioemotional, or behavioral development. It is important for intervention programs that involve families because it focuses on the parent–child dyad instead of just the

discovered principles of mathematics for themselves. I guided them to make discoveries for themselves at higher levels of understanding.

How does communicating their ideas help your students construct their own knowledge?

Communication validates learning and helps students construct their own knowledge. Visualizations that students create in their minds deserve an appropriate communication path, such as drawing, writing, acting, or talking. Communicating allows students to revisit their own thinking as well as share their ideas with others.

Explain how learning takes place between the students.

Learning is active. It demands attention and respect for other people and for the process of learning. I listen to the students, and they listen to each other. It's important for kids to listen to each other.

Learning is active. It demands attention and respect for other people and for the process of learning.

When we do a schoolwide graphing project, students talk math on their own. The younger students talk to the older ones, and the older ones mentor the younger ones. Peer groups compare data and discuss the graphs. One student said she thought that teachers sometimes got in the way of learning. I think that she has a good point. A lot of learning takes place between students.

We built a large dome in our classroom. Students worked together in small groups to construct miniature domes before we built our big one together. Within each group, students watched and listened to each other and helped each other build domes, offering each other suggestions and help. Children can understand one another's learning problems much better than I do. I often rely on peer tutoring to help a child who is having trouble.

What advice would you give to new teachers?

A teacher is a lifelong learner. The longer I teach, the more important I realize it is to collect best lessons from others (and from my own experience), to determine my own students' learning styles, and to keep up with current trends in learning and brain research. A teacher's job is to meld all of these into a classroom environment. Go slowly, one step at a time in a determined direction, and always follow your heart.

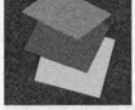
You can follow someone else's lead, such as the directions in a teacher's guide, until you have modified a lesson to suit yourself and your students. Use the standards to guide what you teach; use your students' learning styles to guide how you teach.

Listen to your students. Listen to what they say and how they say it; read their body language. Determine how each student learns. Include visual, kinesthetic, and aural techniques in each lesson, simultaneously if possible. Encourage your students to learn with all of their senses. Listen and learn with your students.

child: Parents need to respond to their children's needs. Scaffolding requires parents to provide carefully designed guidance based on the capacities a child already has. It focuses on a child's potential gains, and is sensitive to a specific child's specific needs. Many intervention studies where parents were additional interventionists did not show any positive effects because parents were taught what they were supposed to do, but were not taught how to respond to their child's needs, how to read behavioral and socioemotional clues, or how to deliver interventions without overstimulating their child. It is not enough just to do what works "on average." Instead, we need to tailor instruction to children's specific needs.

Scaffolding also is important when the intervention focuses on education and is delivered in a centralized manner by professionals. Such programs focus on the teacher–student pair. Because scaffolding that supports the socioemotional needs of a child is crucial within the family, the most effective intervention programs for developing cognitive expertise intertwine active educational intervention at preschools with adequate scaffolding at home.

Third, studies of the long-term effects of intervention indicate that if a program does not last long enough, and if there is inadequate scaffolding after the program, cognitive gains tend to disappear (Grotzer & Perkins, 2000; Sternberg & Williams, 1998). Inadequate scaffolding means inadequate results for children in need of help. To foster and ensure long-term effects of early intervention, families and schools both need to provide scaffolding.



THE FLEXIBLE EXPERT

TEACHING AND LEARNING ABOUT COGNITIVE DEVELOPMENT

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Maria knows her high school chemistry students will need different levels of help on the upcoming lab assignment. She assigns students to groups that match more advanced students with those who need more help, so the advanced students can share their expertise as needed.

THE CREATIVE TEACHER: Maria uses her computer to make colorful posters and handouts that remind students of the steps for setting up the lab equipment. For the first few lab assignments, she requires students to check off each step as they complete it. Later, the posters and handouts serve as reminders. Eventually, all the students perform each step without even referring to the reminders.

THE PRACTICAL TEACHER: Maria works one on one with Betsy to teach her how to get a solid precipitate to form in a certain liquid compound. First Maria models the steps herself. Then she talks Betsy through the steps, providing reminders and directions as Betsy does the work herself. Finally, Maria leaves Betsy to do the experiment on her own.

THE ANALYTICAL STUDENT: Jacob plans to do all problems he can on his geometry assignment before he asks the teacher for help on the problems he cannot complete.

THE CREATIVE STUDENT: Jacob draws an illustrated checklist to help him remember the steps for solving his geometry problems.

THE PRACTICAL STUDENT: Jacob forms a study group with three other geometry students. Each member can call, e-mail, or get together with someone else in the group whenever he or she has trouble figuring out an assignment.

EVALUATING VYGOTSKY'S THEORY

Table 2.1 compares Piaget's and Vygotsky's theories. It will help you see the main points of similarity and difference.

Vygotsky's ideas provide a major contribution to the field of cognitive development, but they seem to deal with only limited aspects of cognitive development. Most likely, internalization accounts for part of, but not all of, how both children and adults learn. The information-processing theories we present next provide more details on learning.

*i*MPLICATIONS FOR TEACHING

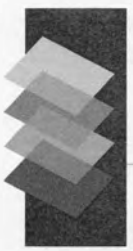
Vygotsky's theory has at least three key implications for instruction and assessment:

- **Serve as a role model for students.** Children learn by internalizing external dialogue. They learn to think critically and well by observing those around them doing it. One of the most important aspects of being a teacher is serving as a role model for students. Other, more expert students also can serve as role models, although as with any such models, they can do so for good or for ill.
- **Build rather than hinder language.** Language and thought are intimately and inextricably related. The view that language is key to both direct instruction and mediated learning experience has direct implications for everyone. It is especially important for students who come to school speaking a language that is not the principal language of the school. Teachers need to build rather than hinder children's native languages when they do not correspond to the language of the school (Bialystock & Hakuta, 1994). When language learners are able to interact within their ZPD, increased positive outcomes are observed (McCafferty, 2002).

TABLE 2.1 Comparison of Piaget's and Vygotsky's Theories

Theorist	Position on Stages	Direction of Development	Major Constructs
Piaget	Stages: Sensorimotor Preoperational Concrete operational Formal operational	Inside, outward	Equilibration, assimilation, accommodation, stage
Vygotsky	Continuous	Outside, inward	Internalization, zone of proximal development scaffolding

- **Make sure you neither expect too much nor too little.** Children do not always operate at the peak of their capacity. Obviously, teachers can expect too much of children. At least as often, however, they expect too little. Vygotsky's theory points out that children have a zone of proximal development, and that with proper guidance, children can be helped to develop further within the range of this zone. One means of development is through the enhancement of information processing in learning and memory.



Information-Processing Theories: Examining Learning and Memory Skills

Information-processing theorists look at cognitive development in terms of how people of various ages process information and represent it mentally (Klahr & MacWhinney, 1998). Information processing in itself is not a theory, but rather an approach to cognitive development that has generated a number of different theories about how cognitive development takes place (see Amsel & Renninger, 1997; Kuhn & Siegler, 1998; Sternberg, 1984; Sternberg & Berg, 1990). Most of these theories deal with particular domains of information processing. Examples include the mental processes and strategies children use when they solve arithmetic problems, write essays, draw pictures, or engage in any of a number of other tasks. Although the same mental processes may occur in a variety of domains, the way they are used varies across domains.

Consider mathematical processing and verbal processing. Thinking about both numbers and words uses two key processes of cognitive development: encoding and combination. Encoding is the process of taking in new information and making sense of the world. Combination is the process of putting together the pieces of information we have encoded (Davidson, 1995; Siegler, 1984, 1998). The way we combine numbers, however, may have little in common with the way we combine words. For this reason we need to study cognitive processes in two ways: (1) a domain-general way, where we identify processes that are used in a variety of cognitive tasks, and (2) a domain-specific way, where we identify how the processes are used in each kind of task.

This section discusses three extensively researched domains—verbal skills, quantitative skills, and memory. Researchers have considered other intellectual abilities as well.

VERBAL SKILLS

People have studied **verbal comprehension**—the ability to understand written and spoken material—in some detail and at various levels.

■ **WORDS IN SENTENCES** Understanding words in sentences is one level. How do children learn what words mean? Several researchers have suggested that most vocabulary is learned from context (Sternberg, 1987a; Sternberg & Powell, 1983; Werner & Kaplan, 1963; Woodward & Markman, 1998). These researchers suggest that children (as well as adults) use various cues to figure out word meanings. For example, read this sentence: "The teacher's instructions were ambiguous, with the result that the children just couldn't figure out what they were expected to do." A child might try to figure out what "ambiguous" means by noting it is something that can apply to instructions and it results in uncertainty. The researchers found that the difficulty of learning a word could be predicted by the kinds and numbers of cues available for figuring out the word's meaning. They also found, as predicted, that a student's ability to figure out word meanings was a good predictor of his or her future vocabulary. The ability to identify ambiguity in sentences is also related to later reading ability (Cairns, Waltzman, & Schlisselberg, 2004).

These findings suggest a link between the ability to use verbal contexts and the level of vocabulary a person develops. One of the best ways for children to increase their vocabulary is simply to read a lot, which gives them many opportunities to learn words in their natural contexts.

The use of sentences to interpret words is apparent very early in development. For example, 18-month-old children use sentences to interpret words more quickly as compared with words presented in isolation (Fernald & Hurtado, 2006).

■ **SENTENCES IN PARAGRAPHS** Ellen Markman (1977, 1979; Woodward & Markman, 1998) has studied verbal comprehension at the level of paragraph understanding. In one study, she asked children to read a passage such as the following:

> *To make it they put the ice cream in a very hot oven. The ice cream in Baked Alaska melts when it gets that hot. Then they take the ice cream out of the oven and serve it right away. When they make Baked Alaska, the ice cream stays firm and does not melt. (Markman, 1979, p. 656)*

As you may have noticed, this brief paragraph contradicts itself. In one place, it says the ice cream in Baked Alaska melts when it gets hot; in another place, it says the ice cream stays firm and does not melt. Amazingly, almost half of the children between 8 and 11 years of age that Markman tested did not notice the contradiction, even when warned in advance that such contradictions might exist. As a teacher, therefore, do not be surprised to discover that children may read and even accept two contradictory statements as though they did not contradict each other.

CONSTRUCTING YOUR OWN LEARNING

Read the following paragraph and see whether you can detect the contradiction embedded within it. If possible, you might ask some of the children you are working with in a practicum to try this same test. What makes a contradiction more or less difficult to detect? What could you, as a teacher, do to help your students learn to detect contradictions and improve their reading comprehension?

Janet was glad finally to be home after a hard day at school. Her English teacher had yelled at her, she had gotten a low grade on her math test, and she had struck out in baseball during gym class. Now she could relax and watch TV for a couple of hours before she started her homework. The TV shows were boring, though, so Janet decided to stop watching TV and call her friend Susie. She was not sure what to talk about, though. Janet changed her mind again and decided to start working on studying for her first math test of the term.

QUANTITATIVE SKILLS

Investigators have taken a variety of approaches to understanding the development of quantitative skills. For example, Brown and Burton (1978) have found that children's errors in

arithmetic can often be accounted for by *buggy algorithms*, or wrong series of steps the children consistently use when they add, subtract, multiply, or divide. Children may reason well but come to wrong answers because they are using algorithms that do not work (Ben-Zeev, 1995, 1998; see also Heirdsfield & Cooper, 2004; Sternberg & Ben-Zeev, 1996). For example, one of Joan Carlin's middle school math students may always get the wrong answer when asked to find the area of a circle. When Joan sees the student's homework, she notices that the student inserts the diameter—rather than the radius—of the circle into the formula for finding area. The student's algorithm, or set of steps, for finding the area of a circle has a "bug" that needs to be fixed if the student is to solve circle problems correctly.

Buggy algorithms are common in addition and subtraction of fractions. A student who adds $\frac{1}{3} + \frac{1}{2}$ may come up with $\frac{2}{5}$, thinking that the correct algorithm is to add numerators and denominators separately. Because students often do not check whether their answers make sense, their buggy algorithms persist. In the case of this example, the sum is actually less than $\frac{1}{2}$, a nonsense result, but one that the student may still think is correct.

Groen and Parkman (1972) studied the steps people use when they add and subtract. With addition, for example, they found that people tend to count upward from the larger addend by the amount of the smaller addend when they add two numbers. For example, in 8 + 3 they would count 3 up from 8. Siegler and Shrager (1984) proposed that when children do arithmetic, they first try to solve the problems by direct retrieval of the correct answer from memory. If their attempt at direct retrieval fails, they then use backup strategies to see whether they can reach a solution in another way—for example, by counting up from the larger of two numbers in an addition problem (Siegler, 1996).

Paige and Simon (1966) did one of the more interesting studies of mathematical thinking. They gave students algebra word problems to solve and looked not only at whether children made errors but also at what kinds of errors the students made. These researchers found that students were surprisingly willing to supply problem solutions that simply made no sense—for example, that involved receiving "negative" change from a purchase. One of the most useful skills a teacher can offer his or her students is the ability to question whether the answers they arrive at when they solve problems, in arithmetic or otherwise, make sense.

THINKING PRACTICALLY

As a teacher, how might you instill in students the strategy of always checking answers to problems in mathematics to ensure the answers are sensible, given the terms of the problems?

SUGGESTION: Show students how answers to math problems can sometimes be wrong simply because they do not make sense, such as in the case of negative change for a dollar.

MEMORY SKILLS

As you would predict, children's memory skills improve with age (Kail, 1986; Ornstein, Haden, & Hedrick, 2004; Schneider & Bjorklund, 1998). Two factors that influence this improvement: people's knowledge about the domain in which they are learning and remembering, and people's understanding of their own memory.

Chi and Koeske (1983) found that we remember things better if we are knowledgeable about the domain in which we are recalling. Thus memory skills lead to increased knowledge, which in turn leads to better memory. Children will learn better, generally speaking, in domains about which they already have more knowledge.

It has also been noted that deficits in memory are frequently observed in children with both reading and mathematical disabilities (Gathercole, Alloway, Willis, & Adams, 2006; Geary, Hoard, Byrd-Craven, & DeSoto, 2004; Swanson & Jerman, 2007). This observation has led some researchers to conclude that memory is an important factor in one's ability to learn (Gathercole et al., 2006). Further improvements in working memory can mediate improvements in reading comprehension (Swanson & Jerman, 2007).

The ability of people of any age to remember material depends in part on their prior experiences. For example, Guatemalan and Australian aboriginal children from rural regions, even at the grade school level, are generally more expert than children in a typical urban or suburban U.S. environment at coming up with strategies that help them remember the locations and arrangements of objects in space (Kearins, 1981; Rogoff, 1986). The greater skill of the Guatemalan and Australian aboriginal children may reflect their greater reliance on spatial skills in their environment They do not have the road signs, maps, access to mapping software, and many other aids we use in navigating from one place to another. Often, they need to rely on subtle cues in their environments that many of the readers of this book

never would even know how to use, such as the positions of stars or of the moon. By comparison, most U.S. children are usually better at generating strategies for learning isolated chunks of information, as they are often required to do in the schools they attend, and at reasoning abstractly with this information. These abstract reasoning skills can then be applied to a variety of situations in which they are needed.

School can also teach children how to understand and control their own memories. For example, learning how to study for tests is one way in which children develop strategies for retaining information they later will need. Such memory-control skills can affect memory performance (Flavell, 1976, 1981; Flavell, Green, & Flavell, 1995; Flavell & Wellman, 1977; T. O. Nelson, 1996, 1999; Wellman & Gelman, 1998). In general, understanding and control of memory seem to develop as children age; children become more expert at using their own memories. Younger children, for example, are less likely than older children or adults to use recall strategies even if they are aware of them. When asked to memorize information they often do not spontaneously rehearse the information. **Rehearsal** is a memory strategy in which a person, either mentally or aloud, recites information over and over again in an effort to remember it. In this way, rehearsal allows an individual to gain some control over which information is stored in memory over the long term. A young child may simply assume he will remember his new e-mail address, even though the child does not repeat the new address, either mentally or aloud.

THINKING CREATIVELY

On what kind of memory test might you expect people from a rural region to do better than people from a city? On what kind of test might you expect the reverse?

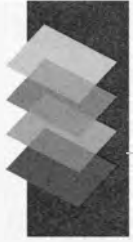
SUGGESTION: Rural people might do better on problems involving animals or grains; city people, on problems involving street addresses or train schedules.

When taught strategies in one domain, younger children often fail to transfer them to another domain: For example, they do not apply what they learned in the literary domain to the new history domain. They may know the years in which an artist lived, for example, but never think about how those years tie in with world events. Yet the writing of many authors can be understood only in its historical context. Harriett Beecher Stowe's novel, *Uncle Tom's Cabin*, can be understood in its own right, but can be much more fully appreciated if understood in the context of slavery in the Old South of the United States.

The information-processing approach to cognitive development helps explain how children and adults develop strategies for solving cognitive problems in a variety of domains. What are some of the implications of this approach for educators?

*i*MPLICATIONS FOR TEACHING

- **Try to understand children's thought processes, not just their final answers.** The information-processing approach for instruction and assessment tells us that we need to understand not just the answers children provide, but also the means by which they arrived at these answers. By trying to understand children's thought processes, teachers can help students develop correct strategies and change incorrect ones. Expert teachers often ask students to explain how they came up with an answer or to "show their work" on tests and homework problems.
- **Teach strategies for learning.** Teach the material of interest, but also teach children how to learn and use the material to best make use of their pattern of abilities. Do not just assume that students will acquire those strategies on their own.
- **Teach knowledge not for its own sake, but rather to help children develop expertise.** We now recognize that both knowledge and strategy are key to expertise. Students cannot learn to think effectively in the absence of either knowledge or strategies for effectively utilizing that knowledge.
- **Pay attention to how students represent information.** How students represent information—that is, which algorithms they use—can be a key to their learning and problem solving. The key to solving a mathematical word problem, a physics problem, or even a problem in social policy can lie in the way information is represented. Often an error occurs not in the computation, but in how the problem is set up in the first place.



Three Major Approaches to Cognitive Development: A Comparison

We have considered three main approaches to cognitive development—Piaget's approach, as well as an offshoot of Piaget's approach called the neo-Piagetian approach; Vygotsky's approach; and the general information-processing approach. How are these ways of understanding cognitive development similar and how are they different?

Piaget claimed that cognitive development comes with maturation: Children reach cognitive milestones, such as the development of object permanence or the ability to reverse operations and recognize conservation, when they became cognitively mature enough to do so. Piaget did not encourage trying to hurry children through their cognitive development. His theory is based on stages of development. Piaget also proposed that, in general, development proceeds at the same rate across different cognitive domains. He did, however, create the concept of horizontal décalage to make minor allowances for differences in the speed at which children show development in different domains.

Neo-Piagetian theorists tend to agree with many of Piaget's basic ideas about cognitive development. They also see development largely as a product of maturation, rather than being based on learning. Like Piaget, most neo-Piagetians propose stages of cognitive development. The main area of difference is that some neo-Piagetian theorists have suggested stages that go beyond Piaget's final stage of formal operations. In addition, neo-Piagetians tend to agree with Piaget's view of cognitive development as domain general.

Vygotsky's theory contrasts in several basic ways with the theories put forth by Piaget and the neo-Piagetians. Vygotsky proposed that cognitive development happens as children internalize information from their environment. In other words, children learn from the people around them. Vygotsky also thought of internalization as a continuous process, without distinct stages in cognitive development. The importance of the child's surroundings in Vygotsky's theory also suggests he believed that development can occur at different rates in different cognitive domains, depending on the information available to a child and the amount of encouragement the child was provided.

Information-processing theorists also tend to see cognitive development as a combination of learning and of the child's level of maturation (e.g., Keil, 1989). They typically view development as a continuous process with no obvious stages. They also suggest that domain-general cognitive abilities exist, such as encoding and combining pieces of information, and that people may use these abilities differently in different cognitive domains. For this reason, information-processing theorists also study domain-specific cognitive development.

Piaget's, Vygotsky's, and the information-processing approaches all take slightly different views of the development of cognitive expertise, but they are not entirely contradictory. Rather, they complement one another: Some theories address aspects of cognitive development that others do not consider. All of these approaches provide us with valuable insights into the development of children's thinking abilities. Each approach also has several important implications for the way children are educated.

As a teacher, your goal is to become an intelligent consumer of theories relevant to education, not a slavish adherent to any one of them. You need to decide in each instance how the theories can be helpful to you, and then apply them as appropriate. No one can tell you exactly how to apply every theory in every situation, any more than anyone can tell a child exactly which mathematical concept or formula to apply in every possible mathematical word problem. Expertise in teaching consists of gaining an appreciation of which concepts to use when. It does not mean memorizing what would be an infinite list of the possible situations a teacher can encounter, and which theory to apply in each.

Although these approaches tell us a great deal about how children's thinking develops, we need to go beyond them to understand one more particularly crucial part of development: theory of mind.

Theory of Mind

Piaget and Vygotsky were both concerned with the development of children's understanding of how the mind operates (Keil, 1999; Perner, 1998, 1999). As children grow older, their *theory of mind*—how they understand their own minds—becomes more sophisticated. Consider an example (Perner, 1999, p. 207):

> *Maxi puts his chocolate into the cupboard. He goes out to play. While he is outside he can't see that his mother comes and transfers the chocolate from the cupboard into the table drawer. She then leaves to visit a friend. When Maxi comes home to get his chocolate, where will he look for it?*

Children younger than age 3 typically give the wrong answer, believing that Maxi will search for the chocolate in the drawer where it actually is. By age 3, some children start to get the problem right. By 4 years of age, most children solve the problem correctly, although even some 5- and 6-year-olds still make errors (Ruffman, Perner, Naito, Parkin, & Clements, 1998).

Autistic children seem to lack or have a seriously defective theory of mind (Baron-Cohen, Leslie, & Frith, 1985; Perner, 1999). They also are deficient in their language development. It is, therefore, not surprising that the development of theory of mind is highly related to children's verbal ability (Hughes, Jaffee, Happé, Taylor, Caspi, & Moffitt, 2005). Furthermore, theory of mind is intimately linked to the development of executive functioning (Sabbagh, Xu, Carlson, Moses, & Lee, 2006). Additionally, the development of theory of mind is consistent across cultures (Sabbagh et al., 2006). By contrast, the specific course of the development of theory of mind seems to be moderated by the environment more than by genetic factors, and by the verbal environment in particular (Hughes et al., 2005).

Language Development

As Vygotsky and others have recognized, language is crucial to cognitive development (K. Nelson, 1999). Language is made up of a special set of abilities (L. Bloom, 1998; P. Bloom, 2002). Virtually everyone is able to learn a language, regardless of the environment the person is in, unless the person is subject to extreme deprivation. In one severe case, a child named Genie was denied all interpersonal interaction until the age of 13. After intense language training, even Genie was able to gain some language skills (Jones, 1995; LaPointe, 2005). There is also evidence of a critical period in children's development when they are particularly receptive to learning language.

WHAT MAKES A LANGUAGE A LANGUAGE?

Five key properties make a language (Brown, 1965; Clark & Clark, 1977):

1. **Communication.** Language provides a means for one individual to understand the thoughts of another. It enables students to understand what the teacher is saying, and vice versa.
2. **Arbitrariness.** With few exceptions, the relation between a word and what it refers to is arbitrary. *Dog, chien*, and *perro* all are equally usable ways of referring to the same animal, as are words for dog in other languages. Similarly, terms such as *subtract, take away*, and *minus* are arbitrary ways of saying essentially the same thing.
3. **Meaningful structure.** All languages are patterned so larger structures build in a sensible way on smaller ones: words on sounds, sentences on words, paragraphs on sen-

tences, and so on. Children speaking any language are equally capable of creating meaningfully structured expressions.

4. **Multiplicity of structure.** All meaningful utterances can be analyzed at many levels. For example, we can analyze a sentence in terms of its grammar or its meaning. To appreciate language fully and expertly, children must learn about all these different types of structure.
5. **Productivity.** Any language can produce an infinite number of sentences. Every day, many new strings of words are being created that have never before been created in the history of the world. In other words, children are using language creatively every day of their lives, from a very early age.

STAGES OF LANGUAGE ACQUISITION

Language can be seen as developing in seven basic stages. As children pass through each of the following stages, they develop increasing expertise in speaking their native language (Jusczyk, 1997):

1. **Prenatal responsiveness to the human voice.** It now appears that fetuses can hear their mothers' voices. In fact, a fetus near full term can distinguish between voices (Lecanuet, Granier-Deferre, Jacquet, Capponi, & Ledru, 1993). Prenatally, infants demonstrate, through increased heart rate, a preference for their mother's voices as compared with new voices (Kisilevsky et al., 2003). Within days after birth, newborns show a preference for voices (e.g., their mothers') they have heard over voices they have not heard prenatally (e.g., DeCasper & Fifer, 1980).
2. **Cooing.** The earliest postnatal step in language acquisition occurs when an infant makes cooing sounds (Stark, 1978). These sounds potentially include all sounds humans can produce (see Bel'tyukov, & Salakhova, 1973). Infant cooing is virtually the same all over the world, even among the deaf.
3. **Babbling.** Infants babble sounds that are characteristic of the infant's to-be-learned first language. At this stage, the infant begins to lose the ability spontaneously to make sounds outside his or her own language system. Babbling thus differs among babies around the world. Infants who can hear but are exposed to American Sign Language as their primary language also demonstrate babbling. However, babbling in these infants is nonverbal. These infants form both nonlinguistic and linguistic hand movements much in the same way that verbal infants do with spoken phonemes (Petitto, Holowka, Sergio, Levy, & Ostry, 2004).
4. **One-word utterances.** During this stage, the infant utters his first word. By 18 months of age, infants typically have vocabularies ranging from 3 to 100 words (Siegler, 1996). Some evidence suggests that girls have more extensive vocabularies than boys at 18 months of age (Lutchmaya, Baron-Cohen, & Raggatt, 2002). At this stage children are likely to make great use of their limited vocabularies. In doing so, they often make **overextension errors,** or applications of a word beyond its legitimate use. For example, any man may come to be referred to as "Dada." Children sometimes make **underextension errors** as well, which involve using words too specifically—for example, fruit is only a banana.
5. **Two-word utterances.** At roughly 2.5 years of age, children may produce their first two-word utterances. During this stage, children first acquire the most rudimentary understanding of **syntax,** or the rules for combining words.
6. **Telegraphic speech.** Children of roughly age 3 become able to express **telegraphic speech,** or speech that uses simple syntax in utterances of two or three words that impart simple meaning. Children's vocabulary expands rapidly at this stage, typically reaching about 300 words at age 2 and about 1000 words at age 3.
7. **Basic adult sentence structure.** This stage, which children typically enter by about 4 years of age, involves their speaking in much the manner of an adult, although in a format that may be simplified. However, by about age 10, the structure of children's language differs little from that of a typical adult, although their vocabulary is likely to be lesser and their knowledge of formal grammar still lacking. Thus, at a young age, children have all the ingredients for linguistic expertise.

THEORIES OF LANGUAGE ACQUISITION: A COMPARISON

Several theories describe how children acquire language. These theories differ in several ways, most notably with respect to their claims regarding the role of nature (genetic programming) versus nurture (upbringing and interactions with the environment).

■ **NURTURE: ACQUISITION OF LANGUAGE BY IMITATION** One theory, sometimes called behavioral theory, holds that acquisition is largely by imitation. This theory emphasizes the role of nurture in language acquisition. Indeed, we know that, to some extent, children imitate the speech patterns they hear in others. B. F. Skinner (1957) believed language acquisition goes beyond imitation: Children learn language through a system of reinforcements whereby they are consistently rewarded for correct but not for incorrect language use. Moreover, parents often use child-directed speech, which is a simplified way of speaking to children so the children will understand (Kemple, Brooks, & Gills, 2005; Thiessen, Hill, & Saffran, 2005). It has been shown that children prefer listening to such speech over other kinds of speech (Fernald, Taeschner, Dunn, Papousek, DeBoysson-Bardies, & Fukui, 1989).

We must consider some drawbacks to any theory that suggests children learn language by imitation alone. One of the biggest problems with this theory is that children are constantly producing new sentences different from any they have ever heard. In producing such sentences, they go beyond—rather than imitate—what they have heard. Moreover, children frequently **overregularize**—that is, they use word forms that follow a rule rather than recognize an exception to it. For example, a child may overregularize the rule that says past tense words end in *-ed*, by saying "I goed home." Yet children typically have never heard the overregularizations they produce. Although this imitation theory may be incomplete, it correctly suggests that children will learn to speak and write better if they are given good models to learn from.

■ **NATURE: AN INNATE ABILITY TO ACQUIRE LANGUAGE** Another theory emphasizes nature. In this view, humans possess a **language acquisition device (LAD)**—an innate predisposition or ability to acquire language expertise (Chomsky, 1965, 1972; Pinker, 1994, 1998; Stromswold, 1998, 2000). Children are preprogrammed to learn language, and the environment merely serves as a catalyst for language development. Many language theorists who advocate this point of view believe that children exhibit **critical periods,** certain points in their development during which they are particularly attuned for various aspects of language development.

Such critical periods may be behind the phenomenon of accents. Generally, if children learn a second language in an environment of native speakers, they acquire the accent of a native speaker. Adults, however, typically retain an accent that identifies them as speakers of another first language, whether or not they learn the second language from native speakers. Even when they become expert in the structure and vocabulary of a language, adults are still likely to speak with a non-native accent.

■ **NATURE AND NURTURE** A consensus view states that both nature and nurture play interactive roles in stages of language development (Hespos, 2007; Locke, 1994). On the one hand, humans do appear to be preprogrammed to learn their first language during childhood. On the other hand, the stimuli presented in the environment—the kind of speech, the amount of reading material, and so forth—can affect how well people acquire that language. Children seem to learn language, at least in part, through active **hypothesis testing,** forming hypotheses about language and linguistic forms and trying them out in their environments (L. Bloom, 1998; P. Bloom, 2002; Slobin, 1985). Parents, teachers, and others who are responsive to the children's tests can facilitate the children's acquisition of language.

Hypothesis testing is illustrated in children's acquisition of the meaning of words. For example, children learn the meanings of many words in context through hypothesis testing. Suppose a student sees the following sentence: "Tanith peered at Tobar through the oam of the bubbling stew" (Sternberg & Powell, 1983). A child reading this sentence can use hypothesis testing to figure out the meaning of *oam.* We know it is something translucent or transparent and connected with a bubbling stew, perhaps arising from it. A plausible meaning, and the

correct one, is that *oam* means "steam." Sternberg and Powell (1983) found a high correlation between students' ability to figure out meanings of words from the context and a measure of vocabulary, suggesting this ability is crucial to the formation of vocabulary.

THE RELATIONSHIP BETWEEN LANGUAGE AND THOUGHT

As children develop language, what effect is the language having on the children's thought processes? Again, there are competing views.

Edward Sapir (1941/1964) and Benjamin Lee Whorf (1956) have proposed what is usually considered an extreme view—namely, **linguistic determinism.** In this view, the structure of our language shapes our thought processes. Is there a difference in how you think about the words "I am" in the two sentences "I am tired" and "I am a woman (or man)"? In Spanish, the words used to mean "I am" in these two sentences are different. Thus, for someone who believes in linguistic determinism, Spanish-speaking individuals will think of states of being differently from English-speaking individuals—because English speakers have just one form of the verb "to be," whereas Spanish speakers have two: *ser* and *estar*. Although there are several differences between the two forms, in general, *ser* is used for relatively permanent states and *estar* for more temporary ones (Sera, 1992).

Another piece of evidence used to support linguistic determinism can be seen in a study of the Pirahã tribe of the Amazon. One researcher noted that the members of this tribe do not have words for numbers greater than two (Gordon, 2004). Further, this researcher observed a failure of members of this tribe to find pairs of exact quantities greater than two or three (Gordon, 2004). Some theorists take these observations as evidence for linguistic determinism, although other theorists disagree (see Casasanto, 2005). This point of view is intriguing, but not fully supported, because almost all languages permit us to communicate basically the same thoughts (Gerrig & Banaji, 1994). Moreover, although different languages have different color terms, and different numbers of them, speakers of these various languages are nevertheless all able to identify the same various colors (Heider & Olivier, 1972).

A related version of this point of view is called **linguistic relativity,** which suggests that language influences but does not determine thought (Lucy, 1997). For example, people familiar with all the different kinds of grass found in a lawn are likely to think about grass in a different way from people who simply view grass as "the green stuff that makes a lawn"—that is, they will have many more specific words for the generic word grass. Many theorists of language today accept the idea that language can influence thought, without absolutely determining it. However, the exact role of language remains a disputed issue (January & Kako, 2007; Ji, Zhang, & Nisbett, 2004; Mashrov & Fischer, 2006).

In conclusion, language and thought are related and interactive. It is important to teach language well because language can facilitate thought. But language does not completely determine thought, nor does thought completely determine language. Moreover, language is related not only to thought but also to the social context of its use, as we discuss in Chapter 3 on social development. Adding a second language to a well-developed first language also seems to enhance cognitive functioning (Bialystock & Hakuta, 1994; Hakuta, 1986). The role of second language learning will be discussed extensively in the next section.

THINKING CREATIVELY

Would an Inuit child from northern Alaska think about snow differently from a child growing up in southern Arizona? Why or why not?

SUGGESTION: The linguistic-determinism hypothesis would say yes. In reality, the difference may not be large, especially if the child from southern Arizona has visited snow-covered mountains.

THINKING CREATIVELY

Suppose language did determine thought. Would people who have grown up speaking different languages be able to communicate effectively? Why or why not?

SUGGESTION: If language determined thought, the more different the languages, the harder people would find it to communicate with one another. The reason is that the greater the divergence of their languages, the more different will be their conceptual systems.

BILINGUALISM AND EDUCATION: AN INTRODUCTION

Language is not only related to thought but also, in complex ways, to culture and educational and social functioning. In the United States, especially since the late 1970s, there has been an increase in the number of immigrants and refugees, especially from Latin America and Asia, adding to America's linguistic and cultural diversity. These demographic changes are influencing both education and society. In this educational and societal context, some groups have insisted that members of non-English-speaking communities learn English to function well in U.S. society. For children, this means learning English in school as early as possible and devoting a significant amount of school time to that second-language learning. Other groups prefer to value and preserve linguistic diversity and to use students' first language as a key resource for learning in school and performing in society in general.

The simplest definition of **bilingualism** is the ability to speak two languages. However, included with this definition should be an awareness of the social and cultural conditions that can make it difficult for a child speaking in a first language to learn a second. Likewise, social and cultural conditions of bilingualism can impede other kinds of learning and functioning in school and outside.

■ **MOVING BETWEEN CULTURES** A Vietnamese-speaking child, or a child who knows for the most part only Spanish or Haitian Creole, experiences problems in school and society that students who speak English as a first language are spared. For example, moving between the social circle of one's English-speaking classmates and one's parents, who speak the native language and practice their culture at home, presents difficulties in adjustment. Some children may also be devastated by the teasing they suffer as a result of stumbling over English, even though they have acquired an age-appropriate mastery of their native language. In addition, these students may be pressured to learn English, yet not always have access to it. Access will depend on several circumstances. Clearly, the age at which English as a second language is learned (usually, the earlier, the better) and the context in which it is learned will be important factors, as will the presence or absence of English in the child's community.

■ **THE STATUS OF LANGUAGES** Also critical to both English-language acquisition and other learning is the relative status of the languages: When the student's native language, such as Spanish or Chinese, is valued as much or virtually as much as English, then the bilingual experience will be a positive one. The individual's cultural identity will not suffer, nor will cognitive development and learning. In fact, when students are not pressured to give up their native language and bilingualism is accepted in the community, abilities in concept formation, creativity, and other cognitive functions appear to be enhanced (Garcia, 1992; Ricciardelli, 1992).

Unfortunately, this is not always the case in the United States, where language diversity is not always tolerated and young people may experience discrimination as a result of speaking a "foreign" language. Even teachers may view students who have learned a first language other than English as being "handicapped" or "disadvantaged" or suffering a "deficit" (see Lee & Oxelson, 2006).

■ **THE FIRST LANGUAGE AS A RESOURCE FOR LEARNING** Negative thinking about non-English languages can cause teachers to ignore the first language as a resource for learning, thereby robbing students of access to that essential educational foundation. When this happens, the child's essential prior learning—the acquisition of the first language as a basis for future learning—cannot be tapped. On the significance of prior learning, Jim Cummins (1996, p. 75) writes, "There is general agreement among cognitive psychologists that we learn by integrating new input into our existing cognitive structures or schemata. Our prior experience provides the foundation for interpreting new information. No learner is a blank slate."

Studies in **bilingual education,** in which two languages are used as the medium of instruction, have indicated that recognizing and affirming students' native languages can be beneficial to learning in the classroom (Nieto, 2000). One example of this benefit can be seen in enhanced test scores for students in dual-language classrooms (Gómez, Freeman, & Freeman, 2005). Where teachers understand and appreciate the process of learning a second language and how to teach to those who are just acquiring it, learning can be successful. Cummins (1976, 2004), Hakuta (1986), and others have shown that **additive bilingualism,** the addition of a second language that builds on an already well-developed first language, seems to enhance thinking ability. This contrasts with **subtractive bilingualism,** the learning of a second language that starts to replace a first language that has not yet been fully formed. In subtractive bilingual education, cognitive abilities tend to decrease. By comparison, the additive—or English-plus—notion helps not only to enrich cognitive development but also to avoid the psychological costs of abandoning one's first language.

Although educational psychology has increasingly affirmed the need to build on first-language learning for students' success in school, hot debate continues about how speakers of languages other than English are to learn. This debate is broken down and reevaluated in the Forum feature on bilingual education.

FORUM

BILINGUAL EDUCATION

What is the best way for non-native speakers of English to learn in U.S. schools? Although the research on this topic is explored in depth in Chapter 6, this chapter's introduction to multilingualism provides an excellent basis for a discussion of this controversial question. This issue is clearly important: The number of children whose primary language is not English increased more than 20 percent between 1990 and 1995 in the United States, to approximately 3 million students, and has grown even more since then.

FIRST VIEW: The most widespread method now used to teach students whose first language is not English is through special bilingual education programs, which have been in use in many American schools since 1968. In these programs, students receive instruction in core academic topics, as well as English lessons, in their primary language. Supporters of this instructional method believe it allows children to keep up with their peers in critical academic subjects while they learn sufficient English to eventually become able to join English-only classes. According to this view, students placed in English-language classes fail to learn academic topics sufficiently because of language barriers. These children are then at risk for failure or for dropping out of school. In addition, proponents of bilingual education suggest that increasing knowledge in other areas of the curriculum may help students learn English. Alfredo Schifini states this position succinctly: "The more students know in their first language, the easier it will be to acquire a second" (Bozzone, 1995). In addition, the notion of additive bilingualism (Hakuta, 1986), discussed in this chapter, suggests that adding English to a first language that has become well developed through use in school as well as at home may enhance thinking skills.

SECOND VIEW: There is growing public opposition to bilingual education as it is practiced in many large school districts (Hornblower, 1995; "Separate and Unequal," 1997). Critics are concerned that students participating in bilingual education are not receiving enough English instruction to enable them to join English-language classes within a *reasonable* amount of time. Rather, they contend that bilingual classes have become an "educational ghetto" for children whose first language is not English, with children sometimes "stuck" in bilingual education for eight or nine years without developing English competency (Headden, 1995). They also point out that the shortage of qualified bilingual teachers often leads to inferior teaching of core academic topics, and sometimes of English, in bilingual programs (Headden, 1995; "Separate and Unequal," 1997).

Opponents of bilingual instruction propose placing all children in English-language classes throughout the school day, for all topics. Children who do not speak English as their first language would be offered either English tutoring or classes in English as a Second Language (ESL) for part of the day to help them understand the instruction they receive in other subjects. Programs that do not offer this supplemental English instruction show deficits in language mastery in English-language learners (Saunders, Foorman, & Carlson, 2006). Proponents of ESL instruction contend that students learn just as effectively as in bilingual classes and develop valuable English skills sooner. They also point out that English-language classes are often less expensive and that children with a variety of first languages can be taught using the English-language method, whereas bilingual education programs can usually serve only students whose first languages are rather common, such as Spanish speakers.

In one study, a majority of teachers reported negative feelings and opinions toward English-language learners in their classrooms (Walker, Shafer, & Iiams, 2004). These same teachers reported never receiving training in how to provide appropriate adaptations for English-language learners (Walker et al., 2004). The researchers concluded that

if English-language learners are going to be placed in standard classrooms, teachers need more training to render them more effective and positive in working with such students (Walker et al., 2004).

THIRD VIEW: A SYNTHESIS. A small, but growing number of schools are developing immersion programs, also known as two-way or dual-language programs. In these programs, all students, no matter what their primary languages, learn in English for part of the day and in the target immersion language for the rest of the day. Academic subjects are taught in both languages. The goal is "to create fully bilingual individuals, whether they be black, white, Hispanic, or Asian," says Elena Izquierdo, developer of one such program (Rodriguez, 1996).

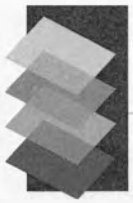
One of the pioneer schools in this form of instruction is the Oyster Elementary School in Washington, D.C. Another is the Dool Elementary School in Calexico, California. Both offer two-way Spanish–English programs. One of these schools is in an affluent area, and the other in a poorer area; however, students in the two-way programs at both schools have tested well above the national average in English, as well as in other academic subjects (Hornblower, 1995; Rodriguez, 1996). Furthermore, benefits for both the English-language learners and English-language speakers are observed (Culatta, Reese, & Setzer, 2006). Other findings reveal improvements in the experience of teachers, parents, and administrators in addition to the students in dual-language classrooms (Collier & Thomas, 2004).

Not all schools can afford to develop this option. Nevertheless, it remains a viable option not only for teaching non-native speakers of English, but also for developing students' competence in a global economy, no matter what their native tongue.

iMPLICATIONS FOR TEACHING

The study of language development and its interaction with thought harbors several implications for instruction:

- **Ensure that children understand the language in which new material is presented.** Sometimes children fail to learn not because they are incapable of understanding the concepts, but rather because the use of language in which the concepts are presented is above their level of sophistication. For example, telling a class full of 8-year-olds that antibiotics can help ameliorate their health is not an effective way of communicating that such drugs can help improve health.
- **Be aware of the effects of your use of language.** How you say something affects, but does not determine, how children think about that thing. Language affects, but does not determine, thought. If you show through your use of language a negative attitude toward a group, children are likely to pick up on that negative attitude and possibly adopt it.
- **Show respect for all languages, regardless of the language in which you teach.** Language and culture are often intertwined. By showing respect for languages other than the one in which you teach, you also show respect for the cultures that use that language.
- **Try to develop additive bilingualism.** Developing additive bilingualism enriches cognitive skills, whereas developing subtractive bilingualism detracts from them. Students benefit from a second language when that language builds on rather than replaces the first language. It is essential that all students learn to communicate well in at least one language, rather than to communicate poorly in multiple languages.



Brain Development

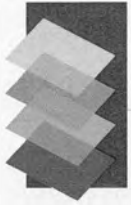
The development of the brain is central to all other aspects of development. At birth, the cerebral cortex—the part of the brain generally responsible for cognition, learning, and learning—is still largely immature. The areas of the brain that develop most rapidly after birth are the sensory cortex, which is responsible for receiving sensory input, and the motor cortex, which is responsible for physically acting upon this input, as when we brush away a fly (Casey, Tottenham, Liston, & Durston, 2005). Subsequently, the association areas that relate to problem solving, reasoning, memory, and language development develop most rapidly. Adolescence marks a period of extensive brain development associated with increased skill levels, with those processes subsumed under the label of "executive functioning." In particular, these processes include working memory and behavioral inhibition (Paus, 2005).

Neural interconnections become increasingly complex during the first 2 years after birth. After that, the rate of neural growth and development declines dramatically. In fact, 90 percent of all neural growth is complete by age 6 years. Between our peak of neural development in early adulthood and approximately age 80, we typically lose about 5 percent of our brain weight. Nonetheless, neural connections continue to increase as long as we remain mentally active. These connections help to compensate for our cell loss (Coleman & Flood, 1986). Performing mental tasks that require advanced mental processes results in increased retention of mental functioning with age. Specifically, the risk of dementia declines significantly with mental exercise in older age (Valenzuela & Sachdev, 2006). In fact, increased mental exercise is associated with lower risk of many neuropsychiatric disorders, including depression (Barnett, Salmond, Jones, & Sahakian, 2006). This maintenance of cognitive functioning seems to be due to one of two processes—the preservation of existing neural pathways or compensation for degraded neural pathways through other pathways (Stern, 2006).

Our brain structure is not unique to humans. Instead, what differentiates the human brain from the brains of other animals is its greater volume, particularly in the cerebral cortex, and its much slower and more extended development after birth. This rate of development renders us more open to influences in our interactions with the environment than are other organisms (M. H. Johnson, 1997). Interestingly, it is not the addition of neurons that is critical in early neural development, but rather the elimination of neurons (called *neural pruning*) and the strengthening of connections between neurons (Casey, Giedd, & Thomas, 2000). Neonates are born with too many neurons. In the pruning stage, neurons that will not serve a useful purpose wither and die. This process of pruning extraneous neural connections is seen again in adolescence (Blakemore & Choudhury, 2006). Neural development is partially biologically driven and partially environmentally driven.

A study (Thatcher, Walker, & Giudice, 1987) of the EEG patterns of 577 people ranging in age from 2 months to early adulthood found different patterns of brain activity in each of the two cerebral hemispheres. In the right hemisphere, which often is associated with holistic processing of information, continuous, gradual changes in EEG patterns occur with age. In the left hemisphere, which typically is associated with analytic processing of information, there appear to be abrupt shifts in the EEG patterns, at least through early adulthood. Thus different kinds of cognitive processing may show different developmental progressions. Development may result in part from changes in the electrical activity in the frontal lobe, the portion of the brain most closely associated with problem solving (Case, 1992; Thatcher, 1992). However, other sources of development must be involved as well, because the frontal lobe does not develop fully until late in childhood.

In considering these various changes as the human body matures, we must realize that just as the brain can affect cognitive functioning, so can cognitive functioning affect the brain. The brain is remodeled, to some extent, as a function of which experiences we have and how we interpret them.



Expertise and Cognitive Development

In Chapter 1, we noted some themes about expertise. We now close this chapter by reviewing how these themes apply to the development of cognitive, learning, and language skills.

According to Piaget (1972), as children grow older, their schemas grow larger, more complex, and better organized. Piaget believed that schemas tend to be domain general, applying across many domains. Today, we know that at least some schemas are domain specific. The fact that a child can think in a sophisticated way while reading, for example, does not guarantee he or she will think in an equally sophisticated way when engaging in mathematics. The expert teacher carefully analyzes behavior in each domain so as to design appropriate kinds and levels of intervention within each domain.

Vygotksy (1978) showed many of the same things as Piaget, but emphasized the role of the social environment in the formation of mental representations about the world. In short, we internalize the social world and make it part of ourselves.

Both Piaget and Vygotsky viewed children's repertoire of strategies as increasing with age. Whereas Piaget emphasized qualitatively different strategies with different levels of development, Vygotksy focused on quantitative differences in development.

As they mature, children spend proportionately more time determining how to represent problems. For example, in analogical reasoning, children spend more time thinking about how to represent the analogical relations as they grow older (Sternberg & Rifkin, 1979). They realize that carefully representing the nature of the problem will facilitate their later problem solving.

In addition, many of children's skills become automatized over time. For example, reading, which may be halting and effortful in the early years of learning, becomes more fluent and effortless as children become older. Children also gain a better sense of how difficult the material is and how much work will be required to read it. Markman's (1977, 1979) research shows that their comprehension monitoring—their understanding and regulation of their own comprehension processes—increases with age. In other words, as they grow, children read more quickly, comprehend more of what they read, and become more aware of what they understand and what they do not understand. Also, as they grow older, they often find themselves helping younger children learn the same skills that they have mastered. Thus, with age, children acquire many different forms of cognitive expertise. Such acquisition is not a necessary result of age. Rather, innate processes interact with the opportunities afforded by the environment for them to acquire the mastery that will enable them to deal effectively and even expertly with the world around them.

SUMMING IT UP

COGNITIVE DEVELOPMENT: CONCEPTS FOR TEACHING

- The study of cognitive development deals with questions such as when children first acquire various kinds of cognitive skills, whether the form that cognitive development takes is continuous or occurs in stages, and whether it is domain specific or domain general.
- Psychologists distinguish between maturation (development that occurs without much regard to the environment) and learning (the acquisition of information and skills from interactions with the environment). Behavior is highly canalized when it develops without regard to the environment.

PIAGET'S STAGE THEORY OF COGNITIVE DEVELOPMENT

- The most nearly complete theory of cognitive development is that proposed by Jean Piaget. This theory stresses the role of the development of new schemas, via accommodation, and the elaboration of old ones, via assimilation of new information, in a process of equilibration, an effort to achieve balance between cognitive capacities and the demands of the environment.
- Piaget proposed a series of four stages that he believed always occur in the same order, and at roughly the same ages, in all children: sensorimotor stage, preoperational stage, concrete operational stage, and formal operational stage. He focused on the domain-general aspects

of cognitive development, explaining temporary differences in domains in terms of horizontal décalage.

- Neo-Piagetians have elaborated on and refined Piaget's theory, often suggesting one or more stages of cognitive development that go beyond the fourth stage proposed by Piaget, such as a problem-finding stage, or the development of postformal thought. Dialectical thought, another possible fifth stage of cognitive development, involves the use of a thesis and an antithesis to create a synthesis.

VYGOTSKY'S SOCIOCULTURAL THEORY OF COGNITIVE DEVELOPMENT

- Vygotsky's sociocultural theory emphasized how interactions in the external environment are internalized by the child. He believed we also ought to consider the zone of proximal development (ZPD), the difference between what has been developed in the child and what might be developed with intervention from the environment, by testing via a dynamic-assessment environment.
- Scaffolding, such as through mediated learning experiences (MLE), indirectly helps children's learning. It stands in contrast to direct instruction.

INFORMATION-PROCESSING THEORIES: EXAMINING LEARNING AND MEMORY SKILLS

- Information-processing theorists emphasize the role of cognitive processing in development; they have provided fairly detailed models of how children of different ages solve various kinds of cognitive tasks. In recent years, these theorists have stressed the extent to which development is domain specific or domain general, as well as the importance of knowledge in cognitive development.
- Language develops in a series of seven stages: prenatal receptivity to voices, cooing, babbling, one-word utterances, two-word utterances, telegraphic speech, and, finally, basic adult sentence structure.

THREE MAJOR APPROACHES TO COGNITIVE DEVELOPMENT: A COMPARISON

- Piaget claimed that cognitive development comes with maturation: Children reach cognitive milestones, such as the development of object permanence or the ability to reverse operations and recognize conservation, when they became cognitively mature enough to do so. Development is largely domain-general. Like Piaget, most neo-Piagetians propose stages of cognitive development. The main area of difference is that some neo-Piagetian theorists have suggested stages that go beyond Piaget's final stage of formal operations.
- Vygotsky proposed that cognitive development happens as children internalize information from their environment. In other words, children learn from the people around them.
- Information-processing theorists also tend to see cognitive development as a combination of learning and of the child's level of maturation. They typically view development as a continuous process with no obvious stages. They also suggest that domain-general cognitive abilities exist.

THEORY OF MIND

- As children grow older, their *theory of mind*—how they understand their own minds—becomes more sophisticated.
- Autistic children seem to lack or have a seriously defective theory of mind.

LANGUAGE DEVELOPMENT

- Humans seem to have an innately preprogrammed language acquisition device (LAD), as seen when children overregularize. Many language theorists believe in the existence of critical periods in language development. Nevertheless, experiences in the environment also affect language development, as seen when children use hypothesis testing as they learn language.
- The theory of linguistic determinism holds that the structure of language shapes thought processes. A related idea, linguistic relativity, proposes that language influences, but does not determine, thought processes. People speaking any language are generally able to express any thought, although the expression may be simpler in one language and more complex in another.
- Studies of bilingualism have shown that a student's first language, one other than English, can effectively be used as a resource for learning in schools. Research indicates that additive bilingualism, in which the student learns English by building on an already established first language, can enhance thinking abilities.

BRAIN DEVELOPMENT

- Neural interconnections become increasingly complex during the first 2 years after birth. After that, the rate of neural growth and development declines dramatically. Ninety percent of all neural growth is complete by age 6 years.
- Performing mental tasks that require advanced mental processes results in increased retention of mental functioning with age. Specifically, the risk of dementia and other neuropsychiatric diseases declines significantly with mental exercise in older age (Valenzuela & Sachdev, 2006).

EXPERTISE AND COGNITIVE DEVELOPMENT

- As children grow older, they spend proportionately more time determining how to represent problems. They realize that carefully representing the nature of the problem will facilitate their later problem solving.
- Many of children's skills become automatized over time. For example, reading, which may be halting and effortful in the early years of learning, becomes more fluent and effortless as children become older.
- With age, children gain a better sense of how difficult tasks are and how much work will be required to do them.

- **Accommodation** Process of creating new schemas, or mental frameworks, to organize information that cannot be assimilated into existing schemas. Page 42
- **Additive bilingualism** Addition of a second language that builds on an already well-developed first language. Page 66
- **Antithesis** Proposed solution to a problem that directly contradicts an existing thesis. Page 48
- **Assimilation** Revision of existing cognitive schemas to incorporate new information. Page 42
- **Bilingual education** Schooling in which two languages are used as the medium of instruction. Page 66
- **Bilingualism** Ability to communicate in two languages. Page 66
- **Canalization** Extent to which a behavior or an underlying ability develops without respect to the environment. Page 38
- **Cognitive development** Changes in mental skills that occur through increasing maturity and experience. Page 36
- **Concrete operational stage** Piaget's third stage of cognitive development, occurring from about ages 7 to 12 years. During this stage, children become able to mentally manipulate internal representations of concrete objects. Page 44
- **Conservation** Recognition that even when the physical appearance of something constant in quantity or amount changes, its underlying quantity remains the same. Page 44
- **Critical periods** Certain points during development when individuals are particularly attuned to various aspects of language (or other) development. Page 64
- **Dialectical thinking** Recognition, usually occurring during late adolescence or early adulthood, that most real-life problems do not have a unique solution that is fully correct, with other solutions being incorrect; involves thesis, antithesis, and synthesis. Page 48
- **Direct instruction** Learning situation in which a teacher, parent, or other authority imparts knowledge to a child by teaching it. Page 53
- **Disequilibrium** State of confusion encountered when a situation does not match a preconceived notion of the way the world is or should be. Piaget suggested that disequilibrium is good for children, because it serves as the impetus for the development of expertise. Page 42
- **Domain-general development** Development that occurs more or less simultaneously in multiple areas. Page 40
- **Domain-specific development** Development that occurs at different rates in different areas. Page 40
- **Dynamic assessment environment** Testing situation, designed to assess a child's zone of proximal development, in which the examiner not only gives the child problems to solve, but also gives the child a graded series of hints when the child is unable to solve the problems. Page 52
- **Egocentric** Centered on the self without understanding of how other people perceive a situation. Page 43
- **Equilibration** Balancing of cognitive structures with the needs of the environment. Page 41
- **Formal operational stage** Piaget's final stage of cognitive development, occurring at about 11 or 12 years of age and extending through adulthood. Individuals in this stage form and operate on (e.g., reverse) abstract as well as concrete mental representations. Page 45
- **Horizontal décalage** Piaget's term for the temporary difference in performance that a child shows between various cognitive domains or activities, within a given stage of development. Page 41
- **Hypothesis testing** As specific to this chapter, children's learning of language by forming hypotheses about language and linguistic forms and then testing those hypotheses in their environments. Page 64
- **Internalization** Absorption, or taking in, of knowledge from the social contexts in which it is observed, so that one can use it for oneself. Page 51
- **Intervention** Action undertaken to improve a child's cognitive, socioemotional, or behavioral development. Page 54
- **Language acquisition device (LAD)** Innate predisposition or ability to acquire language. Page 64
- **Learning** Any relatively permanent change in thought or behavior that occurs as a result of experience. Page 38
- **Linguistic determinism** Theory of the relationship between language and thought that suggests the structure of our language shapes our thought processes. Page 65
- **Linguistic relativity** Theory of the relationship between language and thought that suggests language influences, but does not determine, thought. Page 65
- **Maturation** Any relatively permanent change in thought or behavior that occurs as a result of biological aging, regardless of personal experience. Page 37
- **Mediated learning experience (MLE)** Learning situation in which an adult or older child indirectly helps a child learn by explaining events in the environment, but without directly teaching some lesson. Page 53
- **Object permanence** Realization that an object continues to exist even when it is not immediately visible. Page 43
- **Overextension error** Application of a word beyond its legitimate use. Page 63
- **Overregularize** To use word forms that follow a rule rather than recognize an exception to it. Page 64
- **Postformal thinking** Thinking that goes beyond that of formal operations in some way. Page 48
- **Preoperational stage** Piaget's second stage of cognitive development, occurring between approximately 2 and 7 years of age. During this stage, the child actively begins to develop mental representations and learns to use words. Page 43
- **Problem finding** Stage of cognitive development proposed by Patricia Arlin, in which an individual becomes able not just to solve problems, but to find important problems to solve. Page 48
- **Rehearsal** Memory strategy in which a person, either mentally or aloud, recites information over and over again to remember it. Page 60
- **Representational thought** Well-formed mental representations, or ideas, of external stimuli. Page 43
- **Reversible thinking** Ability mentally to reverse a physical operation. According to Piaget, this ability develops during the concrete operational stage of cognitive development. Page 45
- **Scaffolding** Competent assistance or support, usually provided through mediation of the environment by a parent or teacher, in which cognitive, socioemotional, and behavioral development can occur. Page 53
- **Schema** Cognitive framework that provides a way to understand and organize new knowledge. Page 42
- **Second-order relations** Relations between relations, as required by analogical reasoning. Page 45
- **Sensorimotor stage** Piaget's first stage of cognitive development, occurring between birth and about age 2. The sensorimo-

tor stage is characterized by the development of sensory (simple input) and motor (simple output) functions. During this stage, infants respond largely in reflexive (inborn) ways; as they develop, children modify these reflexes to suit the demands of the environment. Page 43

- **Sociocultural theory** Vygotsky's major premise that cognitive development is largely from the outside, inward. Children reflect on the interactions between the people in their world and others, including themselves, and then make use of these interactions to further their own development. Page 51
- **Static assessment environment** Testing situation in which the examiner gives the child problems to solve, but provides little or no feedback about the child's performance. Page 53
- **Subtractive bilingualism** Learning of a second language that starts to replace a first language that has not yet been fully formed. Page 66
- **Syntax** Rules for combining words. Page 63
- **Synthesis** Proposed solution to a problem that reconciles two opposing points of view (the thesis and the antithesis). Page 48
- **Telegraphic speech** Speech that uses simple syntax in utterances of two or three words to impart a simple meaning. Children begin to develop this form of speech at about age 3. Page 63
- **Thesis** Proposed solution to a problem. Page 48
- **Underextension error** Limiting the application of a word so the word's proposed meaning has too narrow a range of possible examples. Page 63
- **Verbal comprehension** Ability to understand spoken and written material. Page 57
- **Zone of proximal development (ZPD)** Range between a child's level of independent performance and the level of performance a child can reach with expert guidance. Also called the zone of potential development. Page 52

BECOMING AN EXPERT: QUESTIONS AND PROBLEMS

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

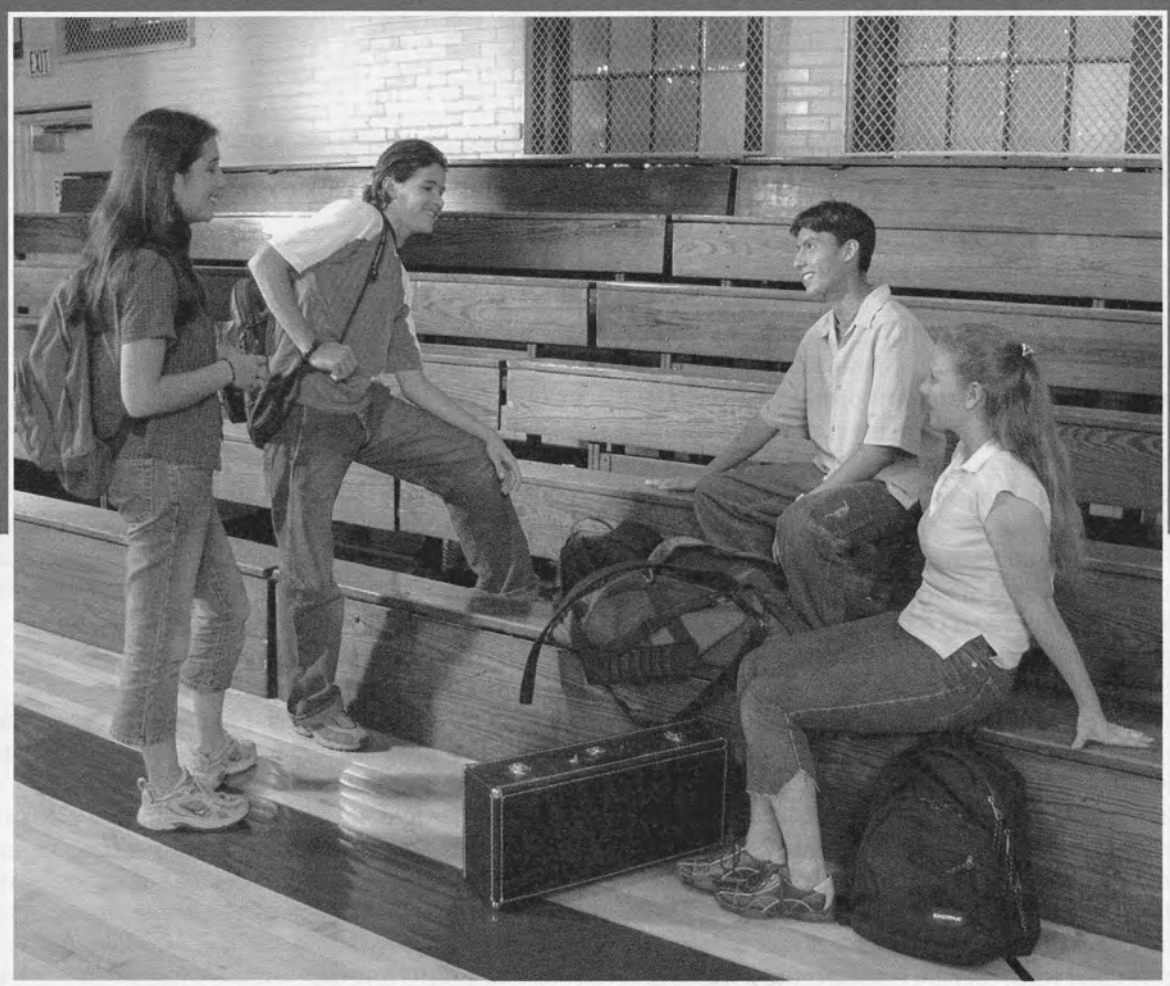
1. In your fourth-grade class, almost all students are operating at Piaget's concrete operational level. How might you design a unit on the cycle of rain and evaporation that takes advantage of the concrete operational students' understanding of conservation?
2. How would you teach a class of first graders, all of whom are thinking at Piaget's preoperational level, about the water cycle? Could you design activities that take advantage of the egocentric thought that characterizes the preoperational stage?
3. Which aspects of a unit on poetry would you emphasize for fifth graders?
4. How could you use Vygotsky's concept of internalization and Feuerstein's idea of the mediated learning experience to help a child who is having vocabulary and pronunciation problems?
5. How could you model or teach ways to figure out the meanings of unfamiliar words that your fifth graders encounter when they are reading the newspaper for social studies class?

IN MIDDLE SCHOOL

1. How could you use a unit on South American countries to encourage eighth graders to start using formal operational thinking?
2. Design a game or contest that might induce seventh graders to perform at their optimal level in an American government class.
3. What are some stories, poems, books, or plays you might assign to your eighth-grade English class to start a discussion of the importance of metacognition—that is, being aware of one's own mental processes?
4. What kinds of mediating answers could you give to questions during a field trip to a sewage treatment plan to encourage learning about the chemical processes involved in treating wastewater?
5. Some of your sixth-grade English students seem to have very limited vocabularies. What are some interesting and fun ways you could help them expand their repertoire of words?

IN HIGH SCHOOL

1. What assignments could you make to encourage problem finding in a junior-level history class? What about a personal health class?
2. How would you balance the lessons of a physics unit on energy that introduces new ideas (i.e., concepts that students must change their current cognitive schemas to accommodate) with lessons that focus on filling gaps in knowledge (i.e., facts the students can assimilate into their current cognitive structures)?
3. How would you design a peer tutoring program to encourage math achievement? How could you avoid frustrating students who use the tutoring program, but who have not yet achieved formal operational thinking abilities?
4. How could you use a unit on grocery shopping in a life-skills class to strengthen verbal-comprehension skills, especially noticing contradictions in written material?
5. What kinds of activities would you include in a literature class to encourage students to think dialectically


EXIT

Personal, Gender, Social, and Moral Development

3

CHAPTER OUTLINE

Why Understanding Personal, Gender, Social–Emotional, and Moral Development Is Important to Teachers

Personal Development: Becoming Unique

Erikson's Theory of Psychosocial Development

Marcia's Theory of the Achievement of a Personal Identity

Evaluating the Theories of Erikson and Marcia

Temperament

Sexual and Gender Development: Acquiring Gender Roles

Views on Sexual and Gender Development

Freud's View of Psychosexual Development

Social Development: Learning to Interact with Others

Attachment

Friendship and Play

Development of Perspective Taking

Moral Development: Acquiring a Sense of Right and Wrong

Piaget's Theory of Moral Development

Kohlberg's Theory of Moral Development: Levels and Stages

Gilligan's Alternative to Kohlberg's Theory

Evaluating Kohlberg's Theory

Identifying, Understanding, and Managing Developmental Risks

At Risk for Eating Disorders

At Risk for Major Depression

At Risk for Violent Behavior

Drug Use: A Prevalent Problem

Unwanted Consequences of Sexual Activity

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this chapter:

- How does a child's personality develop, and what types of problems do children face as their personalities mature?
- How do students develop a sense of who they are and what they want to accomplish in life?
- How do children develop a sense of their roles as males or females?
- How is the progression of students' social development reflected in the classroom?
- What is moral reasoning, and how do children learn to think about morality? Can teachers help students develop a sense of moral values?
- How do expert teachers help students cope with risks to their personal development, such as eating disorders, depression, suicide, drug use, or pregnancy?

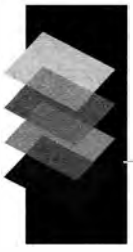
Carla bit her lip to keep it from quivering. She knew the answer to the question her teacher, Mr. Conto, had just asked her, but her nervousness kept her from answering out loud. Tommy and Kim, the most popular boy and girl in the class, turned around to make faces at Carla. She could see them laughing, and all she wanted was to slink under the table and forget that school existed. Most of the time in class Carla tuned out, embarrassed just to be there. She was taller than the other girls in the fifth grade, and worst of all, she was taller than all of the boys! Her facial breakouts made her feel even worse. Her only friend, Tanya, was also unpopular—in fact, this is what the two had most in common. They sat around after school and fantasized about what it would be like never to have to go back to the pit of despair school had become.

Carla's teacher, Jim Conto, wanted to help. He was very frustrated. He would like to have thrown out of the class the nasty kids who made fun of Carla. Carla was a bright young woman, but she was becoming increasingly less involved in school, and soon this reduced involvement would translate into failure. Jim had tried explaining logically to the other kids why they should be kinder to Carla. He had tried disciplining the other kids when they disobeyed. He had also tried counseling Carla to help her improve her sense of self-esteem. None of these approaches had solved the problem.

Jim could not understand why the other kids were so mean-spirited: Didn't they see that they could just as easily be in Carla's shoes? Nor could he understand why Carla caved in so easily. Sometimes he thought she almost enjoyed being a victim! Carla seemed headed for a life scarred by a deep sense of inferiority and an inability to socialize with other people. Jim decided to read about theories of social development to get some help. He got it.

Jim Conto is facing an inevitable teaching problem: He is finding out that teaching is not just about imparting knowledge. Teaching also means dealing with children and adolescents as they confront the problems—sometimes life-threatening problems—involved in growing up and attaining adult identities (Eisenberg, 1998). Sooner or later, every teacher must try to help a student who is having problems with personal or social development.

What would you do if you were Jim Conto? This chapter will give you some ideas to use when you are in his situation. Chapter 2 outlined the ways children's thinking changes as they develop. In Chapter 3, you will learn what kinds of changes in personality, gender development, social interactions, and reasoning about right and wrong you can expect from your students at various points in their development.



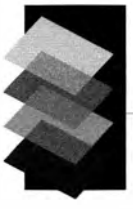
Why Understanding Personal, Gender, Social–Emotional, and Moral Development Is Important to Teachers

Teachers face many challenges and difficulties in coping with their students' developmental changes and in helping them grow up to be as sound and as trouble free as possible (Eisenberg & Fabes, 1998). To reach this goal, knowing your subject area and understanding methods of instruction will not be enough. To be an expert teacher, you also have to understand the processes of personal, gender, social–emotional, and moral development:

- Personal development is the process of human development in which individuals acquire the set of attributes that makes them unique.
- Gender development is the process of human development in which individuals learn about and construct gender roles and gender identity.
- Social–emotional development is the process of human development in which individuals learn how to interact with others and understand themselves as social beings.
- Moral development is the process of human development in which individuals acquire a sense of right and wrong, to use in evaluating their own actions and the actions of others.

Knowing what kinds of personal achievements (e.g., in artwork, musical performance, science projects, or athletic participation), social skills, and ideas about right and wrong you can expect from most of your students will help you plan developmentally appropriate lessons that challenge but do not frustrate students. For example, very young students who are still seeking to establish their autonomy and demonstrate their individual abilities may not be ready effectively to take on cooperative group projects. Expert teachers also use a knowledge of typical personal, social–emotional, and moral development to help them see when students, such as Carla, are having problems in one or more areas. Before he can decide what kind of help Carla needs, Jim Conto needs to know whether her shyness is merely an expression of normal developmental processes or a sign of a serious developmental problem (Coplan & Armer, 2007). Normal shyness is nothing to worry about; in fact, it even can have advantages. Children who are shy at age 3 are less likely to be aggressive and are more likely to avoid dangerous situations when they become adolescents (Caspi & Silva, 1995).

Although we examine each aspect of development separately, of course these aspects interact. You'll notice, for instance, that as children's sense of morality develops, their interactions with peers change. Interactions with peers can also affect aspects of personal development, such as self-esteem. The section of the chapter on sexual and gender development—that is, the growth of children's sense of themselves as male or female—may provide you with the clearest examples of the ways in which the domains of development overlap. For example, girls and boys often go through a period when they prefer to interact almost exclusively with members of their own gender. When designing lessons and activities, teachers need to keep in mind the overlapping nature of domains of student development and to remember that development in all areas contributes to the growth of a mature individual.



Personal Development: Becoming Unique

How does an individual's personality develop? Erik Erikson's work produced one of the most comprehensive theories of personal development. His theory provides a way to think about how a child's personality develops that can be helpful to teachers, especially when a student seems to be having trouble in developing a healthy personality. This was the case with Carla in the opening vignette.

ERIKSON'S THEORY OF PSYCHOSOCIAL DEVELOPMENT

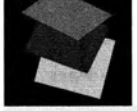
Erik Erikson (1902–1994) proposed what he called a **psychosocial theory** of personal development (1950, 1968). This theory explicitly acknowledges that individual development takes place in a social context. Erikson's theory was an unusual one at the time because it recognized that development is a lifelong process rather than simply a process that ends in early adulthood.

Like Piaget's theory of cognitive development (discussed in Chapter 2), Erikson's theory is a stage theory. It contains eight stages. At every stage, one issue of psychosocial development comes to the forefront of an individual's development. Erikson framed these issues as **developmental crises**—that is, times when an individual has an opportunity to take a significant step in his or her development.

Erikson theorized that each stage is framed in terms of what happens if the crisis of that stage is dealt with successfully or unsuccessfully. Although the focus in each stage is on only one issue of development, developmental steps taken at earlier stages can affect a person's ongoing development. Unsuccessful resolution of a previous stage can affect a person's later development negatively, but later stages also can provide an individual with the chance to overcome earlier problems. During any stage, the individual may bounce back and forth between states, such as between autonomy, on the one hand, and shame and doubt, on the other hand. Because most people do not totally resolve a crisis, throughout their lives they

may still have to struggle with feelings of shame and doubt. The eight stages of Erikson's theory can be summarized as follows:

1. **Trust versus Mistrust** (birth to 1 year). According to Erikson, if infants pass through this stage successfully, they learn to trust that their basic needs will be met. They also develop a hopeful attitude toward life. If infants do not pass through this stage successfully, they come to mistrust others. Thus the outcome of this stage determines in part whether a person will come to view the world as basically supportive and friendly or as basically unsupportive and even hostile. The child's trust or mistrust of classmates may be traced, in part, to this stage. Caregivers who are consistently responsive to infants' needs for food and care demonstrate to the infants that they can depend on the world around them (Thompson, 1999).
2. **Autonomy versus Shame and Doubt** (1 to 3 years). During this stage, children learn to be relatively self-sufficient—in walking, in talking, in eating, in using the toilet, and so forth. Erikson thought that successful passage through this stage results in a sense of autonomy, or independence, and a sense of will, or mastery over one's thoughts, emotions, and behavior. Unsuccessful passage leaves children doubting themselves. They also potentially feel a sense of shame about themselves and about their ability to cope with the environment. Children who pass successfully through the stage are more likely to have confidence in their ability to succeed in their relations with their peers in school. Some evidence indicates that development of autonomy is consistent across cultures (Helwig, 2006). Such confidence can breed success (Eccles, Wigfield, & Schiefele, 1998).
   - Caregivers should allow children opportunities to make choices, to feed themselves, and to exert their own self-control through toilet training. In this way, caregivers support the children as they practice their new physical and thinking abilities in ways that foster a sense of self-confidence. Thus, in this stage, it is important that caregivers be tolerant of accidents and mistakes.
3. **Initiative versus Guilt** (3 to 6 years). In this stage, children learn to assert themselves in ways that are considered socially acceptable. They also learn how to take the initiative in their dealings with people and tasks. Successful passage through this stage results in a sense of purpose in life. In contrast, unsuccessful passage results in feelings of guilt. Ultimately, it can produce difficulties in taking initiative in one's life endeavors. Children who master this stage are more likely to be able to set directions for themselves in their schoolwork, and ultimately in their careers.
   - Caregivers should provide ways for children in this stage to try new things and to engage in some activities on their own. At the same time, they must help children understand rules and limitations.
4. **Industry versus Inferiority** (6 to 12 years). In this stage, according to Erikson, children acquire a sense of competency and industriousness in their work, particularly schoolwork. Successful passage means the development of a sense of competence. Unsuccessful passage results in feelings of inferiority. Children who master this stage are more likely to show engagement and industry in their schoolwork.
   - Providing opportunities for children to set goals that are challenging but that the children can meet encourages the children's sense and attainment of success (Dweck, 1999a, 1999b). Caregivers also foster children's sense of industry by giving them tasks for which they are regularly responsible. These should be tasks that the children can carry out independently. The Flexible Expert feature, "Teaching and Learning about Personal Development," presents some examples of how expert teachers and students might facilitate the transition through this and the next of Erikson's stages.
5. **Identity versus Role Confusion** (adolescence). During this stage, adolescents are figuring out who they are. They struggle with questions such as what is and is not important to them, what their values are, and who they will become as they grow up. They try to integrate various aspects of themselves—intellectual, social, sexual, and moral—into a unified sense of self-identity (Harter, 1998). Those who succeed in their



TEACHING AND LEARNING ABOUT PERSONAL DEVELOPMENT

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Mark knows that most of his fourth-grade students are working through the stage Erikson called industry versus inferiority. He develops a series of progressively more challenging homework assignments as a way to allow each student to see his or her own success and positive progress.

THE CREATIVE TEACHER: Mark makes a job wheel so each student will get the chance to perform an important classroom task.

THE PRACTICAL TEACHER: When one of Mark's students claims to be "no good at school," Mark challenges the claim by helping the student chart her progress since the beginning of the school year.

THE ANALYTICAL STUDENT: Lin learns about Erikson's stages and Marcia's identity statuses in psychology class. She realizes that the questions she has been having about her future are part of a healthy adolescent identity search.

THE CREATIVE STUDENT: Lin becomes involved in a drama club as a way to literally "act out" different identities.

THE PRACTICAL STUDENT: Lin volunteers as a teacher's aide at a local preschool because she wants to "try on" teaching young children as a possible career.

passage through this stage develop a sense of fidelity to themselves. Those who do not remain confused about who they are, what they can become, and what they should do with their lives. Children who master this stage are more likely to view success in school as consistent (rather than inconsistent) with their image of who they are and who they want to become.

- Adults should show their appreciation of many models of problem solving, and of diverse careers, religions, and other ideologies. They even can show tolerance of diverse fashion as they help adolescents struggle to achieve their own identity.

6. **Intimacy versus Isolation** (early adulthood). In this stage, Erikson believed, the young adult seeks intimate relationships with others, including but not limited to a significant other. Success at this stage results in the person's learning nonselfish love—love that involves give-and-take. Failure results in a sense of isolation and in an inability to achieve intimacy with others (Berscheid & Reis, 1998; Sternberg, 1998a).
   - Adults who master this stage are more likely, as teachers, to be giving of themselves to their students without always expecting something in return. They serve as good role models for the students in developing their own relationships (Parke & O'Neil, 1997).
7. **Generativity versus Stagnation** (middle adulthood). Adults who successfully meet this crisis feel a need to nurture and provide for the generation that follows them. They try not only to achieve for themselves, but also for others. They pass on to the next generation the fruits of what they have accomplished, often through child rearing or mentorship (Smetana, 1997). Adults who do not meet the challenges of this stage feel a sense of stagnation in their lives. It is as though they have not made a meaningful contribution to the world through their careers or raising of children. Adults who master this stage are more likely, as teachers, to take pride in the success they have had in molding their students' lives.
8. **Integrity versus Despair** (late adulthood/old age). At this stage, people try to make sense of and give meaning to the lives they have led. In particular, they seek meaning in the choices and decisions they have made in their lives. Erikson thought that those who succeed in this stage gain the wisdom of older age: Although they may not believe they have always made the right decisions, they come to terms with their mistakes (Baltes & Staudinger, 2001). Adults who do not successfully complete this stage feel a sense of despair over the mistakes they have made and the opportunities they have missed.

THINKING CREATIVELY

Think about your years of childhood and adolescence. Do your experiences reflect the early stages of Erikson's theory? Would you add any stages to the theory? Why or why not?

SUGGESTION: Answers will vary. Many people find Erikson's stages useful in understanding at least some of the developmental challenges they have confronted.

TABLE 3.1 Erikson's Psychosocial Theory of Development

Stage	Approximate Ages	What Happens in This Stage?	What Can Be Done to Help a Person Pass Through the Stage Successfully?
I Trust versus Mistrust	Birth to 1 year	Infants either come to believe that their world is a safe and predictable place or that the world is undependable or even hostile.	Parents or child-care providers should respond promptly and consistently to an infant's needs.
II Autonomy versus Shame and Doubt	1 to 3 years	Children who pass through this stage successfully develop a sense of mastery over their thoughts, emotions, and behavior. Those who are not successful come to feel doubt about their ability to cope with their environment.	Parents or preschool teachers should provide young children with opportunities to perform tasks independently, including eating, dressing, and toilet use. Reward children's attempts and successes; avoid humiliating a child when he or she experiences setbacks or difficulties.
III Initiative versus Guilt	3 to 6 years	Children either learn to take control of their actions and situations, developing a sense of purpose, or they come to feel guilt and a lack of purpose.	Teachers or parents can offer children opportunities to make their own decisions when possible. For example, children can choose the colors of their own name tags or paper for art projects, decide which of two books should be read during story time, or choose from three or four different options for using free play time.
IV Industry versus Inferiority	6 to 12 years	Children either develop a sense of their own competence at a variety of tasks, especially schoolwork, or they come to believe they are not capable of success.	Teachers can arrange learning units in a series of steps, and reward or praise children for completing each step of a unit. Encourage children to compare their current level of performance with their own earlier levels, rather than with the performance of classmates.
V Identity versus Role Confusion	Adolescence	Adolescents explore various aspects of identity and either develop a unified sense of who they are or remain confused about who they are and what they want from life.	Teachers of adolescents can provide reassurance and examples of the normalcy of identity searches.
VI Intimacy versus Isolation	Early adulthood	Young adults either learn how to give and take love nonselfishly in relationships, or fail to connect with others in a meaningful way.	Teachers may themselves be in this stage. Consciously developing a network of colleagues can help provide not only practical support, but a sense of belonging. Teachers can help students who are in this stage by providing examples of successful relationships in subjects such as literature, or by encouraging students to develop their own networks, including study groups or organizations in students' fields of career interest.
VII Generativity versus Stagnation	Middle adulthood	Adults either develop the sense that they are somehow caring for or contributing to the well-being of the next generation of people, or they feel their efforts and accomplishments will have little meaning in the future.	Teachers can build their own sense of generativity by continuing to learn and practice innovative ways of teaching. They may also be able to help other adults, and their students, by inviting adults into the classroom as speakers about their career or other choices or as tutors.
VIII Integrity versus Despair	Late adulthood/old age	Evaluation of one's previous actions either leads to a feeling that one's life has unfolded in an inevitable, meaningful pattern, or to despair and a consciousness of missed opportunities.	Teachers who are themselves engaging in this evaluation may want to seek out news of successful former students. Teachers may also want to encourage students who are at earlier stages to keep journals or to "practice" evaluating their choices from the perspective of their future selves.

Source: Table titled "Erikson's Stages of Personal and Social Development" from *Identity and the Life Cycle* by Erik H. Erikson. Copyright © 1980 by W. W. Norton & Company. Copyright © 1959 by International Universities Press, Inc. Used by permission of W. W. Norton & Company.

THINKING ANALYTICALLY

What do you see as the greatest strength and the greatest weakness of Erikson's theory?

SUGGESTION: A strength is that the theory encompasses the entire human life span. A weakness is that the theory has not been adequately tested empirically.

Adults who master this stage look back over their lives with a sense of accomplishment and of a job well done, whatever those jobs may have been.

There are many ways of conceiving of Erikson's theory (which is summarized in Table 3.1). One is as a model of the stages a person goes through in developing expertise in living. For example, in the seventh stage, successful individuals serve as valuable mentors to members of younger generations (the tenth characteristic of experts mentioned in Chapter 1). Those who are less successful face stagnation and cannot be successful mentors. In the eighth stage, some people become expert sense-makers. They are able to take the difficult and novel problem of making sense of a life and successfully confront this challenge

(the eighth characteristic of experts mentioned in Chapter 1). Those who fail to make sense of their lives fall into despair.

MARCIA'S THEORY OF THE ACHIEVEMENT OF A PERSONAL IDENTITY

Erik Erikson wrote more about the search for identity than about any other crisis he proposed. His attention to this phase of development has inspired other psychologists, such as James Marcia, whose ideas we consider next, to think about the search for identity as well.

■ **FOUR KINDS OF IDENTITY STATUS** Marcia has suggested that four main kinds of statuses can emerge during adolescence from the conflicts faced and the decisions made by adolescents (Marcia, 1966, 1980, 1991): identity achievement, foreclosure, identity diffusion, and moratorium. Each status represents a different kind of self-concept. The four kinds of identities are possible combinations of yes-no answers to these two questions:

1. Has the person engaged in an active search for identity?
2. Has the person made commitments (for example, to values, to school, to a job or career path, to who he or she wants to be as a person, or to other aspects of his or her identity)?
   - An individual who answers "yes" to both questions is in the status of **identity achievement.** This individual has searched for his or her identity. Based on the results of this search, he or she has made an educational, vocational, or other personal commitment. For example, Marla has decided on a career in medicine after careful reflection. She believes it will enable her to help people, use her talents, and make a good living besides.
   - Someone who answers "no" to both of the questions is classified as experiencing **identity diffusion.** This person has neither engaged in a search for identity nor committed to any significant aspects of an identity. For example, Jethro has been living for the moment, doing more or less whatever feels good at the time. He has not taken the time to think about who he is or what he wants out of life.
   - A person who answers "yes" to the first question and "no" to the second is in **identity moratorium.** He or she has made a search for an identity, but has not yet made commitments. For example, Bert has gone from one religious group to another, in the hope of finding himself. Despite his search, he feels no closer to self-understanding than he did before he started his quest.
   - Answering "no" to the first question and "yes" to the second leads to **identity foreclosure.** An individual in identity foreclosure status has made commitments to a job, school, or other aspect of his or her identity without first engaging in a search process. For example, Bertha, like Marla, is a premed student. However, she has chosen this path only because she is following in the footsteps of her mother; she has not adequately reflected on whether she is choosing the right path for herself. Such individuals often have made commitments at the urging of their parents.

These four kinds of identities are reviewed in Figure 3.1.

Both Erikson (1968) and Marcia believed that healthy adolescence can include a moratorium period, a time of searching for an appropriate identity while avoiding firm commitments. A moratorium period may be especially important to adolescents in a socially diverse, urbanized society. They must choose from among many options for how to live their lives. In fact, the complexity of many societies may be one reason why identity issues take a long time to resolve. By the time they are seniors in high school, only 20 percent of students are likely either to be actively searching for an identity or to have reached identity achievement status (Archer, 1982). In fact, delaying decisions about the second question—that is, about a career path—is related to higher levels of identity achievement (Fadjukoff, Kokko, & Pulkkinen, 2007).

The goal of an adolescent identity search, no matter how prolonged, is that the adolescent emerge with a firm and relatively secure sense of **self**—an understanding of how she

THINKING PRACTICALLY

Which of Marcia's types of identities best characterizes you? Why?

SUGGESTION: Each student must answer for himself or herself.

FIGURE 3.1 Four Statuses of Identity

Has the person made commitments to values?	Has the person engaged in an active search for identity? YES	Has the person engaged in an active search for identity? NO
YES	**IDENTITY ACHIEVEMENT** ■ Firm and secure sense of self ■ Commitments to occupation, religion, beliefs about sex roles, and the like ■ The views, beliefs, and values of others have been considered, but own resolution has been reached by branching out	**MORATORIUM** ■ Currently experiencing an identity crisis, or turning point ■ No clear commitments to society ■ No clear sense of identity ■ Actively trying to achieve identity
NO	**FORECLOSURE** ■ Commitments to occupation and various ideological positions ■ Little evidence of the process of self-construction; adopted the values of others without seriously searching and questioning ■ Foreclosed on the possibility of achieving own identity	**IDENTITY DIFFUSION** ■ Lacking direction ■ Unconcerned about political, religious, moral, or even occupational issues ■ Does things without questioning why ■ Unconcerned why others do what they are doing

THINKING ANALYTICALLY

What is a way that schools tend to socialize children toward independence? Toward interdependence? How might teaching practices in part represent cultural norms that favor independence versus interdependence?

SUGGESTION: For independence, students primarily work on their own. For interdependence, they do some work in cooperative learning groups. However, individual activities tend to predominate in most U.S. classrooms.

THINKING PRACTICALLY

Describe a strategy you might try if you were Carla's teacher, if your goal was to help Carla feel better about herself.

SUGGESTION: You might help Carla form a list of her own strengths and of ways to make the most of these strengths.

identifies her own characteristics, abilities, and behaviors (Harter, 1998). The adolescent's **self-esteem** (and everyone else's, for that matter) is the value she places on herself. The adolescent's view of herself is referred to as her **self-concept** (see Chapter 10). The adolescent's identity search may potentially affect her self-concept and self-esteem in a very profound way. Good friendships can help in the development of a sense of self and a positive self-concept (Hartup, 1996; Newcomb & Bagwell, 1995; Rubin, Bukowski, & Parker, 1998; Rubin, Coplan, Nelson, Cheah, & Lagace-Seguin, 1999).

■ **CULTURE AND THE VALUE OF A PARTICULAR IDENTITY STATUS** It might seem from the foregoing description that identity achievement is the best of the four main identity statuses. Indeed, in Western societies, which tend to emphasize individual achievement and responsibility, many psychologists agree that moratorium and identity achievement reflect greater developmental maturity than do identity diffusion or foreclosure (Archer, 1982). In contrast, many non-Western cultures place more emphasis on the interdependence of family and community members than do Western nations (Markus & Kitayama, 1991; Matsumoto, 1994, 1996). In these societies, parents or community leaders may be seen as the appropriate persons to choose an adolescent's career or marriage partner. Major decisions may be group based rather than based exclusively on the desires of the individual (Markus, Kitayama, & Heiman, 1996). Identity foreclosure status would be considered more mature than an identity moratorium or search.

EVALUATING THE THEORIES OF ERIKSON AND MARCIA

The theories of Erikson and Marcia make valuable contributions to our understanding of children's personal development. At the same time, like all theories, they have some limitations. One limitation is the lack of solid empirical data supporting them. Neither theory has been adequately tested scientifically, for example, by a study investigating in detail whether the challenges that individuals face at different points in the life span correspond to those identified by Erikson. Because of the many changes in society since the theories first were proposed, there is a specially pressing need for them to be tested. Marcia's theory, of course, applies to only a very limited aspect of the life span, thereby not taking fully into account the lifetime process of identity formation.

Normal adolescent uncertainty about identity, coupled with the complexities of modern society, can put teens at risk for certain psychological and behavioral problems. However, as we see next, the risk is certainly not limited to adolescents.

IMPLICATIONS FOR TEACHING

ERIKSON'S THEORY OF PSYCHOSOCIAL DEVELOPMENT

- **Provide young children with opportunities to perform tasks independently.** Children in school can practice basic skills such as eating, dressing, and toilet use as well as art and drama. This approach helps children who are passing through the autonomy versus shame and doubt stage develop a sense of self-sufficiency.
- **Foster children's ability to assert themselves** by allowing them to make as many of their own decisions as possible about schoolwork.
- **Whenever possible, incorporate children's suggestions about various activities into the classroom,** to give children more opportunities to experience success and, therefore, to gain confidence to try new things by encouraging activities that involve a range of abilities.
- **Foster feelings of competence in students by noticing and praising students' successes.** Arrange learning units in a series of steps. Reward or praise children as they complete each step of a unit. Encourage students to make comparisons with their own earlier performance rather than with the performance of classmates. This approach will help students see their developing expertise. In fact, in some cases, you may wish to provide positive feedback privately to discourage unfavorable comparisons between classmates.
- **If you teach adolescents, reassure yourself and your students by pointing out examples of the normalcy of identity searches.** You may present role models in various subjects—famous scientists, mathematicians, or writers, for example. You may even discuss with the students the paths these individuals took to achieve their success. Include any searching or changes in identity that the role models underwent. For example, Ronald Reagan began his career as an actor and then later became a successful politician. Theodore Geisel worked in advertising before becoming the well-known author Dr. Seuss (Diggins, 2007; Fensch, 2001).

THINKING PRACTICALLY

Can you think of one other educational implication of Erikson's theory? What is it?

SUGGESTION: Teachers themselves are developing, just as are their students. Expert teachers are generative through their contributions to the next generation.

MARCIA'S THEORY OF IDENTITY ACHIEVEMENT

- **Demonstrate role models for identity achievement.** Although expert teachers do not discourage students from engaging in their own identity searches, they do emphasize the value of eventually making the commitments that result in a firm sense of one's self. It may help to point out examples of people who have found success through keeping their commitments—literary characters, or real people in relevant subjects, such as scientists, local leaders, or celebrities. Most important, teachers and other adults need to be solid adult role models, not substitutes for childhood friends (Baumrind, 1991; Bettinger & Long, 2005; Emmer, Evertson, Clements, & Worsham, 1997; Lamb, 1996).
- **Facilitate exploration of alternative value systems, and discuss the advantages and disadvantages of each.** In classes such as English or history, historical figures or literary characters can represent models that students can consider and emulate. In science, students can learn about scientific values by becoming involved in research or by reading about the discoveries of great scientists. Foreign-language classes promote learning about another culture, including recognition of how that culture is similar to and different from students' own culture.
- **Encourage students to make commitments that are sensible for their age level.** These commitments may occur through students' doing their best in school, belonging to school organizations, completing chores in the home, being loyal to friends and family, following religious teachings, or exploring one or more hobbies or fields of special interest. Learning how to make and keep commitments may be as valuable as fulfilling the particular commitments made.
- **Consider cultural differences.** Many students come from cultural backgrounds in which foreclosure is more widely accepted than it is in the United States. Pushing

THINKING PRACTICALLY

Have you searched for your identity? If so, how?

SUGGESTION: Each student must answer for himself or herself. Often, people search for their identity by trying out various roles and seeing which roles work for them and which do not.

students from such a background to engage in an identity search may promote conflict with their families and with their own deeply held cultural convictions.

- **Be aware of the ongoing nature of identity formation.** Marcia's theory is relevant primarily to individuals during adolescence and, potentially, young adulthood. In a certain sense, however, identity formation lasts a lifetime. People often must assess and reassess who they are, what they have become, and whether what they have become is what they want to remain.

TEMPERAMENT

Some students (and teachers!) get angry easily but get over it quickly. Others are slow to anger but have more difficulty recovering. Still others rarely get angry at all. Differences such as these are a matter of temperament—the individual tendency to feel a given emotion with a particular intensity and duration.

TEACHER INTERVIEW

FOCUS ON: EARLY ADOLESCENT IDENTITY DEVELOPMENT

GREGORY BOULJON: BETTENDORF MIDDLE SCHOOL, BETTENDORF, IOWA—GRADE 8, LANGUAGE ARTS

Gregory Bouljon has been teaching for 30 years. In 2000, he was certified by the National Board for Professional Teaching Standards as a teacher of English Language Arts for Early Adolescence.

Would you say that your students are at the personality development stage Erikson called "identity versus role confusion"?

This definitely describes many of my eighth graders. Some are obvious, like a girl I taught last year, whom I'll call "Stephanie." Stephanie had a checkered past of numerous school disciplinary actions as well as police involvements with her "friends" in the community. She arrived the first day in total Goth attire: white makeup, black lip and eye color, all-black clothes, and demon-figure jewelry. She sat in the back of the room with arms folded across her chest with a look of "Go ahead and try, but I'm not doing anything in here."

Over the next few weeks, we did a Writers' Workshop in which students self-select their own topics and genres. Fortunately (for all of us), Stephanie liked to write. Her first pieces were profanity-laced angry diatribes meant to offend us. The profanity turned out to be forced, but the anger for her parents was real—and deep. My student teacher and I listened, read, responded to the ideas, and ignored the profanity.

Stephanie used her writing as a way to understand her anger. She began to realize that she had been reacting to her parents and an abusive relative and was not being herself. Once that began to happen, she changed. By October, she had apologized for her early work. She promised to rewrite it so that she could read it to the class and put it up in the room and in our display case. She began to wear other colors, and the makeup was gone. By December, she had new friends. The old ones, she told the two of us and the class, just wanted to use her. Some of her new friends were in our class and welcomed her insightful writing about herself that also seemed to capture their own identity struggles.

Not all students suffer with finding themselves as visibly as Stephanie did. For most, it is a much more quiet, personal struggle to balance the expectations of parents, family, peers, coaches, and the perceived community in which they live. But in the course of a year, all my eighth graders begin, or continue, or set their concepts of themselves in relation to all the forces that push and tug and make demands on them.

Some theorists describe a process of "trying on" different identities during early adolescence. Your students seem to show they are in this process through their choices in clothing.

In the process of finding their identity, students' choices in clothing can change and do, regularly. It is not uncommon to see girls in the course of a single week dress in miniskirts and tight tops one day, loose jeans the next, and sweats another day. Holidays (especially Halloween) bring out the most bizarre attire allowed by our school codes. Often students will bring an extra, more acceptable outfit in case their first choice turns out to be too bizarre, revealing, or inappropriate.

Students also want their clothes to signify their membership in various peer groups. Most groups have a uniform of the day, or at least limits of what the student can wear and still be okay with his or her group.

Brand names are important. Either you have the "right" line of clothes on, or you don't, if you want people to know you are "your own person" and are not swayed by fashion.

Is sexual development and dating a big concern for your students?

I do not believe that many of my students are sexually active during their eighth grade year. Most of our students

Temperament is relatively consistent across situations and over time (Kagan, 2001; Komsi, et al., 2006; Rothbart & Bates, 1998). For example, Caspi, Elder, and Herbener (1990) studied consistency of temperament in a project conducted in Berkeley, California. They found that children who were ill tempered at 8, 9, and 10 years of age were also ill tempered at age 30. Moreover, they tended to show a variety of maladaptive personality characteristics as well as relatively poor performance at work.

Temperament involves both emotional and self-regulatory aspects. A shy child, for example, may be fearful in response to others—an emotional response—but also inhibited in dealing with them—a matter of self-regulation (Kagan, 1998). The level of disinhibition in toddlers, which is related to extraversion, has been found to be a reliable predictor of adult personality (Blatny, Jelinek, & Osecka, 2007).

Temperament is shaped by both genetic and environmental factors (Caspi, 1998; Kagan, Snidman, & Arcus, 1998; Lerner, 2002). Over the life span, it influences the development of personality and, therefore, the development of relationships (Thompson, 1999).

seem to be in the early stages of exploring their sexuality. Students talk and write disparagingly about their friends who are sexually active. They feel the others are wasting themselves on something meant for later in life. What is done is mostly "experimental."

Most of our students socialize in large, mixed-gender groups at school functions (of which we have many) and in their private social lives. We encourage parents to create events and places where kids can "hang out" under supervision. Relationships change often, and few become serious in terms of sexual experimentation.

What about students who may be gay or bisexual?

It is very hard for kids who are asking questions about their sexual orientation. Not only do they have to sort out their school and personality identities, but they have the sexual identity issues to deal with as well. In the last few years, it was not uncommon to hear students call others gay as a put-down for almost any offense to an individual or group. As a result of a near-crusade on my part, I've gotten many faculty members to add the word "gay" to the list of other unacceptable epithets and to help put a stop to its use in that way. Many students caught saying it in the halls will tell you that they don't "mean it as a put-down," but, for all of us who see respect as a crucial element of school, it is when used inappropriately—especially for those students who are desperately trying to sort out their sexual orientation.

Does your school have any character-education initiatives, such as service learning projects, to encourage moral development?

Our school is divided into interdisciplinary houses, and service learning projects are central. We do a wide variety of fundraising for families and organizations, read and write to younger students, and volunteer time at nursing homes and senior centers. We initially tried to make everyone participate in these projects in our school, but soon realized that each student must be allowed to participate at the level at which it is most comfortable for that student at that time. Service learning projects give students an opportunity to explore and develop another dimension of their personal identities. Often, the very kids who are usually talented "work avoiders" will do the most in these projects. Last year, it was about the only time that one boy wrote for my class at all. He took great care in writing stories for his elementary school pen pal. He also led other students to involvement with our charitable fundraising.

Once the student opens himself or herself to what you're teaching, miracles can happen in a very short time.

What advice would you give to new teachers?

Be slow to judge and quick to accept. Some students are so involved with finding out who they are, and with what their friends and family are demanding, that they have little left for your class. Start with where each student is, establish a friendly (and humorous) relationship, and gradually work your agenda into theirs.

I really believe that until a person "opens" herself or himself up to a topic, person, idea, or text, she or he cannot learn of it or from it. But to open yourself up when you are 14 and not really sure of who you are is tough. There is a way to reach every student, if you can be patient enough to wait for that student to open the door enough for you to come in. It may not happen today, or next week, or next month, but it will happen, and you must be ready to seize that moment using the relationship of acceptance and understanding that you have built up in all your previous encounters. Once the student opens himself or herself to what you're teaching, miracles can happen in a very short time.

Some of the best-known and most highly regarded work on temperament was done by A. Thomas and Stella Chess, who conducted a longitudinal study of children from birth until adolescence that identified three types of temperament in babies (see, for example, Thomas & Chess, 1977, 1987; Thomas, Chess, & Birch, 1970). *Easy babies* constituted roughly 40 percent of the sample. These children were playful, adaptable, and regular in their eating and other bodily functions; they were also interested in novel situations and responded moderately to them. *Difficult babies* constituted 10 percent of the sample. Irritable and not very adaptable, these children avoided unfamiliar situations and reacted intensely to them. *Slow-to-warm-up babies* accounted for 15 percent of the sample. They had relatively low activity levels and showed minimal responses to novelty. They disliked new situations and needed more time than other babies to adapt to them. Even though more than one in every three babies (the remaining 35 percent) in Thomas and Chess's study could not be classified according to these criteria, the categories have nevertheless proven helpful in understanding temperament.

To what extent do differences in infant temperament remain stable throughout development? Several studies (Kagan & Moss, 1962; Kagan, Reznick, Clarke, Snidman, & Garcia-Coll, 1984) have found consistency in temperament over time. In one study, children identified as either highly inhibited or essentially fearless at 21 months showed similar patterns at age 4. In particular, three-fourths of the inhibited children remained inhibited, whereas none of the children who had been fearless became inhibited. Calkins (1994) also found that inhibited behavior in childhood was predicted by their temperamental characteristics during infancy.

At first glance, temperament research seems only to state the obvious. Is it really surprising that two categories of babies are "easy" and "difficult"? Can categorizing children really change the way we look at them? Yes. In fact, Thomas and Chess's work profoundly changed the way we view the *person–environment interaction.* Prior to the publication of their studies, countless books had been written to tell parents how to create a good environment for children, in general. Thomas and Chess's findings, however, suggested that we ought to ask, "Which environment is best for this particular baby?" Clearly, no two people are the same at any age, and the right nurturing atmosphere is different for different babies. This conclusion was the true gift of the research by Thomas and Chess.

The idea that environment should be matched to temperament has not been universally accepted (e.g., Kagan, 1982; Wasserman, Di Basio, Bond, Young, & Collett, 1990). Thomas and Chess suggested that difficult children are essentially unmodifiable. They believed that attempts by parents to change them would merely increase their resistance. According to these researchers, parents of such children need patience more than anything else.

But consider some of the implications of this notion. First, it suggests that some babies are, in a sense, preferable to others. The terms *easy* and *difficult* reflect value judgments, and the danger in using them is that parents might think that their "difficult" children are inferior. Moreover, grave dangers are associated with the risk of self-fulfilling prophecies. Once people rightly or wrongly assign the "difficult" label, they may treat the child accordingly. Eventually the child may fulfill the prophecy by behaving in line with parental expectations. Even worse, the misbehaving child may then become vulnerable to abuse (Starr, Dietrich, Fischoff, Ceresnie, & Zweier, 1984).

A second implication is that parents should not blame themselves for their children's temperaments. Parents are responsible for guiding and sometimes even controlling their children's behavior, but they are not necessarily the *causes* of that behavior. Research has demonstrated that temperament is at least in part a result of genetic differences (Saudino, 2005; Silberg et al., 2005). From an evolutionary point of view, there is no one "better type" of person. The adaptive value of different attributes differs from time to time, place to place, and person to person. In fact, few people have a single type of temperament. If they did, then genes that might have committed people to one type only would have lost out evolutionarily to genes that provided a more flexible personality (Trivers, 1971; Wright, 1994). In personality and temperament, as in other attributes, the flexible individual has the greatest advantage.

Sexual and Gender Development: Acquiring Gender Roles

Psychologists typically distinguish between sex and gender. A person's sex is physiologically determined, whereas a person's gender is psychologically determined and culturally influenced (Deaux, 1993). **Sexual development** refers to increasing awareness of the characteristics of each of the sexes, of the differences between the sexes, and of changing perceptions of one's own sexuality. **Gender identification** is a person's acquisition of sex-related roles, regardless of whether they correspond to one's physiological sex. For most people, sex and gender identifications correspond, but many exceptions to this generalization exist.

The culture in which an individual is raised shapes gender roles—that is, behavior considered appropriate for males or for females (Best & Thomas, 2004; Brody, 1996; Eccles, Wigfield, Harold, & Blumenfeld, 1993; Nierman, Thompson, Bryan, & Mahaffey, 2007). Sandra Bem (1985, 1993) has described the typical feminine gender role in some societies as comprising what she refers to as expressive behavior, such as nurturing children, and traits, such as passivity. The typical masculine role is made up of what Bem calls instrumental behavior, such as sports participation, and traits, such as aggressiveness. However, these patterns do not hold true for all societies, and even where they do, there may be great overlap in behavior. Many women may display aggressive behavior, for example, and many men may be nurturant or passive. Also, many gender roles are actually sex neutral—that is, they could be performed equally well by males or females. This fact, in addition to the great variability in the way individual males and females perform their gender roles, makes it difficult to generalize about being "male" or "female" (Levy, Taylor, & Gelman, 1995).

Bem (1981) has defined a state in which an individual feels comfortable displaying both expressive and instrumental qualities as **androgyny.** Some evidence indicates that androgynous individuals tend to have more ease selecting and using appropriate coping strategies in stressful situations (Cheng, 2005). The influence of androgyny on behavior hase been explored in a number of studies (Singh & Agrawal, 2007; Strough, Leszczynski, Neely, Flinn, & Margrett, 2007).

The distinction between sex and gender is a vital one for teachers to keep in mind. Expert teachers do not make assumptions about their students' abilities based on biological sex. They know that researchers have found relatively few consistent sex differences in academic ability or personality (Halpern, 2000). In contrast, as we discuss in detail in Chapter 6, research has shown a great deal of overlap in males' and females' scores on most tests of ability or personality (Feingold, 1992a, 1992b; Fennema, 1987; Grossman & Grossman, 1994; Hyde, 2005). Nevertheless, it is clear to most teachers that many male and female students behave very differently in certain contexts (Zakriski, Wright, & Underwood, 2005). Most of these differences are likely results of differential socialization. Others may be due to biological factors, including differing levels of hormones, such as testosterone. By the time they enter kindergarten, most children have a clear understanding, and usually acceptance, of their society's gender roles (Wynn & Fletcher, 1987).

Although there may be little difference between the potential abilities of males and females, it seems that boys and girls have inborn predispositions to develop their abilities in different ways. However, researchers disagree about whether these differences are biological, social, or a mix of both.

Prentice Hall School Division

VIEWS ON SEXUAL AND GENDER DEVELOPMENT

How do children come to recognize and to accept the gender roles that are deemed appropriate in their cultures? Are any differences between males and females consistent around the world? Several points of view toward these questions have been developed. These views often complement, rather than contradict, one another.

■ **BIOLOGICAL VIEWS** Biological researchers argue that differences between the sexes are rooted in the physiological differences between men and women. They believe that boys and girls acquire different gender roles because they are biologically predisposed to do so (e.g., Benbow & Stanley, 1980; Berenbaum & Hines, 1992; Berenbaum & Snyder, 1995; Hampson & Moffat, 2004; Hines, 2004; Kagan, 1998).

Some investigators (e.g., Buss, 1996; Buss & Kenrick, 1998; Kenrick & Trost, 1993; Kenrick, Trost, & Sundie, 2004) emphasize the role of evolution in determining sexual behavior. For example, male students consistently perform better than do female students on tests of certain spatial abilities, including mental rotation of figures and predicting the paths of moving objects (Halpern, 2000). Evolutionary thinkers suggest that these differences may be lingering adaptations from the hunting role that the students' male ancestors played long ago (Buss, 1995; Geary, 1995).

Biological explanations seem to suggest that, although there may be little difference between the potential abilities of males and females, boys and girls may have inborn predispositions to develop their abilities in different ways. People who believe that gender roles are biologically determined are more likely to agree with gender stereotypes. In one study, women were more likely to say that negative gender stereotypes describe them if they believed that gender roles are biologically determined (Coleman & Hong, 2007). Biological differences between boys and girls may also trigger different treatment from parents and others in their environments. Sigmund Freud developed an account of psychosexual development that is based, in part, on the assumption that males and females have inborn tendencies to develop in different ways.

FREUD'S VIEW OF PSYCHOSEXUAL DEVELOPMENT

Sigmund Freud (1856–1939) suggested that psychosexual development—the psychological development of one's sexuality—begins immediately after birth (1905/1964). However, gender-role identification arises primarily from psychological crises faced during a stage of development that lasts from about 4 to 7 years of age (Bell, 2004). During this stage, children become susceptible to conflict, in which they start to have sexual feelings for the parent of the opposite sex. For boys, this conflict is called the Oedipal conflict, named after Oedipus, from Greek mythology, who killed his father and (unknowingly) married his mother. In particular, boys may in some ways desire their mothers but simultaneously fear the anger of their fathers. Eventually, boys realize they cannot express sexual desire for their mothers and look for an appropriate partner of the other sex.

THINKING CREATIVELY

How do you think sex typing occurs?

SUGGESTION: Children may imitate behavior of older persons who seem most like them, which usually, but not always, would be the same-sex parent.

The comparable reaction in girls—attraction to the father but fear of the mother—is sometimes referred to as the Electra conflict, after the myth of Electra, who hated her mother for having betrayed and then killed her husband, Electra's father. As they mature, girls realize they cannot express sexual desire for fathers and look for an appropriate partner of the opposite sex.

Freud believed these conflicts eventually cause children to identify with the same-sex parent. At the same time, they internalize that parent's gender role as their own. Freud believed, as do many modern psychologists, that how parents treat their children has a major effect on their development (Bugental & Goodnow, 1998). Ultimately, children end up perpetuating the stereotypes foisted on them by adults.

■ **BEHAVIORIST VIEW** A behaviorist view emphasizes the importance of environmental forces. Boys and girls are treated differently from the moment they are born (Jacklin, DiPietro, & Maccoby, 1984; Ruble & Martin, 1998). Most parents of preschool and school-age children continue to treat boys differently from girls. They reward assertive behavior on the part of boys and emotional sensitivity in girls (Fagot & Hagan, 1991; Lytton & Romney, 1991). Research has shown that teachers also treat boys and girls differently (Nicaise, Cogérino, Fairclough, Bois, & Davis, 2007). Boys generally receive more teacher attention, both positive and negative, than do girls (Bailey, 1993; Sadker & Sadker, 1994).

These differences in treatment can lead to different behavior. In particular, female students tend to become more passive in school. They show increasingly less class participation in relation to male

students as they progress from elementary school through college (Sadker, Sadker, & Klein, 1991). In addition to rewarding or punishing children directly for gender-related behavior, parents and teachers often reinforce gender roles simply by acting as models of what men or women are like.

Index Open

As this young boy helps his father bake cookies, he's also forming ideas about gender roles. In gender-role learning, people observe and learn from role models as they follow those thought and behavioral patterns they see being rewarded.

■ **SOCIAL LEARNING VIEW** The **social learning view** holds that people come to think and behave as they do by observing others and then by imitating behavior they have seen reap rewards. This view may be applied to gender-role learning, in which people observe and learn from role models as they follow those thought and behavioral patterns they see being rewarded (Bandura, 1977a, 1977b; Bussey & Bandura, 2005; Pomerantz, Ng, & Wang, 2004). For example, children who observe domestic violence are more likely to justify the use of violence in dating relationships (Lichter & McCloskey, 2004).

Similarly, television provides many children with a way to observe a variety of models, including gender-role models. Television programs, however, may be demonstrating inaccurate gender stereotypes (Furnham & Skae, 1997; Signorielli, McLeod, & Healy, 1994). For example, about twice as many men as women appear on television, despite the fact that slightly more than half the real-world population is female (Calvert & Huston, 1987). In addition, males are frequently shown in aggressive roles. Women are more often portrayed as helpless, not just in the United States, but around the world (Hovland, McMahan, Lee, Hwang, & Kim, 2005; Mwangi, 1996; Zuckerman & Zuckerman, 1985). When they use these roles as models, children end up perpetuating the stereotypes foisted on them by adults.

■ **SCHEMA VIEW** A **schema-based view** suggests that everyone possesses organized mental systems of information (schemas) that help them make sense of and organize their experiences (S. Bem, 1981). The gender-schema view holds that people acquire schemas that guide their interpretations of what are and are not appropriate gender roles (Palomares, 2004). For example, gender stereotypes are examples of schemas that are widely shared—views explaining that certain behaviors are appropriate for males, whereas other behaviors are appropriate for females (Yzerbyt, Rocher, & Schadron, 1996). Schema theorists would suggest that many of these factors contribute to the development of a person's gender schema.

For example, consider how a girl might form a gender schema that includes an emphasis on physical appearance. Perhaps she has seen that the women in her environment are more interested in their personal appearance than are the men. In addition, she herself may have been praised for looking pretty in new clothing. She may conclude that women are supposed to be more appearance conscious than men and, as a consequence, pay great attention to her own appearance. Television and movies often strengthen these stereotypes.

FORUM

SINGLE-SEX VERSUS MIXED-SEX SCHOOLS

Several states have begun to introduce single-sex classes in their public schools. For example, in 1997, California began a pilot program offering single-sex academies within its public school system. Either boys or girls could enroll in a single-sex alternative to mixed-sex public schools. Is separating the sexes the wisest way to make sure that boys and girls receive the best possible education?

FIRST VIEW: IN FAVOR OF SINGLE-SEX SCHOOLS. Advocates of single-sex schools suggest that boys and girls learn differently. For example, some studies indicate that girls prefer cooperative learning, whereas boys prefer competition. In addition, advocates of single-sex classes point out studies showing that boys dominate mixed-sex classrooms,

THINKING PRACTICALLY

Think of ways you have interacted with students, either as a teacher or as a fellow student. In what ways, if any, have you encouraged sex-role stereotyping? How might you have done things differently?

SUGGESTION: Each student must answer for himself or herself. Sometimes teachers hold different expectations for girls and boys, depending on the subject. Teachers should try to overcome this stereotyping. One way to do so is by calling equally on boys in literature classes and on girls in math and science classes.

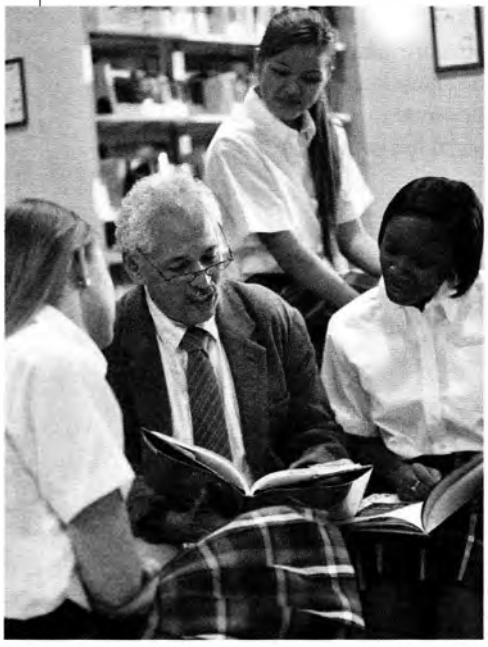
receiving a disproportionate share of teacher attention (Bailey, 1993; Sadker et al., 1991). Girls are more likely to speak out in class if there are only girls in the room than if the room contains members of both sexes. Further, research suggests that participation in all-girl classes fosters positive attitudes about learning. This finding applies even in subjects in which female students typically lack self-confidence, such as math (Streitmatter, 1997). High levels of self-confidence may be linked to better academic performance (Bandura, 1986a, 1986b; Norem & Cantor, 1990).

One complication of many of these studies is that, frequently, the single-sex environment studied is in a private school. However, when the private coeducational and single-sex are classrooms are compared, an advantage for the single-sex classes is still apparent (Vezeau, Bouffard, & Chouinard, 2000). There was not an advantage for single-sex public schools as compared with coeducational public schools (Vezeau et al., 2000).

SECOND VIEW: IN OPPOSITION TO SINGLE-SEX SCHOOLS. Opponents view single-sex schools as an unfair form of segregation. Several states have already discontinued experiments with single-sex public schools because of lawsuits contending that such schools violate laws entitling all students to have equal access to educational opportunities. For example, a boy who dislikes competitive learning and does not perform well under competitive pressure would not be allowed access to cooperative learning-style classes that could further his achievement if those classes admitted only girls. In addition, opponents suggest that single-sex public schools do little to prepare students for the mixed-sex world they will encounter outside of school. Additionally, one set of researchers observed an increase in problematic peer relations, such as aggression, victimization, and rejection, in some girls-only classrooms (Barton & Cohen, 2004).

THIRD VIEW: A SYNTHESIS. Entirely separate schools for boys and girls may be unnecessary, given that the evidence from many of the studies conducted in the last two decades suggests that differences between test scores of male and female students are declining (Feingold, 1988; Linn & Hyde, 1989). Some psychologists and educators conclude that social developments in the same time period, including increasing awareness of teachers' different treatment of boys and girls, and efforts to equalize that treatment, have helped narrow the performance gaps (Linn & Hyde, 1989).

In same-sex classrooms, girls often volunteer answers more readily than they would in a mixed-sex classroom.



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Achievement differences persist between male and female students in math and science, however. Research suggests that these differences may be linked to differences in the levels of encouragement girls and boys receive for taking advanced science and math classes (American Association of University Women, 1992; Pallas & Alexander, 1983). They may also be linked to different treatment of boys and girls by math and science teachers (American Association of University Women, 1992; Sadker et al.,, & Klein, 1991). In response to these difficult-to-eradicate differences, some public school systems have offered single-sex classes in math and science. Girls and boys have the opportunity to enroll in classes that cover the same academic content, using many of the same teaching methods—but the classes are limited to students of just one sex. At the same time, students also have the benefits of mixing with members of the other sex in other classes and in school activities. Such limited use of single-sex classes may help promote equal achievement in math and science until schools and teachers are able to develop effective ways of achieving the same goals in mixed-sex math and science classes. Single-sex classrooms have shown benefits for female students in a variety of circumstances (Jackson, 2002); likewise, such classrooms have also shown benefits for male students. Specifically, improvements in English scores have been observed for both high school male and female students in single-sex classes (Mulholland, Hansen, & Kaminski, 2004).

■ **HOMOSEXUALITY** **Homosexuality** describes a person's tendency to direct sexual attention toward members of the same sex. People with a homosexual orientation tend to seek sexual partners primarily of the same sex rather than of the opposite sex. Homosexuality is not a form of mental illness (Hooker, 1993). It is also neither a "lifestyle"—gay and lesbian people occupy a full range of occupations and social classes—nor a "choice" or "preference" of sexuality. Rather, it is a sexual and affectional orientation and identity, probably rooted primarily in psychosexual development.

Sexuality may be thought of as a continuum. People who have an exclusively heterosexual orientation are at one end of the continuum, and people who have an exclusively homosexual orientation are at the other end. Those people who fall in between may be considered bisexual, or people who direct their sexual attention toward members of both sexes. Research has shown that approximately 10 percent of men and a slightly smaller proportion of women identify themselves as having predominantly homosexual orientations (e.g., see Fay, Turner, Klassen, & Gagnon, 1989; Rogers & Turner, 1991).

Many explanations have been proposed for the origins of homosexuality. It may well be that there is no one "correct" explanation; instead, the truth may lie in a combination of explanations. This section describes the major theories, but keep in mind as you read these explanations that none has been demonstrated conclusively.

The biological view of sexual orientation suggests that genetic factors play an important role in the development of people who are gay, lesbian, bisexual, or transgendered (i.e., people who are of one gender but view themselves as being of the other gender). For example, if one of a pair of genetically identical twins is homosexual, the other is almost three times more likely to have the same orientation as in nonidentical twin pairs (Bailey & Pillard, 1991). Some evidence also indicates that a small region of the hypothalamus may be less than half as large in homosexual men as in heterosexual men (LeVay, 1991). Differences in the metabolism of neurotransmitters and composition of the X chromosome are also observed between heterosexual and homosexual men (Kinnunen, Moltz, Metz, & Cooper, 2004; Rahman & Wilson, 2003). There is fairly strong support for an explanation that is at least partly biological (Byrne, 1995). Even so, expressing a biological tendency toward a homosexual orientation (or heterosexual or bisexual orientation, for that matter) may depend on social learning and other environmental factors (D. J. Bem, 1996; Wade & Cirese, 1991).

A second explanation has been offered by D. J. Bem (1996, 2000a, 2000b). According to this perspective, homosexual behavior develops when a child views members of the same sex as more unfamiliar and exotic than members of the opposite sex. According to this view, what starts off as exotic later becomes erotic. Over time, the child becomes attracted to members of the same sex.

Other explanations for the origins of homosexual orientation have been offered but have been largely discredited. One view states that homosexual individuals had weak fathers and dominant mothers; there is no evidence for this view, however. Another explanation claims that homosexual people become fixated in a homosexual phase of psychosexual development, though no such phase has ever been found. Yet another perspective suggests that gay and lesbian people have been rewarded for homosexual leanings and punished for heterosexual ones. Of course, mainstream U.S. society (among other societies) does not reward a homosexual orientation, and relatively few children are likely to be exposed in their households to overtly homosexual orientations.

We view homosexuality and sexual orientation, more generally, according to our culture's prescriptions and taboos (Wade & Cirese, 1991). Even within our own culture, views are changing. Vermont was the first state in the United States to recognize homosexual civil unions, and other states have adopted similar policies. Some, including Massachusetts and California, recognize marriage between same-sex partners. Canada and a few other countries including the Netherlands recognize such unions as well.

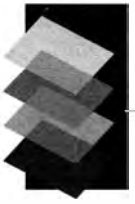
Expert teachers make a conscious effort to understand current research on homosexuality and to refrain from stereotyping or discriminating against students (or parents) who have a homosexual orientation.

IMPLICATIONS FOR TEACHING

- **Model and reward the behavior you expect from your students.** Although teachers must be sensitive to parental or community standards regarding gender roles, teachers who wish, say, to encourage androgyny (sex-neutral behavior) can do so by modeling it themselves and by rewarding it in their students. Teachers should model respect for all sexual orientations on the continuum as well as respect for the abilities of both sexes.
- **Acknowledge and strive to overcome gender stereotypes.** Expert teachers examine their own gender stereotypes while analyzing how they interact with students. They learn to be aware, for example, of whether they are calling on boys in class more often than on girls or whether they are avoiding interaction with students who may have a homosexual orientation. Some public schools have introduced single-sex classes in an effort to reduce gender stereotyping. This development has turned out to be somewhat controversial, as described in the Forum feature, "Single-Sex versus Mixed-Sex Schools."
- **Check learning materials for damaging gender stereotypes.** Expert teachers compensate for a lack of gender equity in curriculum materials by adding examples or discussing different possibilities. Expert teachers also check reading material for fairness when the material discusses homosexuality. Table 3.2 suggests ways in which the teacher might apply these implications at different educational levels.

TABLE 3.2 Educational Implications of Gender Development Theories

	How Teachers Might Apply the Implications at Different Educational Levels			
Implications	**Preschool and Primary Grades**	**Elementary School**	**Middle School**	**High School**
Model and reward the gender behavior desired of students.	Preschool and elementary school teachers may want to use gender-neutral terms, such as "fire fighter" or "mail carrier," when discussing potential occupations or dramatic play roles so that children of both genders feel free to play roles that interest them.	Children in the upper elementary grades generally prefer to play and work with same-sex peer groups. Teachers may wish to remind students of the value of working with the other gender by providing examples of boys and girls, or men and women, who have worked together to solve a problem, finish a job, or invent something.	Teachers of both genders should model respect for the other gender. Teachers should prohibit sexually harassing comments.	Female teachers may wish to demonstrate their own competence or interest in math and science, areas in which high school girls have been shown to lack confidence in their abilities. Teachers of both genders can point out examples, in daily life or the media, of the need to use math and science concepts.
Acknowledge and strive to overcome limiting gender stereotypes.	Teachers of young children will quickly notice that both girls and boys are very energetic and need opportunities to exercise large muscles in vigorous activities.	Teachers should avoid communicating expectations that either groups of boys or groups of girls will cause more "trouble" in class or on the playground. Correct misbehavior from individuals of both genders when it occurs.	Teachers may have been led by recent research to expect all middle school girls to develop low self-esteem. However, teachers should be alert for changes in the self-esteem of both male and female students, and avoid giving members of either gender special treatment unless needed.	High school teachers and counselors should avoid making assumptions about the level of interest and ability that male and female students have for various subjects or careers. Some male college-bound students may be planning to study traditionally "female" subjects, such as early childhood education.
Check learning materials for damaging gender stereotypes.	Check storybooks and picture books to see if male and female characters are equally represented.	Avoid literature that reinforces helpless female or aggressive male stereotypes.	Provide additional examples of female accomplishments in relevant subjects if they are not included in text or other materials.	Examine science and math for gender inclusion. Math word problems should not humorously reinforce male or female stereotypes, for example.



Social Development: Learning to Interact with Others

Personal development concerns the development of the individual in relation to the self. In contrast, social (interpersonal) development concerns the relationships of the individual with others, including how these relationships change over time. Several concepts of social development are relevant to the concerns of educational psychologists, one of which is attachment.

ATTACHMENT

Attachment is the strength and kind of emotional bond that exists between two people (Colin, 1996; Sroufe, 1996). Early work by John Bowlby (1951, 1969) claimed that the way an infant is attached to the mother has long-term effects on the child's interpersonal development.

Mary Ainsworth (Ainsworth, Bell, & Stayton, 1971; Ainsworth, Blehar, Waters, & Wall, 1978) proposed three basic modes of attachment. Although the three attachment patterns are described in terms of mother–child bonds, keep in mind that children form attachments with fathers and other significant people in their lives. Ainsworth assessed attachment style through infants' reactions to the **strange situation,** an experimental procedure in which the attachment of an infant to the parent is observed after the parent has left the infant with a stranger, and has then returned.

> *The mother is with the child. A stranger enters and starts playing with the child. The mother steps away and the child notices that she is gone. The mother then returns.*

- In the first pattern, **avoidant attachment** (sometimes called "type A" attachment), the child generally avoids or ignores the mother when she returns after leaving the child with the stranger. These children pay little attention to the mother even when she is in the room. Moreover, they show minimal distress when she leaves. Children (and adults) with an avoidant attachment style sometimes are further subclassified in terms of whether they seem not to care about attaching themselves or actively avoid attachments (Main & Solomon, 1990).
- In **secure attachment** ("type B" attachment), the child shows distress when the mother departs. When the mother returns, the child immediately goes to her, showing pleasure at being reunited. The secure child is friendly with the stranger but shows an obvious preference for the mother.
- In **resistant attachment** ("type C" attachment), the child is ambivalent toward the mother. Upon reunion with the mother, the resistant child both seeks and resists physical contact. For example, the child might run to the mother when she returns, but then try to get away when held.

In her research, Ainsworth found that among American middle-class children in the 1970s, roughly 20 to 25 percent tended to be avoidant, about 65 percent were secure, and about 12 percent were resistant. However, patterns of attachment differ across socioeconomic class and family situation. For example, it appears that in unstable or nonintact American families of lower socioeconomic status, the chances of a child's being resistant are somewhat higher (Egeland & Sroufe, 1981; Vaughn, Gove, & Egeland, 1980).

Attachment research originally focused on the role of the mother in the life of the infant, but later examined the role of the father and others as well (Coley, 2001; Ricks, 1985). Infants do become attached to their fathers, protesting separations from approximately 7 months of age (Lamb, 1977a, 1977b, 1979, 1996). At home, infants approach their fathers, smile at them, and seek contact with them. Fathers who feed their 3-month-old babies can show the same sensitivity to cues as do mothers. Fathers rarely use this skill, however, instead typically yielding the feeding function to the mother (Parke & Sawin, 1980; Parke & Tinsley, 1987).

When the father substitutes for the mother in the strange situation, the child uses the father as a haven. Children prefer fathers to a strange woman as well. In addition, infants who

are cared for by their fathers while their mothers are at work are more likely to show secure attachment than are infants who are cared for outside the home (Belsky & Rovine, 1988).

Fathers seem to provide a different kind of care from mothers. They tend to be more active in playing with their children (Clarke-Stewart, Perlmutter, & Friedman, 1988; Parke, 1981, 1996). They also engage in more novel games (Lamb, 1977b). One study found that two-thirds of toddlers prefer playing with their fathers to playing with their mothers (Clarke-Stewart, 1978). Also, the relationship between toddlers and their fathers may be more instrumental in helping the infants widen their social contacts and interact sociably with persons outside their families (Bridges, Connell, & Belsky, 1988).

Caregiving has lasting biological and socioemotional effects. If the early experiences of an infant with respect to caregiving are stressful or if the mother is seriously depressed, such experiences can have permanent effects on the development of the child's neurobiological functioning (Dawson & Ashman, 2000; Gunnar, 2000; Gunnar & Davis, 2003; Thompson, Easterbrooks, & Padilla-Walker, 2003). Similar effects are associated with lower socioeconomic status of the family (DiPietro, Costigan, Shupe, Pressman, & Johnson, 1999), presumably because mothers experience more stress in such environments. Poverty and sometimes physical danger associated with some low-income neighborhoods are stressors on parents and children alike (Duncan & Brooks-Gunn, 1997; Fitzgerald, Zucker, & Yang, 1995; Zucker, Fitzgerald, Refior, Puttler, Pallas, & Ellis, 2000). Interestingly, a child whose stress level is low is less likely to stress the mother (Gunnar, 2000). This reciprocal effect shows that development is a system, rather than a simple linear process (Sameroff, 2000).

THINKING PRACTICALLY

How would you characterize the effects of your own early modes of attachment to significant others on your personal relationships?

SUGGESTION: Answers will vary. Adult relationships with teachers, employers, or friends often reflect patterns of attachment formed during infancy.

Patterns of attachment also differ by cultures. A larger percentage of avoidant children have been observed in Western Europe, and a larger percentage of resistant children have been found among Israelis and Japanese (Bretherton & Waters, 1985; Miyake, Chen, & Campos, 1985; Morelli, Rogoff, Oppenheim, & Goldsmith, 1992). These patterns suggest that traditionally used labels are probably culturally biased. After all, had German people, who have a higher proportion of avoidant children, labeled the types of attachment, they would have been unlikely to have used the label "avoidant" to characterize their children's more common pattern of attachment, and unlikely to have used "secure" to characterize the pattern more commonly found in U.S. children. Clearly, sociocultural biases can lead people to label behavior as somehow "better" if it is indigenous to, or common in, their own culture.

Does attachment have a long-term effect on children's patterns of development, as Bowlby claimed? It appears so. For example, securely attached children at the nursery school level tend to be more active, more likely to be sought out by other children, and rated by their teachers as more eager to learn than are other children (Waters, Wippman, & Sroufe, 1979). Several researchers have found evidence that an adolescent's security of attachment to his or her parents may be related to his or her competence and well-being (Allen & Kuperminc, 1995; Armsden & Greenberg, 1987; Black & McCartney, 1995; Kobak & Sceery, 1988; Torquati & Vazsonyi, 1994). Shaver, Hazan, and Bradshaw (1988) have even found what seems to be a relationship between infantile patterns of attachment and the kinds of attachments an individual forms to friends and lovers during adulthood. Thus attachment styles first formed during infancy may persist in one form or another throughout the life span (Shaver, Collins, & Clark, 1996). Secure attachment in infancy is also related to improved cognitive functioning and, in general, to improved physical and mental health in later childhood (Ranson & Urichuk, 2006).

As many teachers recognize, students often form attachments to teachers. Children's attachment to their day-care or preschool teachers is related to how the children get along with their peers. A change of teacher or a change in the child's relationship with the teacher is associated with changes in the child's relations with peers (Howes & Hamilton, 1993; Howes, Hamilton, & Matheson, 1994; Howes, Matheson, & Hamilton, 1994).

Children who have experienced attachment difficulties sometimes later experience problems in school. Disruptions in infantile attachment may have potentially severe effects on social, emotional, and even cognitive development later in the child's life (Belsky & Cassidy, 1994). For example, children with dysfunctional parent–child relationships are likely to have substantial problems of adjustment as they grow up. In particular, they are at considerable

risk for antisocial behavior (Patterson, DeBarsyshe, & Ramsey, 1989). In addition, less severe attachment disruptions, such as those that occur when a student's parents divorce, can affect school performance (Hetherington, 1993; McLanahan & Sandefur, 1994).

FRIENDSHIP AND PLAY

Students form some of their most important, and potentially satisfying, attachments with their friends. Play, both by themselves and with peers, is an important aspect of all children's social development. Most of the interaction between young children occurs in the context of play (Hughes, 1995), and play offers a way for children to begin forming friendships. Play with members of culturally diverse groups is a wonderful way for children to learn to value and appreciate what members of these various groups have to offer all of us. Both play and friendship development seem to reflect cognitive development (described in Chapter 2).

■ **STAGES OF PLAY** One classic developmental model of play defines six kinds of behavior (Parten, 1932).

- Unoccupied children seem unable to decide what to do with themselves; often they watch other children, perhaps looking for clues. For example, Melissa walks around the nursery-school playroom watching other children play but rarely engaging in play activities herself unless the teacher asks her to.
- In solitary play, the child plays by herself or himself with things that are available in the environment. For example, Andrew likes to engage in solitary play and plays with others only when encouraged to do so by his parents.
- A step beyond is when the child is an onlooker, watching other children play but still playing alone. For example, James is an onlooker who, while playing with a set of blocks, watches other children building block villages and cities.
- In parallel play, the child plays with the same toys as other children, but the child does not directly interact with the others. For example, Marlon often can be seen in play groups, seeming at first to be playing with the other children in the group, but upon closer inspection, to be playing on his own in the company of the other children.
- In associative play, the child shares toys and interacts to some extent with other children, but still basically plays on his or her own. For example, Mai-Li sometimes plays "house" with other children, but she prefers to play on her own.
- In cooperative play, the child fully cooperates with others in joint play efforts. For example, Jose loves to play any team sport that his classmates will engage in.

As they grow older, children tend to progress from the simpler and more solitary forms of play to more interactive and complex forms (Howes & Matheson, 1992; Roopnarine et al., 1992). In elementary school, they begin to progress toward playing games with rules, including organized sports; this change may occur because they are entering Piaget's concrete operational stage of cognitive development, when rules become more comprehensible (Pellegrini, 1988; Rubenstein, 1993). Game playing seems to peak around ages 10 to 12. At later ages, games lose out in favor of organized sports or conversations (Bergin, 1988; Eiferman, 1971).

Curiously, play skills are forms of expertise, just as much as are teaching and learning skills. Children who enjoy play and who can profit from it are more likely to have large, rich schemas containing a great deal of well-organized declarative and procedural knowledge about the domain of play (the first attribute of expertise). They do not just play mindlessly, but rather "planfully." They spend proportionately more time determining how to represent a problem than merely searching for and executing a problem strategy (the second characteristic of expertise). In addition, they develop sophisticated mental and external representations of problems, based on underlying structural similarities among problems (the third characteristic of expertise). For example, in playing with Legos, the expert may construct very sophisticated simulations of buildings or even cities. The novice will simply pile blocks one on top of another without the same kind of planfulness.

■ **TRENDS IN THE DEVELOPMENT OF FRIENDSHIPS** Children show the same trends in their friendships with others that they show in their play—that is, they increase their interactions with others as they develop. Until approximately 1 year of age, children's interactions are usually limited to single exchanges, rather than ongoing relations. In the next few years, however, interactions increase dramatically (Vandell & Mueller, 1980).

FRIENDSHIP IN CHILDHOOD. During most of childhood, mutual play is the most common activity in and is sometimes the basis for friendships. During preschool and the primary grades, children generally form friendships based on shared activities. Between the ages of 3 and 9, they show increasing sharing of thoughts and feelings. They also learn better how to resolve conflicts and discover how to please (as well as annoy!) one another (Gottman, 1983, 1986; Hay, Payne, & Chadwick, 2004). Friendships may change rapidly between children at these ages (Berndt & Perry, 1986; Guralnick, 1986). Teachers may find it fairly easy to help young students who seem isolated by involving them in a group activity. In this way, teachers also help these students improve their self-esteem (Berndt, 1996).

In middle childhood, friendships become more stable, and students may have a more or less permanent best friend. Children usually choose friends of the same sex, on the basis of personality traits and on mutual give-and-take (Berndt & Perry, 1986; Bowker, Rubin, Burgess, Booth-LaForce, & Rose-Krasnor, 2006; Hartup, 1989; Mitchell, 1990).

Expert teachers of students in the upper elementary grades or middle school often notice that some students are more popular than others. Children may be neglected or actively rejected by peers for a variety of reasons. Isolated children may be very shy. They may be members of a cultural group different from the other children, may have difficulty speaking the language the other children use among themselves, or may have a physical or mental challenge. Carla, the student described at the beginning of the chapter, is isolated from most of her peers, perhaps because of her early physical development or because of her shyness.

Today, with the trend toward full inclusion, the kinds of problems just mentioned occur, if anything, more than ever before. Two common reasons why children are rejected are that they lack prosocial (i.e., helpful) skills and that they behave aggressively (Newcomb & Bukowski, 1984). Research has suggested that children who are isolated because they are neglected or rejected by their peers are more at risk for emotional and psychological problems, such as those described earlier in the chapter, than are children who have more friends (Kupersmidt & Coie, 1990; Morison & Masten, 1991).

Teachers may try to encourage isolated children to develop more prosocial skills by gradually involving them in group activities. One possibility is to increase the size of the group and target children's participation in the group in a slow, stable manner. Teachers also need to ensure that the children are treated fairly by others and not isolated within such groups.

FRIENDSHIP IN ADOLESCENCE. Friendships become very important in adolescence. Adolescents in middle school and high school rely on their friends for emotional support, sense of belonging, and intimacy (Hamm & Faircloth, 2005). They also look to friends for norms regarding dress and social behavior (Berndt, 1996; Hill, 1987). Abstract personal qualities, such as loyalty and shared outlook on life, increase in importance as students become better able to think in abstractions (Furman & Bierman, 1984).

Boys and girls show somewhat different patterns in the nature and development of their friendships during childhood and adolescence. Most children of both sexes prefer friendships with same-sex peers during these periods. Nevertheless, in most cultures, boys are more likely to play in groups and to engage in competitive activities. Girls are more likely to prefer cooperative activities that they can do in pairs.

Taking care to avoid gender stereotyping, expert teachers encourage boys and girls to play together.

Valerie Schultz/Merrill

In adolescence, friendships among girls tend to pass through three stages (Douvan & Adelson, 1966). From the ages of about 11 to 13 years, many girls prefer to engage in joint activities, where the central theme is to have fun together. From about 14 to 16, there is more emphasis on sharing secrets, especially about other friends (whether male or female). Trust becomes especially meaningful at this age level, and girls may feel very possessive of their female friends. In fact, between the ages of 10 and 15, girls have more terminated friendships than males (Benenson & Christakos, 2003). Indeed, for members of this age cohort, imagining termination of a friendship is more distressing to females than to males (Benenson & Christakos, 2003). In later adolescence, shared personalities, shared interests, and general compatibility become more important. By this time, girls may have developed some relationship expertise with their female friends. They may begin to transfer onto males some of the trust, disclosure of secrets, and even possessiveness that they earlier shared with females.

At all ages, including adulthood, females have greater emotional closeness and share intimacies more than do males (Berndt, 1982, 1986; Rubin, 1980; Sternberg, 1998a), although the extent of these differences may be decreasing (Peplau, 1983). Boys' friendships tend to be more oriented toward achievement and autonomy rather than toward intimacy. Not surprisingly, male adults typically have far fewer close friends than do female adults.

DEVELOPMENT OF PERSPECTIVE TAKING

As children grow older, their ability to form meaningful friendships increases. They become better able to take the points of view of other people, understanding that people have different experiences and feelings (Eisenberg & Fabes, 1998; Knight, Johnson, Carlo, & Eisenberg, 1994). Skill in taking the perspectives of other people is not just a social skill, but a cognitive skill, as Piaget noted. Robert Selman (1981) has suggested a series of stages in the development of children's **perspective-taking abilities:**

Stage 1: Undifferentiated perspective taking (3–6 years). In this stage, children recognize that others may have perspectives that differ from their own, but they tend to confuse their own thoughts and feelings with those of other people. For example, at this age Von cannot quite understand why his mother will not allow him to go out to play at night when he wants to play.

Stage 2: Social–informational perspective (5–9 years). In this stage, children realize that others may have different perspectives because the other individuals may have access to different information. For example, Von understands that teachers may know better than children what is good for the children because the teachers know things about children that the children themselves do not know.

Stage 3: Self-reflective perspective taking (7–12 years). In this stage, children become able to see themselves as others see them. In other words, they can step into other people's shoes. They further understand that others have this ability, too. For example, Von now can understand that the talking he does with other students while the teacher is speaking is viewed by his teacher as disruptive.

Stage 4: Third-party perspective taking (10–15 years). In this stage, children come to understand how their interaction with another person may be viewed by a third party outside their interaction. For example, Von and a friend throw play punches at each other, but Von suddenly realizes that a teacher observing them views their playful interaction as a fight.

Stage 5: Societal perspective taking (14 years–adulthood). In this stage, individuals come to understand that third-party perspective taking is influenced by larger systems of societal values. For example, Von realizes that a teacher may wish to stop his throwing play punches with friends because such behavior is viewed by society as inappropriate in school settings, even if it is well intentioned.

THINKING ANALYTICALLY

What effect might the different patterns of male and female development in boys' and girls' relations toward peers have on group work during middle childhood and later, during adolescence?

SUGGESTION: Young adults may act toward fellow students in ways that reflect the patterns they established during childhood.

IMPLICATIONS FOR TEACHING

ATTACHMENT

- **Strive to establish as consistently positive a relationship as possible with each student.** Many adults look back on their school years and remember with particular fondness teachers with whom they formed strong attachments. You can positively influence students' lives by forming a relationship with them that students will remember in their adult years as consistently positive and constructive.
- **Provide extra help during transitions to children who seem to be having problems.** Students' infantile attachments to their parents can serve as templates for later interactions with teachers and classmates. Attachment style can affect students' abilities to make transitions, such as the transition to middle school
- **Make yourself aware of students who may be experiencing problems at home, and be prepared to provide extra help to students who may be experiencing such problems.** Teachers cannot assume a supportive home environment, even in the most affluent schools. To the extent possible, teachers should learn about students' home environments, and compensate as necessary for any lack of support the students may experience at home. Watch for signs of children who are neglected and abused. Teachers need to be on the lookout both for children who show possible signs of physical abuse, such as wounds, open sores, or damage to limbs, and for children who show signs of psychological abuse, such as extreme withdrawal or extreme aggression.

PLAY, FRIENDSHIP, AND PERSPECTIVE-TAKING PATTERNS

Most of the work that has been done on play and friendship has been done with younger students, especially in the elementary school. Here are some key points to keep in mind:

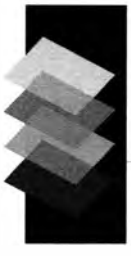
- **Monitor patterns of friendship among students, providing help to isolated students if necessary.** The main concern of expert teachers is not with which styles of friendship are being used, but rather with whether children are forming friendships at all. Expert teachers encourage, but do not pressure, isolated children to form friendships.
- **Carefully structure group activities until most students have reached the cognitive level necessary to take the perspective of other children and to understand rules.** Children's preferred play styles may be related to their preferred ways of learning. Younger students who prefer solitary play may lack the skills or desire to study in groups. By the time students reach upper elementary school and middle school, they may be interested in games with rules.
- **Strive for gender-neutral class activities.** Gender differences in play styles and friendship patterns may affect learning activities because children may be reluctant to participate in learning activities that "only boys do" or "only girls do." Teachers may want to assign children to mixed-gender project groups, at least occasionally, to allow a chance for boys and girls to interact positively with one another.
- **Realize that young children may behave inappropriately because the children do not realize how others perceive the behavior.** Children's behavior reflects their ability to take perspectives. Nevertheless, children must learn to behave appropriately, even if they do not yet fully understand why such behavior is appropriate.

Tables 3.3 and 3.4 offer examples of how teachers might apply the implications of attachment theory and play and friendship development at different educational levels.

At all educational levels, expert teachers often need to help children through the difficulties of adjustment the children face as they try to integrate themselves academically and socially in the classroom environment. Teachers need also to help children confront moral issues, which we consider next.

TABLE 3.3 Educational Implications of Attachment Theory

Implications	How Teachers Might Apply the Implications at Different Educational Levels: Preschool and Primary Grades	Elementary School	Middle School	High School
Students can form attachments with teachers.	Positive and consistent relationships with teachers may help children develop effective social skills.		Teachers should remain aware that they may serve, in many ways, as role models for students.	
Students' infantile attachments to their parents can serve as templates for later interactions with teachers and classmates.	Children who have formed avoidant attachments to parents may also avoid peers and teachers. Such children may need a slow introduction to group processes or may prefer independent learning.	Students with ambivalent attachment patterns may behave inconsistently with schoolmates. Teachers can help by setting and enforcing clear rules for acceptable conduct.	Students whose attachments to parents are secure may experience easier transition to the first year of middle school than do students with other attachment styles. Teachers can help students by providing engaging projects early in the school year, and asking students to compare their experiences in elementary school with those in middle school.	Adolescents with insecure attachments to parents may suffer from lower self-esteem and difficulty establishing friendship and romantic attachments. Teachers should look for ways to involve or interest these students in school activities so that they do not seek emotional satisfaction in socially unacceptable activity.
Children who have experienced attachment difficulties can later experience problems in school.	Extreme language difficulties and resistance or avoidance of all social contact may be signs of severe attachment disruptions, including abuse. Teachers who notice these and other signs of abuse, such as physical damage, must report their suspicions to their principal.	Students' attachment to parents can be disrupted at any age by parental divorce. Teachers should try to know if any of their students are experiencing parental separation and divorce, so that they may be alert for any difficulties the child might experience in school.	Students experience high pressure to conform to peers in middle school and children who have insecure attachments with parents may be at risk for conforming to self-destructive norms, such as drug or alcohol use. Consider adding discussions about making individual choices to classwork by pointing out, for example, historical, literary, or scientific personalities who have profited from nonconformism.	Insecure attachment to parents can be related to low self-esteem in adolescence. Encourage students to develop independent self-esteem by setting their own goals and comparing their performance to their own earlier work, rather than to the work of their peers.



Moral Development: Acquiring a Sense of Right and Wrong

Teachers and parents generally want children to obey adults' rules, but they also hope that children eventually will develop their own abilities to distinguish between what is right and what is wrong. In other words, they want children to develop a sense of morality. As mentioned at the beginning of the chapter, moral development is the process by which individuals acquire a sense of right and wrong, to use in evaluating their own actions and the actions of others (Turiel, 1998). Moral development begins early, and it continues throughout the life span. One of the earliest theories of moral development was proposed by Jean Piaget (1932/1965).

PIAGET'S THEORY OF MORAL DEVELOPMENT

According to Piaget, young children are egocentric and have difficulty taking the perspective of other people until roughly the age of 7.

TABLE 3.4 Educational Implications of Theories of Play and Friendship Development

	How Teachers Might Apply the Implications at Different Educational Levels			
Implications	**Preschool and Primary Grades**	**Elementary School**	**Middle School**	**High School**
Monitor patterns of friendship among students, providing help to isolated students if necessary.	Because friendships between children in this age range can easily be formed on the basis of shared activities, teachers may find it fairly easy to help isolated children by assigning them to groups with other children for games or projects.	Students at these ages who have trouble making friends may need some practice with basic social skills. Teachers could hold class meetings so that all students could discuss, without naming specific students, ways for everyone to become more expert at making friends.	The physical changes of puberty may make some middle school students feel conspicuous and uncomfortable. These students may also be teased or rejected. Teachers should not allow teasing or harassment. They may wish to initiate classroom discussions about the actual importance of appearances, or the temporary nature of appearance in junior high school.	Friendships are often fairly well defined by the time students are in high school, and teachers may experience difficulty helping isolated or rejected students. Classroom groups may need to be assigned by the teacher to avoid arrangements based on friendship cliques and to assure all students a chance to join a group.
Children's preferred play styles may be related to their preferred learning styles.	Very young students may not be able to share play or learning materials, so teachers should make sure enough supplies are available for all students.	Students may still have some difficulties with fully cooperative play and learning activities. Teachers may need to provide clear guidelines for cooperative activities or structure group activities so each group member is assigned his or her own part of a complete project.	Middle school students may enjoy working as cooperative teams who compete against other teams in learning games. Students may enjoy helping define the rules for these games, but game structure should not be allowed to overwhelm academic content.	Students should be well able to work together in cooperative groups.
Gender differences in play styles and friendship patterns may affect learning activities.	Gender roles are apparent in younger children's preferred play activities. Learning activities that are gender neutral should interest all students.	Throughout elementary school, students generally prefer to interact with and form friendships with members of the same gender. Encourage mixed-gender learning groups, at least occasionally. Avoid unfavorable comparisons between genders.	Girls' and boys' friendship patterns begin to diverge in middle school. Rifts in intense female friendships could temporarily disrupt some students' academic performance.	Males' preference for competition may discourage female students from classroom participation. Consider including some cooperative learning activities.

■ **MORALITY IS FOLLOWING THE RULES** Until approximately age 7, children generally believe that rules are inflexible mandates provided by some higher authority. Breaking a rule, they think, will automatically lead to punishment. Young children tend to make moral judgments on the basis of how much harm their actions will cause. For example, someone who breaks 15 glasses (by accident) while trying to sneak into the cookie jar will be judged more harshly than someone who breaks just one cup.

Piaget called this first phase of moral development heteronomous morality, or morality that is subject to rules imposed by others. Also called the stage of **moral realism** or the morality of constraint, this phase is characterized by the view that rules are absolute. Children pay attention to the actions of others but not to the intentions underlying their actions.

■ **MORALITY IS A SOCIAL AGREEMENT** After approximately age 8, children are able to understand that rules and laws are not absolute, but rather are formed by the agreement of groups of people. That is, rules can be changed in the same way if people agree a new rule is needed. In the case of a broken rule, older children are now capable of considering whether the individual acted intentionally.

Piaget referred to this second phase of moral development as autonomous morality, the level at which children understand that people both make up the rules and can change the rules. These rules are now seen as the products of people's agreements. Piaget also referred to this level as moral relativism or the **morality of cooperation.**

More research has suggested that, as with Piaget's theory of cognitive development, children's abilities—in this case to judge intentions—may start to take form earlier than age 8 (Schultz, Wright, & Schleifer, 1986). In addition, moral development, like cognitive development, can be influenced by a child's social environment. For example, authoritarian parenting and teaching styles, which stress unquestioning obedience to adult rules, may tend to restrain children's moral reasoning from developing to the second, autonomous morality level (DeVries & Zan, 1995).

As did his theory of moral development, Piaget's theory of cognitive development has motivated others to develop their own ideas. Psychologist Lawrence Kohlberg used Piaget's theory as one of the starting points in developing his own, detailed theory of morality, which we consider next.

THINKING CREATIVELY

How might you try to show young children the importance of intentionality in judging the relative guilt or innocence of a child who has been caught stealing?

SUGGESTION: The children might be asked to think of a time when other people misinterpreted the intentions behind their own actions.

KOHLBERG'S THEORY OF MORAL DEVELOPMENT: LEVELS AND STAGES

Students encounter moral dilemmas constantly. Should they cheat on a test? Should they report a student whom they observed cheating? Should they violate a confidence, such as a confession of a crime made to them in confidence?

> *In Europe, a woman was near death from a rare form of cancer. The doctors thought that one drug might save her—a form of radium a druggist in the same town had recently discovered. The drug was expensive to make, but the druggist was also charging ten times his cost: Having paid $400 for the radium, he charged $4000 for a small dose. The sick woman's husband, Heinz, went to everyone he knew to borrow the money, but he could collect only $2000. He begged the druggist to sell the drug more cheaply or to let him pay the balance later, but the druggist refused. So, having tried every legal means, Heinz desperately considered breaking into the drugstore to steal the drug for his wife. (Adapted from Kohlberg, 1963, 1983, 1984)*

Lawrence Kohlberg (1963, 1983, 1984) used **moral dilemmas**—like the ethically unclear and difficult situation just described—to assess what he believed to be three levels and six stages of moral development in children. Kohlberg was not especially interested in the specific choices students made—in this case, whether they said Heinz should steal the radium or he should not. What interested Kohlberg was the reasoning students gave for their choices. He believed students' reasoning revealed their underlying moral reasoning, or thought processes about moral issues. The three levels and six stages of Kohlberg's theory of moral development are summarized in Table 3.5.

CONSTRUCTING YOUR OWN LEARNING

Before reading on, answer the Heinz dilemma for yourself and then try it on some of your friends. If you are currently working in a practicum, you might also ask some of the children you are working with how they would answer the dilemma. (Be sure to discuss this first exercise with your cooperating teacher.) Characterize where each of you would fall on this particular problem, according to Kohlberg's theory.

■ **LEVEL I** Level I describes **preconventional morality,** a level of moral reasoning based primarily on egocentric concerns. Kohlberg suggested that this level of moral reasoning characterizes children between about ages 7 and 10. Some studies have found, however, that as many as 20 percent of U.S. teenagers function at the preconventional morality level (Turiel, 1973).

TABLE 3.5 Kohlberg's Levels of Moral Development

Level I—Preconventional Morality		Level II—Conventional Morality		Level III—Postconventional Morality	
Stage 1: Punishment and obedience are an individual's main concerns. Rules are obeyed because of the threat of punishment for infractions.	**Stage 2**: Individual adopts an orientation of individualism and exchange. Rules are followed if they are in the individual's best interest. Deals and compromises with others are sometimes used to solve problems.	**Stage 3**: Moral reasoning is guided by mutual interpersonal expectations and conformity. People try to do what is expected of them.	**Stage 4**: Individuals place importance on the social system, including laws, and on fulfilling obligations.	**Stage 5**: People recognize and try to balance the importance of both social contracts and individual rights.	**Stage 6**: Individuals adopt an orientation toward universal principles of justice, which exist regardless of a particular society's rules.
Sample Answer to Heinz Dilemma: "No, Heinz shouldn't take the radium because he might get caught and thrown into jail."	**Sample Answer to Heinz Dilemma**: "Yes, Heinz should take the radium, because the druggist is refusing to make a deal that will benefit both people."	**Sample Answer to Heinz Dilemma**: "Yes, Heinz should steal the drug. A good husband takes care of his wife. He would seem cold and heartless if he wasn't willing to risk a little jail time to help his wife live."	**Sample Answer to Heinz Dilemma**: "Heinz should not steal the drug. If everyone disobeyed the laws against theft, society would be in chaos."	**Sample Answer to Heinz Dilemma**: "Yes, Heinz should take the drug, because the value of human life outweighs the druggist's individual right to own property."	**Sample Answer to Heinz Dilemma**: "Yes, Heinz should take the drug, because the value of human life outweighs any other considerations."

- In stage 1 of this level, an individual behaves in one way or another primarily in an effort to obtain rewards and to avoid punishments. Thus obedience and punishment are the main issues for the individual. An authority is viewed as correct because if it is not obeyed, punishment will follow. The popular students in Jim Conto's class, described at the beginning of the chapter, seem to be functioning at a preconventional level, reserving their attacks on Carla for times they believe they will not be caught.
- In stage 2, the orientation of the individual shifts to individualism and exchange. Stage 2 individuals follow rules, but only when they view such behavior as being to their benefit. Realizing that other people have other interests, a stage 2 individual will strike deals as part of a compromise. For individuals in this stage, the sense of morality is relative. They view as right what they will be rewarded for doing. For example, Tommy, an elementary school student, obeys his teachers because he has learned that his teachers will reward him for obedience.

■ **LEVEL II** At level II individuals think in terms of **conventional morality,** a level of moral reasoning that reflects a person's internalization of social rules. In other words, an individual conforms to social rules because he or she believes it is right to do so. For example, Betty, age 13, helps her friends not because she gets rewards from them, but because she believes it is the right thing to do. Kohlberg suggested this level might apply primarily to people between the ages of 10 and 16, although many adults also reason primarily at the conventional morality level. Later in his career, Kohlberg realized his estimate of ages 10 to 16 for this stage may have been optimistic.

- In stage 3, the first stage of level II, people's reasoning is guided by mutual interpersonal expectations and interpersonal conformity. Stage 3 children try to meet the expectations of others who are important in their lives. Being good means that you act from good motives . Children recognize that the needs of a group often have to take precedence over the needs of the individual. We need to live by the Golden Rule, doing unto others as we would have them do unto us. For example, Kenji almost always asks himself not only how his actions will affect himself, but also how they will affect others.

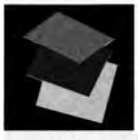
- At stage 4 of level II, adolescents realize the importance of conscience and of the social system. They see the relevance of obeying laws and of fulfilling obligations, except in those rare cases where these obligations violate some higher social obligations. The adolescent distinguishes between the point of view of society and that of individual members of the society. Two or more people may agree on something that is nevertheless to society's detriment. For example, Marvin opposes a war even though his friends and the government support it.

The Flexible Expert feature, "Moving from Preconventional to Conventional Moral Reasoning," provides some examples for expert teachers of young people who are making the transition from Kohlberg's preconventional level of moral reasoning (level I) to his conventional level (level II).

- **LEVEL III** Level III involves **postconventional morality.** This level of moral reasoning is based primarily on an internal set of moral absolutes, which may or may not agree with social rules. For example, Leila has decided to commit civil disobedience because she is convinced that the death penalty, though legal, is immoral. Along with others, she chains herself to a fence in front of the courtroom where a death-penalty verdict has been handed down.

At this level of moral reasoning, society's rules serve as the basis for most behavior. Sometimes, however, a set of internal moral principles may outweigh the rules of society if a conflict arises between the two. The postconventional morality level is reached by few people. If attained, it is generally not achieved before the age of 16.

- In stage 5, individuals recognize the importance of both social contracts and individual rights. They realize that people hold many different values, most of which are relative. These values are upheld because they are part of a social contract to which the



THE FLEXIBLE EXPERT

MOVING FROM PRECONVENTIONAL TO CONVENTIONAL MORAL REASONING

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Sue observes that some of her sixth-grade students have begun to show signs of reasoning at Kohlberg's conventional level. She decides to hold class discussions of moral dilemmas so the students who still reason at the preconventional level can hear and learn from the ideas of the students using conventional-level reasoning.

THE CREATIVE TEACHER: Sue writes a play in which the characters must decide what to do with a large sum of cash they have found in a wallet. Each character's idea about what to do with the money reflects a different level of moral reasoning.

THE PRACTICAL TEACHER: Whenever students face a day-to-day moral dilemma, such as a problem negotiating cleanup duties, Sue leads a brief class discussion in which the students consider several alternative ideas for solving the dilemma. If students do not bring up potential solutions that reflect the conventional level of reasoning, Sue suggests them.

THE ANALYTICAL STUDENT: Dale thinks about the reasons he chooses to go to school every day. He concludes that the main reasons are because his friends would be sad if he didn't show up and because his parents would be disappointed as they have sacrificed their time to help him succeed in school.

THE CREATIVE STUDENT: Dale writes a song called "Give-and-Take" about what he believes to be an immoral attitude of showing kindness only in return for kindnesses already given.

THE PRACTICAL STUDENT: Dale tells his friends he won't shoplift music CDs with them, asking, "How would we feel if it was our store and some kids came in and took stuff without paying?"

people have agreed. Nevertheless, certain values, such as the right of the individual to life and liberty, hold regardless of what the majority of people within a society may think. Stage 5 individuals recognize that, in theory, laws are enacted to provide the greatest good for the greatest number. In practice, however, these laws may violate moral principles. In such cases, there is no easy resolution. Only one-fifth of adolescents actually reach this stage. For example, Damon decides to try to fight against a totalitarian government in the society in which he lives, despite opposition from friends, family, and government.

- In stage 6 of level III, individuals are oriented toward universal principles of justice. They believe they should uphold universal principles and are committed to these principles, whether other people in their society are or not. In his later writings, Kohlberg suggested that stage 6 is rarely, if ever, reached by real people; that is, it might be more of an ideal than a distinct moral stage. Nevertheless, some people may achieve this goal—for example, Mother Teresa battled conditions of extreme poverty because she felt a moral imperative to do so.

GILLIGAN'S ALTERNATIVE TO KOHLBERG'S THEORY

Carol Gilligan (1982; Gilligan, Hamner, & Lyons, 1990) has proposed an alternative to Kohlberg's model. Her research has suggested that women tend to have a different conception of morality than do men. According to Gilligan, whereas men tend to focus on abstract, rational principles such as justice and respect for the rights of others, women tend to view morality more in terms of caring and compassion. As part of this perspective, they are more concerned with issues of general human welfare and ways that relationships can contribute to it. In particular, women seem better able to show **empathy,** or the ability to understand how another person feels, when interacting with others. They are especially sensitive to the obligations of close relationships. In general, men tend to have a more competitive orientation; women, a more cooperative orientation.

Some researchers have found support for the kinds of claims made by Gilligan (e.g., Baumrind, 1986; Gibbs, Arnold, Ahlborn, & Chessman, 1984; Gilligan & Attanucci, 1988). Others have found that both men and women seem to take into account considerations of caring in their moral judgments. Although women are more likely than men to express caring, girls are no more likely to do so than are boys (Walker, 1989; Walker, Pitts, Hennig, & Matsuba, 1995). In one study, no gender difference in the amount of caring used to make morality decisions was observed in a group of African American college students (Knox, Fagley, & Miller, 2004). Thus the empirical support for this theory is mixed, at best.

CONSTRUCTING YOUR OWN LEARNING

Create three or four scenarios that you believe can allow responses that suggest either an orientation more directed toward abstract principles of justice or an orientation of concern with caring for another individual. Then try out your scenarios on friends, asking them their solutions to the dilemmas. If you are currently working on a practicum, you might also try out your scenarios with some of the children. Were males or females more likely to show a caring orientation?

EVALUATING KOHLBERG'S THEORY

Kohlberg's theory has generated enormous interest, in part because it is the most nearly complete theory of moral development. Psychologists have found that moral development in many situations seems to proceed roughly along the lines Kohlberg suggested (Nisan & Kohlberg, 1982; Rest, 1983; Snarey, Reimer, & Kohlberg, 1985a, 1985b), even in other cultures, such as Turkey and Israel. Despite these findings, the theory has been criticized on various grounds (Krebs & Denton, 2005).

First, the scoring of the scenarios is somewhat subjective, and can lead to errors of interpretation. James Rest (1979, 1983) has constructed an alternative test, the Defining Issues Test (DIT), which measures the stages of Kohlberg's theory somewhat less subjectively.

Second, stages of moral development seem to be less domain general than Kohlberg's theory suggests (Kurtines & Greif, 1974). The level of people's responses may vary, depending on the particular scenario to which they respond (Holstein, 1976). Evidence also indicates that, contrary to the assumptions made by stage theories, people may regress to earlier stages of moral reasoning under certain circumstances, such as when they are under stress (see Kohlberg & Kramer, 1969). Kohlberg's reply to this criticism was that even if an individual regresses, he or she still understands the higher level of reasoning.

Third, Kohlberg's own finding that people can regress in their behavior points out the weak link that often exists between thought and action (Kurtines & Greif, 1974). Someone may, indeed, understand higher levels of moral development, yet not act in ways consistent with that understanding.

Finally, although some investigators have found cross-cultural support for Kohlberg's theory (e.g., Snarey, 1985), others have found that in certain circumstances, such as the lifestyle of the communal Israeli kibbutz, what is viewed as a "higher" level of morality differs from the value system suggested by Kohlberg. Other researchers have found that the theory does have some cross-cultural support, albeit within limits (e.g., in studies in South Africa [Maqsud & Rouhani, 1990], Iceland [Keller, Eckensberger, & von Rosen, 1989], and Poland [Niemczynski, Czyzowska, Pourkos, & Mirski, 1988]). For example, in China, the first three stages apply well, but the last three stages are less well supported and require modification to work well within traditional Chinese thought.

In fact, probably no universal stages of morality can apply without modification across cultures. Even so, Kohlberg's theory has shown some strength in this area, as previously noted. In addition, the various criticisms of Kohlberg's theory have prompted some theorists to suggest alternative systems of valuing just what is "moral" (e.g., Etzioni, 1993; Wilson, 1993; Wright, 1994).

In addition, cultural and sexual differences may affect children's moral development. See Chapter 6 for a detailed discussion of these differences.

*i*MPLICATIONS FOR TEACHING

- **Expect a level of moral thought and behavior that is appropriate to the child's age.** Expert teachers know they can fail to challenge students at a level appropriate to their development if they set their expectations either too high or too low (see Table 3.6).
- **Help challenge students' moral reasoning by holding classroom discussions of moral dilemmas.** These explorations of moral issues may arise from the academic subject matter or from events inside or outside the classroom. Kohlberg and Kramer (1969) believed discussion of moral dilemmas could help a child develop expertise in moral reasoning by exposing the child to thinking at higher stages.
- **Use self-assessment to help assess your own level of moral development so that you can better understand how you perceive the thinking and behavior of your students.** Teachers need to understand themselves and their own thinking.
- **Realize that no one theory of moral development is universally accepted.** All of the theories appear to apply only to some—rather than to all—individuals.
- **Encourage and develop thinking that is not just moral, but wise.** Such thinking has as its aim the attainment of a common good—what is ultimately in everyone's best interests (Sternberg, 1999a).

TABLE 3.6 Educational Implications of Morality Theories

	How Teachers Might Apply the Implications at Different Educational Levels			
Implications	**Preschool and Primary Grades**	**Elementary School**	**Middle School**	**High School**
Expect a level of moral thought and behavior that is appropriate to the child's age.	Young children often consider consequences more important than intentions in judging others. Teachers might use everyday examples, such as spills or playground accidents, to help point out to students that causing some damage on purpose is different than doing so unintentionally.	Students in the upper elementary grades and in middle school are often in the second of Kohlberg's moral levels, using conventional moral reasoning. They may enjoy setting some of the rules of the classroom "society" in class meetings.		High school teachers can challenge students to consider whether there are any universal principles. Subjects such as literature and social science make an easy context for moral discussion, but even science classes, for example, offer students opportunities to ponder the existence of global rules.
Discussions of moral dilemmas might help children develop their moral reasoning skills.	Younger children's decisions are generally based on egocentric concerns about their own punishment or rewards. Teachers should challenge young students to sometimes see how individual actions affect other people. Stories or real-life examples from the classroom could be used to provide opportunities for taking another's perspective.	Class meetings provide opportunities to bring up moral dilemmas students are actually facing and encourage discussion of possible choices.	In some school districts, it may be acceptable to encourage students to discuss issues that are being brought to their minds by the changes of puberty, such as personal sexual standards. Be sure to check the district's guidelines before initiating any discussions of sensitive topics.	Current events in many subjects, such as scientific advances leading to cloning or discoveries about the "true" nature of historical figures or events, can provide the basis for discussions of values and ethics in many different classes.
Teachers should be aware of cultural and gender influences on morality.	Children whose cultural backgrounds value interdependence may be uncomfortable away from their families for the first time. Teachers may be able to help by encouraging family members to visit, or even volunteer regularly, at school and by initiating frequent contact with families, designed to promote cooperation in helping the child adjust to school.	Cooperative learning tasks, such as team science or social science projects, encourage students who are oriented to independent achievement to also learn to value working for the sake of the group.	Some classes may wish to participate in civic projects that show students how their individual knowledge could be used to help their whole community. For example, one junior high school science class, on learning that bats eat biting insects, installed bat houses in a local park to make the park more comfortable for the whole community (Schukar, 1997).	In some schools, competition for grades may become fierce as students strive to impress college acceptance committees. Teachers may wish to point out the value of study groups for cooperatively boosting the achievements of all members.

Identifying, Understanding, and Managing Developmental Risks

Children and adolescents are at risk for a variety of problems that can interfere with their development and their success in school. These challenges include increased risk for psychological problems, such as eating disorders and depression; behavioral problems, such as drug use; and unwanted consequences of sexual activity. Because these problems can threaten the success of students in school and in society—and in some cases even threaten students' lives—teachers must know how to identify and handle them.

Anorexia and bulimia are eating disorders that typically do not directly affect learning. Even so, because they are sufficiently common among adolescents and younger students, and especially among female students, teachers need to be aware of them because of the extremely negative impact they can have on children's physical and mental health, as well as on children's personal development in general. If a teacher suspects an eating disorder, he or she should not attempt to confront a child about it or treat it in any way, but rather should relay those suspicions to a mental-health professional such as a school psychologist, who will be in a position to make the proper diagnosis and make recommendations for professional treatment.

■ **ANOREXIA NERVOSA** **Anorexia nervosa** is a life-threatening ailment. A person with anorexia has a distorted self-image and, therefore, a severe fear of gaining weight. As a result of this fear, people with anorexia refuse to eat enough food to maintain adequate body weight and nutrition. Anorexics may also take laxatives and exercise extensively in a desperate effort to lose weight (Davison & Neale, 1994). Anorexia is far more common in women than in men. It occurs in approximately 0.3 percent of young women in grades 9 through 12 (Whitaker et al., 1990), so the chance that a high school teacher will encounter at least one case every year or two is quite high. Ages 15 to 19 are the peak years for anorexia (Frombonne, 1995), but middle school and elementary school teachers should be aware of an increase in the number of cases of anorexia among 8- to 13-year-olds in the past 20 years (Lask & Bryant-Waugh, 1992).

THINKING ANALYTICALLY

Anorexia nervosa has been recognized only relatively recently as a disorder, and appears to be much more prevalent now than in the past. Why might the prevalence of anorexia nervosa have increased in recent times?

SUGGESTION: There is a great emphasis on thinness in many contemporary cultures—particularly in the United States.

Instead of being motivated to eat to live, people with anorexia are motivated to avoid eating, to the point that they risk illness and even death. An estimated 7 million girls and women, and 1 million boys and men, suffer from eating disorders. Approximately 10 percent report onset of the disorder at age 10 or earlier. In contrast, 33 percent report onset between the ages of 11 and 15, and 43 percent between the ages of 16 and 20. With treatment, 60 percent of individuals with anorexia or other eating disorders recover fully. Another 20 percent recover partially (http://womensissues.about.com/library/bleatingdisorderstats.htm, 2003).

Anorexics tend to be young women who are well behaved, conscientious, quiet, and even perfectionistic. Studies have also indicated that people with anorexia are more likely to have anxiety disorders as well (Kaye, Bulik, Thornton, Barbarich, Masters, & Price Foundation Collaborative Group, 2004). A preoccupation with appearance, such as that demonstrated by Carla, the girl in the chapter-opening vignette, may lead to anorexia if it is severe and focused on thinness. Teachers may notice that students with anorexia are becoming extremely thin. In fact, anorexics often grow emaciated, with skull-like faces and protruding ribs. A student with anorexia will nevertheless persist in believing that he or she is too fat (Davison & Neale, 1994). Additional signs of the disease include dry, cracking skin; fine downy hair on the face and neck; brittle fingernails; yellowish discoloration of the skin; increased heart rate; reduced body temperature; and muscular weakness (Kaplan & Woodside, 1987). The self-starving that results from anorexia can bring on irreversible physical and chemical changes, including heart and muscle damage. As many as 10 percent of people with anorexia die from complications of the disorder (American Psychiatric Association, 1993).

Because of the seriousness of this condition, a teacher who suspects a student has anorexia should act immediately, first by advising the student to seek counseling and treatment, and then by contacting the student's parents or school authorities if necessary to help the student get treatment. Anorexics sometimes require hospitalization to ensure weight gain, and follow-up treatment includes psychotherapy. Anorexia is more common in cultures that emphasize bodily thinness as an ideal for women than in cultures that do not have such an emphasis. For instance, the prevelance of anorexia is higher among elite athletes as compared to non-athletes (Sundgot-Borgen & Torstveit, 2004).

■ **BULIMIA NERVOSA** **Bulimia nervosa** is an eating disorder characterized by food bingeing, followed by purging (Polivy & Herman, 1993). Binge eating consists of eating a substantially greater amount of food than a person of equal height and weight normally would consume. The bulimic student may grossly overeat, usually in a short amount of time,

THINKING ANALYTICALLY

Why is it more difficult to determine the prevalence of bulimia than of anorexia?

SUGGESTION: The symptoms of anorexia are more readily apparent.

and then either vomit the food or else take large amounts of laxatives in an effort to rid the body of the ingested food.

Estimates of the incidence of bulimia are hard to come by. Although no reliable statistics have been gathered at the high school level, estimates of the percentage of people in the general U.S. population who have bulimia range from 2 to 4 percent (Kendler, MacLean, Neale, Kessler, Heath, & Eaves, 1991). These numbers are likely to be conservative, because bulimia is much more easily hidden than is anorexia. As with anorexia, the disorder is far more common in women than in men.

Teachers may find it difficult to recognize bulimia in their students. Although bulimics share the concern of anorexics about becoming too fat, students with bulimia do not necessarily show low body weight (Davison & Neale, 1994). Bulimic students may be depressed (Piran, Kennedy, Garfield, & Owens, 1985). Slipping grades or failing interpersonal relationships may also be signals of bulimia, because the eating and purging can use up time that might otherwise be spent on either schoolwork or social relationships. Bulimics may also have dental problems as their teeth become discolored or damaged because of the effects of acid from their repeated purging.

Because bulimia, like anorexia, is unlikely to go away unless treated, teachers should take steps to ensure that students with the disorder seek help. Bulimia is more easily treated than anorexia, with treatment usually consisting of a combination of therapy and re-education (Fairburn, Norman, Welch, O'Connor, Doll, & Peveler, 1995).

Table 3.7 summarizes some of the warning signs of eating disorders.

■ **OBESITY: A SOCIETAL PROBLEM** It is easy to view people with eating disorders as the only ones who need to worry about problems of food consumption. In fact, our society has a serious problem with food consumption that goes far beyond the existence of some people with eating disorders. Consider some weighty facts (from http://www.niddk.nih.gov/health/nutrit/pubs/statobes.htm, accessed December 10, 2003):

- Nearly two-thirds of American adults are overweight (defined as a body mass index [BMI] greater than 25), and nearly one-third are obese (BMI greater than 30).
- The incidence of obesity has been steadily increasing in recent years among people of both sexes, all ages, all racial/ethnic groups, all educational levels, and all income levels.
- From 1960 to 2000, the prevalence of overweight individuals increased from 32 percent to 34 percent in U.S. adults aged 20 to 74. The incidence of obesity during this same time period more than doubled from 13 percent to 31 percent, with most of this increase occurring in the past 20 years.
- From 1988 to 2000, the prevalence of extreme obesity (BMI of 40 or greater) increased from 2.9 percent to 4.7 percent, a drastic increase from 0.8 percent in 1960.

TABLE 3.7 Symptoms of Eating Disorders

Anorexia	Bulimia
Refusal to maintain body weight consistent with age, height, and build	Binge eating, at least twice a month, for a period of at least three months
Overwhelming fear of gaining weight or becoming fat	Lack of control of eating during this time period
Poor self-image	Self-induced vomiting to purge the body of food
Association of low body weight with ideal self-image	Inappropriate use of laxatives, diuretics, or emetics to purge the body of food
Refusal to recognize the existence of an eating problem	Excessive exercise or fasting to lose weight
Missed periods (in women)	Association of low body weight with ideal self-image

Source: Based on http://psychcentral.com/disorders/sx2.htm and http://psychcentral.com/disorders/sx3.htm, accessed August 26, 2003.

In 2004, obesity contributed to more chronic illnesses and to greater health costs than did smoking (Brownell & Horgen, 2004). Moreover, one-fourth of all vegetables now consumed in the United States are french fries, among the most unhealthy foods available (Brownell & Horgen, 2004). Unless schools educate students to eat more wisely, our society will soon face a major health crisis owing to the increased incidence of Type 2 diabetes, heart disease, and other diseases to which overeating contributes. Indeed, Type 2 diabetes, which used to be referred to as "adult-onset diabetes," is now occurring increasingly frequently even in children as young as 10 years of age.

Schools should consider putting as much emphasis on teaching students to eat in a healthful way as they do on teaching students not to smoke or not to practice unsafe sex. Other experts stress the importance of including physical activity during the school day as a means to combat this trend (Economos & Collins, 2004).

A problem teachers may confront in school is discrimination against children who are overweight. It is important for teachers to be aware of the possibility of discrimination based on weight, and to ensure that all children are treated with respect and collegiality.

AT RISK FOR MAJOR DEPRESSION

A person with **major depression**—also called clinical depression—has feelings of hopelessness that significantly interfere with his or her life. You can recognize major depression by its severity and length; it is an exaggerated version of the mood swings we all have such that sometimes we feel happy and other times we feel sad or depressed. Although depression does not usually produce notable physical or other impairments, it can sometimes be deadly, because it can lead to suicide.

■ DEPRESSION

Depression is quite common among adolescents. Clinical levels of depression have been found in approximately 7 percent of adolescents sampled from the general U.S. population (Petersen, Compas, Brooks-Gunn, Stemmler, Ey, & Grant, 1993). Childhood depression is also more common than many teachers may recognize. One longitudinal study found that between 5 and 10 percent of third graders scored at a "serious" level of depression (Nolen-Hoeksema, Girgus, & Seligman, 1992).

A number of studies reported by the National Institute of Mental Health have indicated that as many as 2.5 percent of children and 8.3 percent of adolescents in the United States suffer from depression. Moreover, statistics from the National Institute of Mental Health indicate that the prevalence of depression is more than 6 percent in a six-month period among children 9 to 17 years of age. Of these children, 4.9 percent suffer from major depression (http://www.nimh.nih.gov/publicat/depchildresfact.cfm, accessed December 17, 2003). Clearly, the onset of depression is occurring earlier in life today than in past decades. This trend is especially worrisome because depression places children at risk for suicide, especially if it is accompanied by use of alcohol.

■ HOW DO DEPRESSED CHILDREN AND ADOLESCENTS ACT?

Young children who experience depression, even in preschool or primary grades, may talk about their feelings of sadness, but mainly they show depression through physical symptoms. They may, for example, lose their appetite, have sleep difficulties, develop fatigue, and suffer physical complaints such as stomachaches (Kashani & Carlson, 1987). Older children and adolescents are likely to have similar physical problems. In addition, depressed adolescents show many of the same characteristics as depressed adults, which usually fall into one of two patterns:

- *Agitated depression* is characterized by a person's being unable to stay still, being constantly on the go, speaking loudly or rapidly, and complaining a lot. This form of depression is relatively rare.
- *Retarded depression*, which is more common than agitated depression, is characterized by feelings of profound sadness and hopelessness. Persons with this type of depression generally experience low levels of energy and may speak or act slowly. They are likely to lose weight and may seek to sleep as much of the time as possible.

TABLE 3.8 Signs of Depression

Persistent feelings of sadness (for at least 6 weeks)
Feelings of discouragement (for at least 6 weeks)
Feelings of hopelessness (for at least 6 weeks)
The feeling that nothing is right with one's life
Low self-esteem
Loss of motivation
Pessimism
Generalizing a single failure to believe that one always fails or that other failures will inevitably follow
Low energy
Slow body movements
Slow speech
Difficulty sleeping
Unusual weight gain or loss

Because of their feelings of hopelessness and discouragement, students who suffer from major depression—whether agitated or retarded—are likely to perform well below their ability in school. They may also have problems in their relationships with others, especially loss of interest. Individuals with major depression are likely to have distorted thinking patterns (Beck, 1967, 1985; Clark, D. A., Beck, A. T., & Alford, B. A., 1999). They may magnify the importance of small errors they commit, minimize the importance of their accomplishments, take personal responsibility for things that go wrong for reasons over which they have no control, and make incorrect inferences. For example, a depressed student may believe a glance from a teacher means the teacher does not like the student. Table 3.8 summarizes signs of depression.

THINKING ANALYTICALLY

Why it is important for teachers to be alert for major depression in their students as well as in themselves?

SUGGESTION: Depression can result in flagging quality of work and personal well-being, whether a teacher or a learner.

Depression in children and adolescents is often related to disruptions in the student's life, such as homelessness, child abuse, or parental divorce. Teachers should be aware of students' home life, if possible, and any risks for psychological problems that the home situation may create. Major depression, unlike the occasional mild depression we all experience, needs treatment. Students showing signs of such depression need social support (Henderson, 1992) and should be encouraged to seek help. Such help usually consists of psychotherapy, sometimes in combination with drug therapy (Jaycox, Asarnow, Sherbourne, Rea, LaBorde, & Wells, 2006). Teachers must act immediately to get help for depressed students who communicate ideas of suicide.

In 2004, the Federal Drug Administration (FDA) issued a warning regarding the use of certain antidepressant drugs by adolescents. Use of these drugs has been linked to increased frequency of suicidal thoughts and suicidal actions. Hence, if such drugs are to be used, they must be monitored extremely carefully by a qualified health-care professional.

■ **SUICIDE** The suicide rate for young people ages 15 to 24 has roughly tripled over the past 30 years, reaching almost 18 per 100,000 individuals (0.018 percent) in the United States, or 3000 people each year. Suicide is now the second leading cause of death among U.S. teenagers, surpassed only by automobile accidents—and some "accidents" actually may be suicides (Douglas, 1967; Garland & Zigler, 1993; Gibbs, 1968; National Center for Health Statistics [NCHS], 1991). The rate of attempted suicide also has tripled. In fact, one national poll found that 6 percent of U.S. teenagers have tried to kill themselves (Freiberg, 1991). Suicide, like depression, is not limited to older students (Diekstra, 1996). The NCHS (1993) estimates that as many as 250,000 U.S. children between the ages of 5 and 14 attempt suicide each year.

THINKING ANALYTICALLY

Why should suicide threats always be taken seriously?

SUGGESTION: There is no certain way of knowing how likely a threat is to lead to an actual suicide attempt.

Nearly three times as many females as males attempt suicide, often by overdosing on sleeping pills or other drugs. However, males, because they often choose more effective methods, such as shooting or hanging themselves, are three times more likely than females to complete a suicide attempt. Risk factors for suicide in young people include educational problems, stressful life events, and mood or mental-health issues (Beautrais, 2003).

A common (and dangerously misleading) myth about suicide is that people who talk about committing suicide rarely go ahead and do it. In fact, nearly 80 percent of people who

commit suicide have given some warning beforehand. For this reason, it is critical that teachers take students' threats or discussion of suicide seriously.

Some teachers may believe that talking about suicide with a student who has brought up the idea will encourage the student to act. Expert teachers know that talking can be a first step to getting help for the student (Range, 1993). Find out how much the student has thought about suicide and whether he or she has made plans or preparations for committing suicide. A student who has made a definite plan, or who has obtained the means to kill himself or herself, is in immediate peril and needs professional help immediately.

Many schools have established suicide prevention programs to provide students in distress with counseling services or refer them for further help (Freiberg, 1991). Teachers have an absolute responsibility to report any talk of suicide to appropriate school officers, such as a school psychologist. Expert teachers are also aware that the death of a student by suicide tremendously increases the risk of further student suicides (Lewinsohn, Rohde, & Seeley, 1994). For this reason, many schools arrange to make special counseling available to all surviving students if a student in the school or community dies by suicide. Suicide attempts may also become more likely following highly publicized suicide deaths, such as those involving young celebrities (Stack, 1987).

AT RISK FOR VIOLENT BEHAVIOR

In the past 14 years, there has been an alarming increase of violence against both students and teachers in schools throughout the United States—whether urban, suburban, or rural. Learning how to deal with violence has become a top priority for today's teachers, because violence threatens not only youngsters but also teachers themselves.

Schools and communities are actively working on ways to make schools safer through a variety of programs that involve both protective and preventive measures. Among the many protective measures used are closed-circuit TVs, "zero-tolerance policies" for weapons possession, safe havens for students, locker searches, metal detectors, phones in classrooms, and security personnel. Equally—if not more—important are preventive measures such as conflict resolution and peer mediation training, safety teams, 24-hour student hotlines, multicultural sensitivity training, staff development, and home–school linkages. Table 3.9 lists some signs that predict violent behavior in adolescents.

DRUG USE: A PREVALENT PROBLEM

Drug use has become so prevalent in U.S. schools that teachers simply cannot ignore this issue. For example, nearly half of all high school seniors in one national survey (46 percent) reported that they had used an illicit drug at least once in their lifetimes, and almost one-third (31 percent) of students surveyed said they had used marijuana in the past year (Substance Abuse and Mental Health Services Administration [SAMHSA], 1995). More than 2 million youths aged 12 to 17 reported that they had used marijuana in the past month (http://www.samhsa.gov/oas/nhsda/2k2nsduh/Sect1peTabs31to35.pdf, accessed December 10, 2003).

Alcohol use is also rampant among our society, and it begins at early ages. Twenty-five percent of eighth graders and 40 percent of tenth graders in one survey reported that they had used alcohol just in the past month (SAMHSA, 1995). In a more recent survey, 29.8 per-

THINKING ANALYTICALLY

Psychoactive drugs are addictive, expensive, and potentially life-threatening. Why do so many children—and adults—start using them?

SUGGESTION: People often fail adequately to weigh long-term losses against what appear (often falsely) to be short-term gains.

TABLE 3.9 Signs That Predict Violent Behavior in Adolescents

Frequency in the past year with which the adolescent has engaged in violent acts such as threatening others with physical harm or beating up, mugging, or shooting at someone
Exposure to physical violence
Exposure to sexual abuse or assault, or witnessing of someone else being abused or assaulted
Trauma symptoms such as anxiety, depression, anger, and post-traumatic stress

Source: Adapted from Song L. (1998). Violence exposure and emotional trauma as contributors to adolescents' violent behaviors. *Arch. Pediatr. Adolesc. Med.*, 152, 531–536.

cent of males and 27.2 percent of females aged 12 to 20 in 2001 reported that they had used alcohol in the past month. Approximately 6.8 million (19 percent) of persons aged 12 to 20 reported binge alcohol use (i.e., having five or more drinks on the same occasion) in the past month in 2001 (http://www.samhsa.gov/oas/2k3/UnderageDrinking/UnderageDrinking.cfm, accessed December 10, 2003).

The use of other illicit substances by youths is also concerning. In 2006, a National Institute on Drug Abuse (NIDA) report identified disturbing levels of prescription-drug abuse among eighth-, tenth-, and twelfth-grade students—especially of powerful painkillers such as OxyContin and Vicodin (http://www.drugabuse.gov/Infofacts/HSYouthtrends.html, accessed October 27, 2007). The NIDA report also revealed increased positive attitudes toward use of Ecstasy and LSD in these same students (http://www.drugabuse.gov/Infofacts/HSYouthtrends.html, accessed October 27, 2007). Finally, use of inhalants such as glue is also widespread, especially among middle school students; although adolescents often perceive these substances as relatively safe, they may, in fact, lead to the development of tolerance and withdrawal symptoms, and even to death.

THINKING PRACTICALLY

Some people have argued that the use of psychoactive drugs is the biggest problem our society is facing today. Why does use of illegal psychoactive drugs pose such a large potential threat?

SUGGESTION: Besides their economic costs, the costs of illegal psychoactive drugs in terms of wasted and even lost lives are incalculable.

Teachers must become expert at recognizing the effects of drug use in students, which can vary depending on the particular drug. General indicators of drug use include changes in behavior or academic performance; frequent absences or "illnesses"; weight loss; unusually lethargic or active behavior; involvement in criminal activities; possession of drug-using paraphernalia, such as needles; or traces and smells of marijuana, tobacco, or alcohol. Students who are using drugs risk addiction, particularly in the case of narcotic drugs, such as heroin, or stimulants, such as cocaine—especially crack cocaine. Expert teachers know that even the so-called legal drugs (i.e., alcohol, nicotine, and prescription drugs) can be highly addictive and dangerous. Use of some drugs, even at relatively low doses, also can cause permanent damage to brain cells involved in learning and memory (Darley, Tinklenberg, Roth, Hollister, & Atkinson, 1973). Table 3.10 lists some signs of adolescent substance abuse.

TABLE 3.10 Signs of Adolescent Substance Abuse

Signs in the Home	Signs at School	Physical and Emotional Signs
Loss of interest in family activities	Sudden drop in grades	Changes in friends
Disrespect for family rules	Truancy	Smell of alcohol or marijuana on breath or body
Withdrawal from responsibilities	Loss of interest in learning	Unexplainable mood swings and behavior
Verbal or physical abusiveness	Sleeping in class	Negative, argumentative, paranoid or confused, destructive, anxious
Sudden increase or decrease in appetite	Poor work performance	Over-reaction to criticism
Disappearance of valuable items or money	Not doing homework	Rebelliousness
Not coming home on time	Defiance of authority	Sharing few, if any, personal problems with parents
Not telling parents where they are going	Poor attitude toward sports or other extracurricular activities	Not as happy as in the past
Constant excuses for behavior	Reduced memory and attention span	Overly tired or hyperactive
Spending a lot of time in their rooms	Not informing parents of teacher meetings, open houses, and other school activities	Drastic weight loss or gain
Lies about activities		Unhappy and depressed
Presence of the following items: cigarette rolling papers, pipes, roach clips, small glass vials, plastic baggies, remnants of drugs (e.g., seeds)		Cheats, steals
		Always needs money, or has excessive amounts of money
		Sloppiness in appearance

Source: http://parentingteens.about.com/library/weekly/aa050300a.htm, accessed December 17, 2003.

Many schools have alcohol and drug abuse and prevention programs in place. Teachers should encourage students who show signs of drug use to seek help through these or other programs. Such programs can assist students with severe drug problems to find medical help or rehabilitation if needed.

Prevention programs concentrate on teaching students to avoid situations that may encourage drug use and helping them practice the social skills needed to resist offers or peer pressure to use drugs (Hittner, 1997; Newcomb & Bentler, 1989). Effective features of drug-prevention programs include interactive presentation, use of social influence, use of peer leaders, and the addition of life-skills instruction (Cuijpers, 2002). Teachers also may be able to help prevent drug use by modeling abstinence from drugs themselves, by pointing out positive role models, and by mentioning in the course of everyday classwork the negative consequences of drug use.

Drug use is usually, but not always, intentional. For example, some women, without their knowledge, have been given drugs such as Rohyprol in an attempt to render them nonresistant to and unaware of their being raped. Both this drug and its hidden administration are illegal.

THINKING PRACTICALLY

Can you think of an additional element that might be a part of an effective school program to combat student drug use?

SUGGESTION: Students might design posters to encourage abstinence from the use of illegal drugs.

UNWANTED CONSEQUENCES OF SEXUAL ACTIVITY

According to the Alan Guttmacher Institute (http:www.agi.usa.org/pubs/fb_teen_sex.html, accessed December 10, 2003), most very young teens have not yet had intercourse. At age 15, for example, eight in ten girls and seven in ten boys have not had intercourse. The probability of having intercourse increases with age, such that by the end of the teenage years, four of five U.S. adolescents have had intercourse. Most youths first have intercourse in the mid- to later teen years; by age 17, more than half have had intercourse. The younger women are when they first have intercourse, the more likely the act was to have been involuntary. For seven in ten of those girls who have had intercourse before age 13, it was involuntary. One study found that nearly one in ten 13-year-olds had already experienced sexual intercourse (Mott, Fondell, Hu, Kowalski-Jones, & Menaghan, 1996).

Unfortunately, for many students sex has unwanted consequences, such as sexually transmitted infections and teenage pregnancy.

■ **SEXUALLY TRANSMITTED DISEASES** Three million U.S. teenagers contract a sexually transmitted disease (STD) (also called sexually transmitted infection—STI) every year (Tanfer, Cubbins, & Billy, 1995; http://www.agi-usa.org/pubs/fb_teen_sex.html, accessed December 10, 2003). Adolescents are at risk for contracting acquired immune deficiency syndrome (AIDS) and other STDs because of their general ignorance about the means of sexual transmission and because of the illusion of invulnerability that frequently accompany the adolescent years. Teenagers may believe, for example, that STDs are something that happens to "someone else." In reality, nearly half of the new reports of STDs every year are in people 15 to 24 years old (http://www.guttmacher.org/pubs/fb_ATSRH.html, accessed October 27, 2007). Further, infection with the human papillomavirus (HPV)—a virus that in certain forms causes genital warts—accounts for approximately half of the new STDs reported each year (http://www.guttmacher.org/pubs/fb_ATSRH.html, accessed October 27, 2007).

Although many STDs are curable, some are not. Syphilis and gonorrhea can both be treated by antibiotics, for example. If not treated, they can have grave consequences: Syphilis can lead over the long term to dementia and even death, and gonorrhea can lead to sterility. Chlamydia is also treatable, but it can result in pelvic inflammatory disease in women if not treated. Genital herpes can be treated, but not cured.

Venereal warts can be treated, but are associated with later risk in women for cervical cancer. A vaccine against the strains of HPV most likely to cause cervical cancer, known as Gardasil, has been developed for girls 9 to 26 years of age. Some states have proposed making it mandatory for young girls to have this vaccine, though such proposals have generated extensive controversy (De Soto, 2007; Honey, 2007).

Of special concern among the STDs is AIDS. This potentially fatal disease is contracted through exchange of bodily fluids—primarily blood and semen—that contain the human

THINKING PRACTICALLY

Do you believe condoms should be distributed on request to high school students? Why or why not?

SUGGESTION: An advantage is disease prevention. A disadvantage is inconsistency with the religious beliefs of some students.

immunodeficiency virus (HIV). Although new forms of drug treatment have extended the lives of those with AIDS, there is at present no known cure for this disease.

Approximately one-fifth of all AIDS cases in the United States occur in people between the ages of 20 and 29 (Berk, 1996). Because it can take ten years or longer for an HIV-infected person to develop the full-blown symptoms of AIDS, it is likely that many of the people who develop AIDS in their twenties were first infected with HIV as teenagers. AIDS is largely preventable through behavioral intervention, and adolescents should be taught how to reduce their risk of infection. In regard to sexual transmission, abstinence is obviously the safest course, followed by diligent use of condoms. Teachers should also make clear the risk to those who take drugs—particularly those who use needles. Besides the risks and modes of transmission of AIDS, teachers should make known how the disease is *not* transmitted—through saliva, routine physical contact with a friend or relative who has the disease, or coughing or sneezing. Research consistently indicates that increased knowledge about HIV and AIDS is related to safer behavior (Fisher & Fisher, 1992; Mickler, 1993).

■ **TEEN PREGNANCY** Although teen pregnancy is found in all socioeconomic groups, data show that it is more prevalent among those who grow up in lower-income homes (Morrison, 1985). Teenage motherhood is likely to lead young women to drop out of school early and to enter into a cycle of poverty that will affect the child or children as well as the mother. According to the Alan Guttmacher Institute, more than 750,000 U. S. teenage girls, ages 15–19, become pregnant each year (http://www.guttmacher.org/pubs/2006/09/12/USTPstats.pdf, accessed October 27, 2007). This statistic reveals a decrease since the peak level of U.S. teenage pregnancies, which was reached in 1990 (http://www.guttmacher.org/pubs/2006/09/12/USTPstats.pdf, accessed October 27, 2007; see also DeRidder, 1993).

Nearly four-fifths of all teen pregnancies are unplanned. Sexually active female teenagers who do not use contraception have nearly a 90 percent chance of becoming pregnant in one year. Nine out of ten sexually active teenagers use some form of contraception; the problem is that they do not use it consistently, so the women are still susceptible to becoming pregnant.

Some of the factors that contribute to the high rate of teen pregnancy are the same as those that contribute to the high rates of adolescent STDs. One key consideration is ignorance about sexual and reproductive facts, such as when in the menstrual cycle a woman can become pregnant. Adolescent girls may also harbor illusions that they are somehow unlikely to become pregnant. In addition, some adolescent girls may feel that preparing for sexual intercourse by obtaining methods of contraception makes them appear promiscuous.

THINKING PRACTICALLY

What is a specific measure a school could take to try to reduce the incidence of teen pregnancy?

SUGGESTION: One measure would be the distribution of condoms. Another would be the encouragement of abstinence from sexual relations.

Teachers may view teen pregnancy in a largely or wholly negative light, but they need to be aware that not all teens do. Put simply, some adolescent girls do not view becoming a parent while young or unmarried as an unwanted situation at all. Indeed, the adolescent may actually wish for the responsibility, believing that it will make her be viewed by others as an "adult." Having a baby may make a girl feel more like a woman, or more nearly self-fulfilled. Teenage pregnancy also may lead girls into supportive social-services environment and give them mentoring, training, and structure that was absent from their lives before. With some students, providing accurate information about the day-to-day life of a teen mother can discourage teens who wish to become parents.

Some teachers and schools are reluctant to provide contraceptive information to students for fear of encouraging teenage sexual activity. Research suggests that formal contraceptive education programs increase the likelihood that adolescents will use birth control methods (Mauldon & Luker, 1996). They may make some adolescents feel "safe" in conducting sexual activity, increasing the probability of its happening in the first place. More likely, however, those who are going to have sexual activity are going to have it, whether contraception is available or not. From this point of view, having contraception available is preferable, in most respects, to not having it available. Overall, providing teens with accurate information about sex and contraception seems to be related to fewer unwanted pregnancies (DeRidder, 1993; Mauldon & Luker, 1996).

SUMMING IT UP

WHY UNDERSTANDING PERSONAL, GENDER, SOCIAL–EMOTIONAL, AND MORAL DEVELOPMENT IS IMPORTANT TO TEACHERS

- This chapter considers the issues of personal, gender, social–emotional, and moral development. Although each aspect of development was considered separately, of course they interact. For example, as children's morality develops, their interactions with peers change.

PERSONAL DEVELOPMENT: BECOMING UNIQUE

- Erikson's theory of psychosocial development posits a series of eight developmental crises: trust versus mistrust, autonomy versus shame and doubt, initiative versus guilt, industry versus inferiority, identity versus role confusion, intimacy versus isolation, generativity versus stagnation, and integrity versus despair.
- Marcia has distinguished among identity achievement, in which people have made their own decisions and have a clear sense of who they are; identity foreclosure, in which people have chosen their path through life with little reflection; identity moratorium, in which people are still seeking an identity; and identity diffusion, in which people lack any clear direction or commitment.

SEXUAL AND GENDER DEVELOPMENT: ACQUIRING GENDER ROLES

- Theories regarding the development of gender identification have considered the roles of biology and evolution, role modeling (social learning view), and schemas that help people make sense of their experiences. Gender schemas that are widely shared are called gender stereotypes. The development of gender identification is different from one's biological sexual development.

SOCIAL DEVELOPMENT: LEARNING TO INTERACT WITH OTHERS

- Attachment is an emotional tie with another person. The first such tie is usually with the mother. Avoidant children seem distant emotionally from others; secure children seem to bond naturally and comfortably with others; resistant children tend simultaneously to be both aloof and in need of closeness. Children who do not attach normally to one or more parental figures are at risk for disrupted behavior later on.
- Theorists of play and friendship have suggested various stages in the formation of strategies of play and of types of friendships. For example, Robert Selman proposed five stages in the development of children's perspective-taking abilities. In general, older children connect more with each other than do younger children, and girls seem to show more intimacy in their friendships than do boys.

MORAL DEVELOPMENT: ACQUIRING A SENSE OF RIGHT AND WRONG

- Various theories of moral development have been proposed, most notably those of Piaget, Kohlberg, and Gilligan. Piaget proposed two phases of moral development: moral realism and the morality of cooperation. Kohlberg's theory of moral development is the most nearly complete. It posits three levels of moral reasoning: preconventional morality, conventional morality, and postconventional morality; each of these levels divided into substages. One way that Kohlberg tested moral reasoning was through the use of moral dilemmas.
- Kohlberg's theory of moral development may be biased toward certain cultural groups and even toward men over women. Gilligan's theory attempts to correct this shortcoming by emphasizing the caring orientation of women, particularly their capacity for empathy.

IDENTIFYING, UNDERSTANDING, AND MANAGING DEVELOPMENTAL RISKS

- The risks to personal development that students face today include eating disorders, such as anorexia nervosa, bulimia nervosa, and obesity; major depression and suicide; drug use; and unwanted consequences of sexual activity, including sexually transmitted diseases and teen pregnancy.

KEY TERMS AND DEFINITIONS

- **Androgyny** State in which individuals feel free to display behavior that is stereotypical of both genders, rather than restricting themselves to behavior considered appropriate to their own gender. Page 87
- **Anorexia nervosa** Life-threatening eating disorder characterized by minimal food intake, a distorted self-image, and a severe fear of gaining weight. Page 107
- **Attachment** Strength and kind of emotional bond that exists between two people. Page 93
- **Autonomy versus shame and doubt** Second stage in Erikson's psychosocial theory, during which, if passed successfully, toddlers gain a sense of mastery of their thoughts, emotions, and behavior. Page 78
- **Avoidant attachment** Form of emotional bond, characterized by the child's avoiding or ignoring the parent or other attachment figure after a separation. Page 93

- **Bulimia nervosa** Eating disorder characterized by bingeing on food, followed by purging. Page 107
- **Conventional morality** Second level of moral development, as proposed by Kohlberg. Individual behavior and moral decisions are guided by interpersonal expectations and conformity to internalized social rules. Page 102
- **Developmental crises** Issues within developmental stages that must be resolved successfully to prepare for the next stage. Page 77
- **Empathy** Ability to feel how another person feels. Page 104
- **Gender identification** Person's acquisition of sex-related roles, regardless of whether they correspond to one's physiological sex. Page 87
- **Generativity versus stagnation** Seventh stage of psychosocial development, as proposed by Erik Erikson. In middle adulthood, adults must develop a sense of helping the next generation of people. This sense is often acquired through child rearing, but generativity can result from work or other efforts as well. Page 79
- **Homosexuality** Person's tendency to direct sexual attention toward members of the same sex; it is a sexual and attentional orientation and identity, usually deeply rooted in psychosexual development. Page 91
- **Identity achievement** One of four possible adolescent identity statuses proposed by James Marcia. Individuals in achievement status have engaged in a period of active search for an identity and have made firm commitments to at least some aspects of identity. Page 80
- **Identity diffusion** One of four possible adolescent identity statuses proposed by James Marcia. Individuals in diffusion status have neither engaged in a period of active search for an identity nor made firm commitments to any aspects of identity. Page 80
- **Identity foreclosure** One of four possible adolescent identity statuses proposed by James Marcia. Individuals in foreclosure status have not searched for an identity, but have nonetheless made firm commitments to at least some aspects of identity, often in accordance with the wishes of their parents. Page 80
- **Identity moratorium** One of four possible adolescent identity statuses proposed by James Marcia. Individuals in achievement status have searched for an identity, but have not yet made any firm commitments to a choice of identity. Page 80
- **Identity versus role confusion** Fifth stage of psychosocial development, as proposed by Erik Erikson. Adolescents try, during this stage, to determine who they are and what is important to them. Page 78
- **Industry versus inferiority** Fourth stage in Erikson's psychosocial theory. Successful passage through this stage results in a sense of competence and industriousness in a variety of tasks. If not successful, children may come to believe they are incompetent. Page 78
- **Initiative versus guilt** Third stage in Erikson's psychosocial theory. Successful passage through this stage results in a sense of purpose in life. If not successful, children may develop feelings of guilt and experience difficulty taking initiative. Page 78
- **Integrity versus despair** Final stage of psychosocial development, as proposed by Erik Erikson. Older adults review their lives and either feel a sense of rightness about the way they have lived or sadness over mistakes it is too late to correct. Page 79
- **Intimacy versus isolation** Sixth stage of psychosocial development, as proposed by Erik Erikson. To successfully complete this stage, a young adult must commit to an intimate relationship and learn to love in a way that is nonselfish. Page 79
- **Major depression** Disorder characterized by feelings of hopelessness that significantly interfere with a person's life. Page 109
- **Moral dilemmas** Ambiguous situations in which no one decision is clearly, morally right. Page 101
- **Morality of cooperation** Piaget's second developmental phase of morality, at which children understand that people both make up rules and can change them. Page 101
- **Moral realism** Piaget's first developmental phase of morality, at which children see rules as absolute. Page 100
- **Perspective-taking ability** Ability to understand that people have different experiences and feelings. Page 97
- **Postconventional morality** Third level of moral development, as proposed by Kohlberg. Individual behavior and moral decisions are based on an internal set of moral absolutes, which may or may not agree with social rules. Page 103
- **Preconventional morality** First level of moral development, as proposed by Kohlberg. Individual behavior and moral decisions are based primarily on egocentric concerns—expectations of reward or punishment. Page 101
- **Psychosocial theory** Theory that explicitly acknowledges that individual development takes place in a social context. Erik Erikson's psychosocial theory of development suggests that people gain important personal qualities and interpersonal skills through successfully meeting a series of crises throughout the life span. Page 77
- **Resistant attachment** Form of emotional bond, characterized by the child's demonstrating ambivalence toward the parent after a separation. Page 93
- **Schema-based view** Perspective that proposes the existence of organized mental systems of information, called schemas, that help people make sense of and organize their experiences. Page 89
- **Secure attachment** Form of emotional bond, characterized by the child's showing distress when separated from a parent, and then displaying pleasure when reunited. Page 93
- **Self** How an individual identifies her or his own characteristics, abilities, and behaviors. Page 81
- **Self-concept** Individual's view of himself or herself. Page 81
- **Self-esteem** Value that an individual places on himself or herself. Page 81
- **Sexual development** Individual's increasing awareness of the characteristics of each of the sexes, of the differences between the sexes, and of changing perceptions of one's own sexuality. Page 87
- **Social learning view** Perspective suggesting that people come to think and behave as they do by observing the behavior of others and imitating it. Page 89
- **Strange situation** Experimental procedure in which the emotional attachment of an infant to the parent is observed after the parent has left the infant with a stranger and has then returned. Page 93
- **Trust versus mistrust** First stage in Erikson's psychosocial theory, in which infants come to either believe or doubt the world is supportive and friendly. Page 78

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

1. How could you help students develop a sense of their own capabilities, the quality that Erikson referred to as industry?
2. What are some values you would choose to model for elementary school students? How would you go about presenting yourself as a model of these values?
3. What is a book you might choose to have students read that would provide models of males and females in nonstereotypical gender roles?
4. How would you use team sports to encourage fifth graders to move from a preconventional, exchange-based level of moral reasoning to a conventional, social expectation–based level?
5. What is an opportunity you could make available to help kindergarten and first-grade students develop a sense of initiative, or control of their actions and choices?

IN MIDDLE SCHOOL

1. What are some ways a junior high biology teacher could build discussions of scientific values and ethics into a standard unit on mammals?
2. One of your sixth-grade science students comes to class with red eyes and smelling of marijuana. The student gives disjointed answers to questions you ask during class. What would you do?
3. How could you help a student who is experiencing friendship difficulties upon entering middle school?
4. After reading Salinger's *Catcher in the Rye* in your eighth-grade English class, a student comes to you and tells you that, like Holden Caulfield, he wishes to kill himself. How should you respond?
5. Several of the students in your sixth-grade math class are picking on a student because she always gets the highest math scores and likes to spend a lot of time on the computer. You suspect the student is lonely and rejected in other classes as well. What can you do to help?

IN HIGH SCHOOL

1. What are some ways a high school science teacher could allow or encourage adolescents in his or her class to explore different identities?
2. If you were a high school counselor or math teacher, how would you go about encouraging qualified female students to enroll in advanced math classes? How would you retain their participation in the mathematics program?
3. How could you use an American history unit on the Civil War to encourage students to explore their current status of identity achievement, focusing on the two key issues proposed by Marcia: seeking an identity and making a commitment to a choice of identity?
4. After school, you come across two members of the wrestling team purging in the bathroom so they can wrestle at their assigned weights in the upcoming meet. What will you do?
5. Two of the girls in your freshman English class started the term as good friends, but now they have had a fight. The friendship problem is interfering with both students' work, and now other students are beginning to get involved, taking sides and forming cliques. What can you do to make the classroom climate more productive?

SKI CLUB

Individual Differences 4

INTELLIGENCE, COGNITIVE AND LEARNING STYLES, CREATIVITY, AND WISDOM

Why Understanding Individual Differences Is Important to Teachers

Understanding Individual Differences in Intelligence

What Is Intelligence?

Psychometric Approaches to Intelligence

Biological Approaches to Intelligence

Contemporary Systems Approaches to Intelligence

Current Educational Controversies in Intelligence

Culture and Intelligence

Heritability and Modifiability of Intelligence

Children at Risk

Teaching Students of Varying Levels: Ability Grouping

Cognitive Styles and Learning Styles

Cognitive Styles

Learning Styles

Understanding Individual Differences in Creativity

The Mystical Approach

The Psychometric Approach

Social–Psychological Approaches

A Confluence Approach

Wisdom

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read through this chapter.

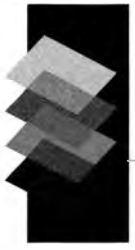
- What is intelligence?
- Is intelligence caused by genes or environment—or both? Can people increase their intelligence?
- What can a teacher do to make students more intelligent? Should teachers adapt to differences in intelligence by grouping students according to ability level?
- What are cognitive styles and learning styles? How can teachers use knowledge about styles to improve instruction and assessment?
- What is creativity, and how does it differ from intelligence? How can teachers encourage and develop creativity in their students and in themselves?
- What is wisdom and why does it matter?

Tony Garcia sat at home grading math tests, fueled by a cup of strong coffee. As usual, there were no big surprises. It never escaped Tony's notice that the same students always excelled on classroom tests. And it was equally true that another group—again always the same—generally bombed on tests. It appeared no matter what Tony did, some students seemed to get it, while others did not. He had tried review sections, practice tests, and extra homework. Indeed, he had tried about everything else he could think of to help the low scorers, but their performance simply wasn't up to the level he expected from his students.

Later that semester, much to his own surprise, Tony's way of thinking changed abruptly. One day Tony read some articles about the value of independent projects for helping students get more excited about math. An open-minded teacher, he decided to add a new requirement to his algebra and geometry courses: a math project. Students were more or less free to do what they wanted, as long as the projects made use of the concepts he had taught in class. Students could apply the math to practical problems, come up with a creative proof, write a paper on some aspect of the history of mathematics, or pursue other options.

To his amazement, Tony discovered on the day the projects were due that some of the most creative and exciting math projects had been done by students he thought were in the less skilled group! Their projects showed that they both understood the concepts and could apply them in novel ways. Tony now saw that he needed to view math achievement much more broadly than simply in terms of scores on his math tests.

Tony Garcia is not alone in his discovery. More and more teachers are finding that the differences among their students are not always what they first appear. Students are far more diverse, and often far more able, than conventional tests show. The goal of Chapter 2 on cognitive development and Chapter 3 on social and personal development was to help you understand diversity across age groups—that is, to answer questions about the similar ways in which nearly all children change as they mature. The goal of this chapter, by contrast, is to help you understand diversity within an age group—that is, the ways in which each child is unique. This chapter describes some of the ways in which students in the same class differ from one another, and what you as a teacher should know about these differences.



Why Understanding Individual Differences Is Important to Teachers

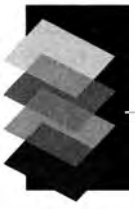
When you walk into your classroom on the first day of school, you will probably be greeted by a sea of unfamiliar faces. You may have read other teachers' files and notes about the students, but in many ways these students will still be strangers to you. How will you get to know each one as an individual? How can you determine what each of your students is capable of achieving in the upcoming school year? On which qualities will you focus in your efforts to teach each child expertly?

These questions are the focus of this chapter. We will cover research and theories about individual differences of several kinds. For teachers, one of the most important student attributes is intelligence. Teachers who wish to place students in ability groups typically start by informally assessing their students' intelligence. They also may hope that higher intelligence will lead to higher scores on statewide or national standardized tests of achievement. This chapter introduces a variety of ideas, including the most current and comprehensive ones, about the nature of intelligence. We will also discuss some of the educational controversies generated by various theories of intelligence: the source of intelligence, the modifiability of intelligence, and ways that teachers can respond to differences in intelligence levels among students.

Expert teachers have learned that each student has a different personality. Particular combinations of personality and intelligence are often referred to as cognitive styles, or personal ways of using one's intelligence. Students' cognitive styles and learning styles can also affect their inter-

actions with teachers. We will uncover some of the key differences in cognitive and learning styles and provide some suggestions for tailoring education to a variety of styles.

Finally, teachers will notice that students differ in their expressions of creativity. We will discuss various views regarding creativity and explore what these perspectives mean to you as a teacher.



Understanding Individual Differences in Intelligence

Much of the modern study of intelligence can be traced back to the work of the Frenchman Alfred Binet (1857–1911) (Brody, 2000). In 1904, the French minister of public instruction formed a commission to develop ways of determining which children should be placed in special classes because they were unable to learn at the average pace or level in classes offered in ordinary schools (Binet & Simon, 1916). To answer the need of the French schools, Binet and a colleague, Théodore Simon, created the first intelligence test (Binet & Simon, 1916).

Today many psychologists use an updated version of the test originally developed by Binet and Simon (Thorndike, Hagen, & Sattler, 1986). This test produces a numerical score, known now as an **intelligence quotient (IQ)** that compares the performance of each student on the test with an average, or standard, performance. Items on this test were originally chosen by Binet and Simon to predict performance in school. We will defer discussion of tests of intelligence, as well as detailed discussion of the IQ and various other types of scores from these tests, until Chapter 14 (on standardized tests; see also Kaufman, 2000). In this chapter, we will consider different ideas about the nature of intelligence and what these ideas mean for teachers.

WHAT IS INTELLIGENCE?

The idea that people vary in intelligence is widely accepted (Deary, 2001; Sternberg, 1994c, 1994d, 2000b; Sternberg & Kaufman, in press). Nearly all of us can name some individuals whom we consider to be smart, or more intelligent, as well as individuals whom we consider to be less intelligent. However, it is difficult to find agreement on just what is meant by "intelligent." When he began assigning math projects, Tony Garcia realized he had been defining intelligence in a very narrow way, based only on test performance. Some people would consider a high school math student who is able to work with college-level differential equations intelligent, even if the student could not carry on a conversation with another person using any more than three sentences. In contrast, some people would describe as intelligent a high school student who is extremely well liked and runs for class president on a platform that is highly popular with students, even if that student was unable to calculate correctly the tip in a restaurant. Indeed, some people suggest that both the math student and the popular student are intelligent, just in different ways. Even experts are not immune to disagreements about what constitutes intelligence.

■ **DEFINING INTELLIGENCE** In 1921 and again in 1986, two groups of experts were asked to define intelligence ("Intelligence and Its Measurement," 1921; Sternberg & Detterman, 1986). Both groups of experts generated many different definitions. Some common themes did emerge, however. Both sets of experts defined intelligence in terms of (1) the ability to learn from experience, and (2) the ability to adapt to the surrounding environment. In the later survey, experts also emphasized **metacognition**—people's understanding and control of their own thinking processes. For example, knowing your strengths and weaknesses would be an important part of metacognition (Levine, 2003; T. O. Nelson, 1999).

Although the experts did not fully agree with one another, based on their areas of agreement we define **intelligence** here as goal-directed, adaptive behavior. This broad definition leaves room for a lot of different ideas about the specifics of intelligence. For instance, is intelligence a single, broad ability, or is it actually a set of capabilities? This is a primary issue dealt with by the various theories of intelligence.

THINKING PRACTICALLY

How might metacognition (how people understand and control what they think) help students study for a test?

SUGGESTION: With metacognitive skills, students have a good sense of what they need to focus on in their study and what study methods are most successful for them, such as spreading out their study time rather than cramming.

■ **CHARACTERISTICS OF INTELLIGENCE** Many of the characteristics of intelligent people overlap with the characteristics of people who are experts, because intelligence is itself a form of developing expertise—in this case, to learn from experience and adapt to the environment (Sternberg, 1998c). In terms of our expertise themes, more intelligent people tend to have large, rich schemas containing a great deal of well-organized declarative knowledge (knowing facts and ideas) and procedural knowledge (knowing how to do things) within a domain. They tend to spend proportionately more time determining how to represent a problem than merely searching for and executing a problem strategy. Such individuals also develop sophisticated mental and external representations of problems, based on underlying structural similarities among problems. They generally choose a strategy based on elaborate schemas of problem strategies, and have automatized many sequences of steps within problem strategies. Through their metacognitive skills, intelligent people accurately predict the difficulty of solving particular problems and carefully monitor and evaluate their own problem-solving strategies. They are likely to be especially flexible in the face of novel problems or problems with unusual features, and to show high accuracy and, in many cases, rapidity in solution of routine problems within a variety of domains. Often they are called upon to serve as mentors.

PSYCHOMETRIC APPROACHES TO INTELLIGENCE

Psychometric theories of intelligence are based on statistical analyses of conventional tests of intelligence. These tests require students to show basic vocabulary, mathematical ability, and reasoning as well as other skills (Brody, 2000; Cianciolo & Sternberg, 2004; Deary, 2001). Earlier in the chapter, we mentioned that some people would consider both an advanced math student and a highly popular student to be intelligent, albeit in different ways. This kind of statement suggests that the quality known as intelligence might actually be a combination of multiple, different abilities.

The idea of multiple abilities is clear in the writings of intelligence-testing pioneer Alfred Binet. Binet and Simon (1916) defined intelligence in terms of judgment skills. They believed that intelligent people had better judgment than less intelligent ones. They suggested three main elements of intelligence:

- Direction, which involves knowing what has to be done and how to do it
- Adaptation, which involves figuring out how to perform a task and then monitoring the strategy you come up with while you are actually doing the task
- Criticism, or the ability to critique your own thoughts and actions

For example, in writing a book report, students would have to know (1) what to include (and not to include) in the book report (direction); (2) how to go about actually writing the book report and making sure it fits within the guidelines given by the teacher (adaptation); and (3) how to critique their own work so that they can turn in the best possible product (criticism).

Since the time of Binet, however, intelligence theorists have offered a number of different ideas about intelligence. These are summarized in Figure 4.1 and described below.

THINKING ANALYTICALLY

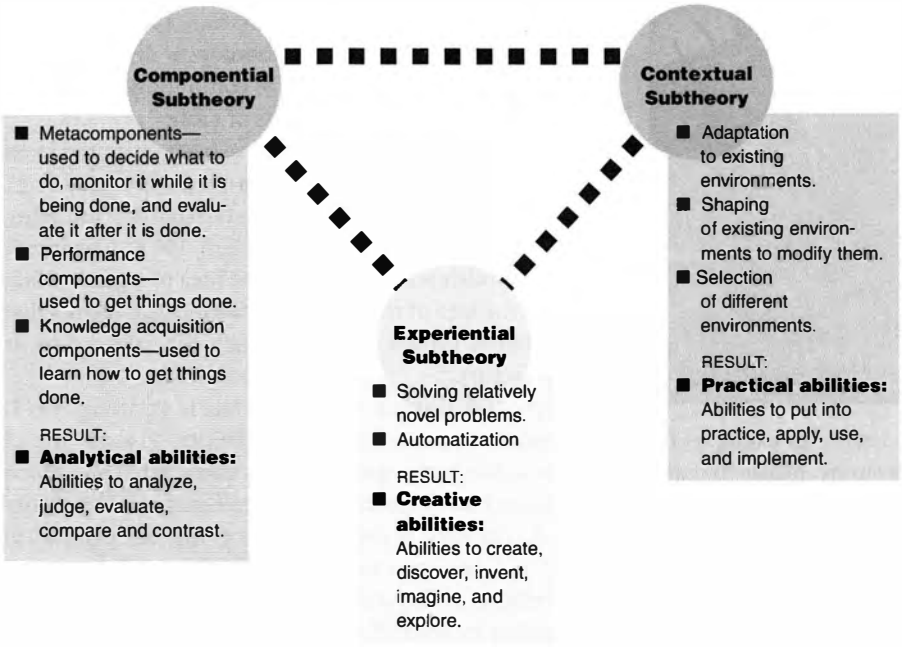
Do you know students who have unusually strong abilities to figure out computer programming problems or who quickly learn their ways around new technology? Do teachers and other students tend to regard these students as highly intelligent even though they may be weak in other areas, such as history or English? How would you assess these students' general intelligence?

SUGGESTION: In a nontechnological society, the student who might excel at computers might never get the chance to show his or her potential to excel with them. Most teachers have a differentiated view of intelligence. They recognize that students can be strong in some areas but not in others. This view corresponds, roughly, to one proposed by Louis Thurstone some years ago.

■ **A GENERAL INTELLIGENCE FACTOR** British psychologist Charles Spearman (1904, 1927) suggested that intelligence can be understood in terms of two kinds of underlying mental dimensions, or factors:

- The single **general factor,** which Spearman labeled ***g,*** is a hypothetical single intelligence ability that is thought to apply to many different tasks. It influences performance on all mental tests.
- Specific factors, each of which Spearman labeled ***s,*** are involved in performance on only a single type of mental ability test (such as a test of vocabulary, or arithmetic computation, or memory). Spearman believed the specific factors were minimally relevant to intelligence, because they do not provide information that generalizes beyond a student's performance on a single test.

FIGURE 4.1 The Triarchic Theory of Intelligence



The general factor is relevant to intelligence, Spearman believed, precisely because it is general. Spearman suggested this factor is the key to intelligence and derives from individual differences in mental activity. Many investigators have continued to try to demonstrate the existence of the *g* factor (e.g., Deary, Strand, Smith, & Fernandes, 2007; Gottfredson, 2002; Jensen, 1998, 2002; Kyllonen, 2002; Petrill, 2002, 2003).

■ **PRIMARY MENTAL ABILITIES: MANY, NOT ONE** Not everyone agreed with Spearman, of course. Among his critics was the American psychologist Louis Thurstone (1938), who concluded that Spearman was wrong (Brody, 2000; Sternberg, 1990). Thurstone suggested that the core of intelligence resides not in one factor, but rather in seven basic interrelated factors, or primary mental abilities. His **theory of primary mental abilities** proposes that students' achievement in school can be understood partly in terms of their relative amounts of these different abilities. For example, a student who rates high in verbal comprehension and verbal fluency might excel in English class. A student who rates high in numerical ability might excel in math.

Thurstone's seven primary mental abilities are as follows:

1. *Verbal comprehension*, which is measured by tests such as vocabulary and general information.
2. *Verbal fluency*, which is measured by tests requiring the test taker quickly to think of as many words as possible that begin with a given letter.
3. *Inductive reasoning*, which is measured by tests such as analogies (lawyer : client :: doctor : ?) and series completions (2, 5, 8, 11, ?).
4. *Spatial visualization*, which is measured by tests requiring mental rotations of pictures of objects.
5. *Number*, which is measured by computation and simple mathematical problem-solving tests.
6. *Memory*, which is measured by picture and word recall tests.
7. *Perceptual speed*, which is measured by tests that require the individual to recognize small differences, as in pairs of pictures, names, or numbers.

Patrick White/Merrill

An adult demonstrates his skill to a younger person. His accumulation of knowledge, or crystallized intelligence, would be expected to surpass that of a younger person or at least to surpass the crystallized intelligence he had when younger.

■ **HIERARCHICAL MODELS** In general, Thurstone's theory of primary mental abilities was more popular in its country of origin (the United States), and Spearman's general factor theory in its country of origin (Great Britain). But is there some way of combining the theories that would retain the best aspects of each?

Several hierarchical theories have been proposed in an effort to combine the best of both kinds of theory (e.g., Carroll, 1993; Cattell, 1971; Gustafsson & Undheim, 1996; Reynolds & Keith, 2007; Vernon, 1971). The intent of these models was to combine the idea of a general factor with the idea of more narrowly defined subfactors that apply across classes of tasks, which are referred to as **group factors.**

Raymond Cattell and John Horn (Cattell, 1971; Horn, 1968), for example, have suggested that we can view general ability (*g*) as the top of the hierarchy. Below that are two major subfactors—group factors that Cattell and Horn refer to as fluid intelligence and crystallized intelligence. **Fluid intelligence** is the ability to understand abstract and often novel concepts; it requires us to think flexibly and to seek out new patterns (Lohman, 1995). For example, solving a series completion such as 1, 4, 9, 16, 25, ? would require fluid intelligence. **Crystallized intelligence** represents the accumulation of knowledge; it is measured by tests of vocabulary and general information. An older person, for example, would be expected to surpass the crystallized intelligence he or she had when much younger (except in cases of mental incapacitation).

THINKING CREATIVELY

What might a teacher do to help students build crystallized intelligence? Explain.

SUGGESTION: One way is to have students do a lot of reading for understanding.

■ **TIME CONSTRAINTS: HOW FAST IS SMART?** As you can see, even contemporary researchers working on precise quantitative measurements of intelligence continue to have differences of opinion about the nature of intelligence. It is difficult to define and analyze this phenomenon. In fact, there are probably at least some aspects of intelligence that no test can fully capture. One element common to many of the currently available tests of intelligence is the existence of time constraints. This chapter's Forum feature explores whether there really is a need for strict timing of performance on tests of intelligence.

*f*ORUM

IS SPEED OF INFORMATION PROCESSING IMPORTANT TO INTELLIGENCE?

Terms that describe speed are often used to indicate intelligence as well. When people say, "She is a quick thinker" or "He is fast on his feet," they are implying that the person is somehow more intelligent than a person who takes longer to come up with answers. What is the relationship between speed and intelligence?

FIRST VIEW: Intelligence is closely linked to speed of information processing (Rindermann & Neubauer, 2004). Some investigators have suggested that intelligence can be understood in terms of the sheer speed of information processing. In an attempt to clarify this relationship, they have used the simplest tasks they could devise to measure pure mental speed uncontaminated by other variables. These researchers (for example, Jensen, 2000, 2004, 2006) have suggested that the time it takes a person to decide which of two or more buttons to push in response to a given stimulus can be used as an indicator of that person's level of intelligence. According to this view, the ability to solve simple tasks quickly pays off in increased efficiency of processing new information (Neubauer & Fink, 2005). For example, students who are able to retrieve basic informa-

tion about words from long-term memory very quickly are able to read and comprehend text faster (Hunt, 1978; Hunt, Lunneborg, & Lewis, 1975). Because most tests of intelligence are timed, and because schools often require children to think quickly, more efficient processing of even the simplest information can lead to higher school grades and intelligence test scores.

Robert Sternberg (1977, 1999c) has suggested that speed might also be important for more complex types of problems, such as analogies. Consider, for example, the analogy, lawyer : client :: doctor : ? (a. patient, b. medicine). Some of the processes that might be involved in solving this analogy would be to encode each of the basic analogy terms (to perceive the terms and retrieve the appropriate concepts from long-term memory), to infer the relation between lawyer and client, and to apply this relation to doctor. People who are faster and more accurate in using these processes, and who devise more efficient strategies for accomplishing them, might be viewed by this theory as more intelligent.

SECOND VIEW: Faster is not always smarter; smarter is not always faster. As we discuss later in this chapter, impulsive students who rush to give answers or complete work do not necessarily give the correct answers or do the work well the first time they try. In contrast, reflective students, who ponder questions or think before acting, may be correct or do good work more often.

For example, Wagner and Sternberg (1985) found that, when asked to perform complex reasoning and reading tasks, more intelligent students actually spent more time before beginning a task than did less intelligent ones. The bright students spent the up-front time deciding how to do a task as a whole, which the investigators referred to as "global planning." The less intelligent students, in contrast, spent more time in "local planning"—that is, the micro-planning needed along the way to accomplish a task. As a result, the less intelligent students often blundered and had to keep going back. Years earlier, Bloom and Broder (1950) had found similar results in comparing better with worse students. Larkin, McDermott, Simon, and Simon (1980a, 1980b) found similar results in a comparison of expert and novice physics problem solvers.

Because many important tasks in everyday life—such as deciding on a course of study or on a job—are not necessarily ones that should be rushed, people who seem slower because they take more time for planning may actually be the ones who perform better when it counts.

THIRD VIEW: A SYNTHESIS. Good information processing is not just a matter of being fast, but also a matter of knowing *when* to be fast (Embretson, 2004; Lohman, 2004; Wenke, Frensch, & Funke, 2004). Teachers who wish to help students develop their intelligence need to help them develop both speed and planning skills. Teachers can help students learn to perform simple processes more quickly by helping students automatize their information processing, such as when they read. Some educational computer software also lets students practice speed.

Just as importantly, teachers should encourage students to spend sufficient time in global planning before beginning a task. Expert teachers model global planning for their students whenever they have the chance, by planning aloud with the class different approaches to tasks and assignments. Teachers can also encourage students to do their own global planning by describing to students the value of global planning. Teachers should tell their students specific steps to follow, tailored to the project at hand. For example, a teacher might tell students to think through a project before beginning, and to collect all materials they will need to do the project successfully before they start. The teacher might also suggest thinking through two or more ways of approaching the project before beginning to help students learn to select an optimal method. To reinforce this message, teachers should provide students with the time necessary to engage in global planning.

IMPLICATIONS FOR TEACHING

What can teachers learn from the ongoing theoretical debate over the number and structure of abilities that constitute intelligence?

- **Accommodate multiple abilities.** Teachers must be open to the different forms of abilities that intelligence takes. An expert teacher assigns activities that involve understanding written prose and poetry (verbal comprehension), writing essays (verbal fluency), recalling main events in a story (memory), understanding the spatial layout presented in a description of a house, town, or nation (spatial visualization), comparing the personalities of two characters in a novel (inductive reasoning), and so on.
- **Help students find and use their strengths.** Having more of one ability can sometimes compensate for having less of another (Salthouse, 1996; Salthouse & Somberg, 1982; Sternberg, 1999c). Put simply, students may use their strengths to compensate for their weaknesses.

■ **CRITIQUE OF PSYCHOMETRIC APPROACHES TO INTELLIGENCE** Although psychometric theories dominate current testing of intelligence, their validity has also been questioned. Some investigators believe the statistical methods used to test psychometric theories have been inadequate in showing the flaws of these theories (Gardner, 1983; Renzulli & Reis, 2007). Psychometric theories also tend to be somewhat narrower than contemporary theories in their conception of intelligence, although there are exceptions (e.g., Guilford, 1967).

BIOLOGICAL APPROACHES TO INTELLIGENCE

Biological approaches seek to understand intelligence by directly studying the brain and its functioning (Jerison, 2002; Vernon, Wickett, Bazana, & Stelmack, 2000). As tools for studying the brain have become more sophisticated, we are beginning to see the possibility of finding physiological indications of intelligence.

■ **NEURAL EFFICIENCY AND INTELLIGENCE** Laboratory research has found that complex patterns of electrical activity in the brain, which are prompted by specific stimuli, correlate with scores on IQ tests (Barrett & Eysenck, 1992; Caryl, 1994). Also, several studies have suggested that the speed of conduction of neural impulses may correlate with intelligence as measured by IQ tests (e.g., Jolij, Huisman, Scholte, Hamel, Kemner, & Lamme, 2007; Reed & Jensen, 1992; Vernon & Mori, 1992; Vernon et al., 2000), although the evidence is mixed. Some investigators (Vernon & Mori, 1992; Vernon et al., 2000) suggest that this research supports a view that intelligence is based on neural efficiency.

Additional support for neural efficiency as a measure of intelligence can be found in studies of how the brain metabolizes glucose—a simple sugar required for brain activity—during mental activities. Richard Haier and his colleagues (Haier, Siegel, Tang, Abel, & Buchsbaum, 1992) cite other research that supports their own findings that higher intelligence correlates with reduced levels of glucose metabolism during problem-solving tasks. In other words, smarter brains consume less sugar (meaning that they expend less effort) than do less smart brains doing the same task. Furthermore, Haier and colleagues found that cerebral efficiency increases as a result of learning in a relatively complex task involving visuospatial manipulations (such as in the computer game Tetris). As a result of practice, more intelligent individuals show lower cerebral glucose metabolism overall, although they demonstrate more specifically localized metabolism of glucose. In other words, in most areas of their brains, smarter persons show less glucose metabolism, but in selected areas of their brains (thought to be important to the task at hand), they show higher levels of glucose metabolism. Thus more intelligent people may have learned how to use their brains more efficiently.

Studies using electroencephalographic (EEG) methods have also noted a pattern of neural efficiency in intelligent individuals. Using EEG methods, Neubauer and colleagues noted that neural efficiency was observed to the largest degree in the brain areas associated with the individual's greatest ability (Neubauer, Fink, & Schrausser, 2002; Neubauer, Grabner, Fink, & Neuper, 2005).

Researchers using electrophysiological approaches have examined the correspondence between intelligence test scores and the speed of a particular type of electrocortical activity, called P300. P300 is associated with detecting, recognizing, and classifying stimuli; these cognitive processes are used, for example, when a person recognizes a new brand of orange juice at the grocery store (Vernon et al., 2000). Quicker onset of P300 activity following stimulus presentation has typically been associated with higher intelligence test scores (Deary & Caryl, 1997; Liu, Shi, Zhang, Zhao, & Yang, 2007). This relationship suggests that faster neurological functioning is associated, on average, with greater intelligence. The relation between the speed of P300 onset and intelligence has not been consistent, however, but rather has been shown to depend on the intelligence test chosen.

New research using electrophysiological approaches has focused on analyzing how changes in electrocortical activity are related to performance on cognitive tasks (Neubauer & Fink, 2005). The results so far indicate that greater efficiency of cortical activity is associated with higher IQ.

■ **BRAIN SIZE AND INTELLIGENCE** Another line of research has examined the relationship between brain size and intelligence (see Haier, Jung, Yeo, Head, & Alkire, 2004; Jerison, 2000, 2002; Vernon et al., 2000; Witelson, Beresh, & Kigar, 2006). The evidence turned up so far suggests that, for humans, the statistical relationship between these two parameters is modest but significant. It is difficult to know what to make of this relationship, however, because greater brain size may cause greater intelligence, greater intelligence may cause greater brain size, or both may be dependent on some third factor. Moreover, how efficiently the brain is used is probably more important than its size. For example, on average, men have larger brains than women, but women have better connections, through the corpus callosum, between the two hemispheres. Thus it is not clear which sex would have, on average, an advantage—probably neither.

The relationship between brain size and intelligence does not hold across species, however (Jerison, 2000). Rather, there seems to be a relationship between intelligence and brain size relative to the rough general size of the organism.

CONTEMPORARY SYSTEMS APPROACHES TO INTELLIGENCE

Some contemporary theorists tend to view intelligence as a complex system. In this section, we look at two widely studied contemporary theories of intelligence. The systems theories of intelligence tend to be broader than the other theories we have described, incorporating some of the major aspects of the other approaches. Systems theories have been criticized by some for being overinclusive—that is, for trying to capture too much in the concept of intelligence. Nevertheless, the general trend in psychology seems to be toward broader rather than narrower conceptions of intelligence, in recognition of the fact that children and adults can be intelligent in many different ways.

The first theory we examine is Howard Gardner's theory of multiple intelligences.

■ **MULTIPLE INTELLIGENCES** Howard Gardner (1983, 1993a, 1993b, 2000, 2003, 2006) has proposed a **theory of multiple intelligences,** which proposes that eight distinct and relatively independent intelligences exist. Each is a separate system of functioning, although the various systems can interact to produce overall intelligent performance:

1. *Linguistic intelligence*: Used in reading a novel, writing an essay or a poem, speaking coherently, and understanding lectures.
2. *Logical–mathematical intelligence*: Used in solving mathematical word or computation problems, balancing a checkbook, and doing a mathematical or logical proof.

THINKING ANALYTICALLY

Gardner's theory specifies eight distinct and important multiple intelligences. In contrast, Spearman's theory specifies just a single important general ability (and unimportant specific abilities). As a teacher, which theory appeals to you more, and why? Which theory would lend itself better to being used in the classroom?

SUGGESTION: Each person must answer for herself or himself.

3. *Spatial intelligence*: Used in walking or driving from one place to another, reading a map, packing suitcases in the trunk of a car so they will all fit, and deciding whether you can fit your automobile into a small parking space.
4. *Musical intelligence*: Used in singing a song, playing the violin, composing a concerto, and understanding and appreciating the structure of a symphony.
5. *Bodily–kinesthetic intelligence*: Used in playing football, dancing, running a race, bowling, or shooting baskets.
6. *Interpersonal intelligence*: Used in understanding why other people behave as they do, deciding how to react to a person's comments in an appropriate way, and making a good impression during a job interview.
7. *Intrapersonal intelligence*: Used in understanding ourselves—why we think, feel, and act the ways we do—and knowing our strengths and our limitations.
8. *Naturalist intelligence*: Used in discerning patterns in nature, such as how different species are related or what kinds of weather we might expect on different days.

Table 4.1 describes users of each type of intelligence and recommends school activities that teachers can use to develop each type.

Gardner (2000) also has speculated on the possibility of an additional intelligence: *existential*. People high in existential intelligence find meaning in their lives. They have success in contemplating fundamental questions of existence.

Gardner reviewed work done with several modern research methods in developing the theory of multiple intelligences. For example, he reviewed the distinctive effects of local-

TABLE 4.1 The Theory of Multiple Intelligences

Intelligence	Core Components of the Intelligence	Example of a Person Who Uses This Intelligence Heavily	School Activities to Develop the Intelligence
1. Linguistic	Sensitivity to the sounds, rhythms, and meanings of words; understanding of the different functions of language.	Poet, journalist	Discussion of metaphor and onomatopoeia
2. Logical–mathematical	Sensitivity to, and capacity to discern, logical or numerical patterns; ability to handle long chains of reasoning.	Scientist, mathematician	Calculating the distance from one corner of a building diagonally to the other by knowing the formula for the area of a triangle
3. Spatial	Capacities to perceive the visual–spatial world accurately and to perform transformations on one's initial perceptions.	Navigator, sculptor	Using perspective in drawing pictures
4. Musical	Abilities to produce and appreciate rhythm, pitch, and timbre; appreciation of the forms of musical expressiveness.	Composer, violinist	Determining the melody or tempo of a song
5. Bodily–kinesthetic	Abilities to control one's body movements and to handle objects skillfully.	Dancer, athlete	Playing pin-the-tail-on-the-donkey; square dancing
6. Interpersonal	Capacities to discern and respond appropriately to the moods, temperaments, motivations, and desires of other people.	Therapist, salesperson	Listening to both sides of an argument between classmates
7. Intrapersonal	Access to one's own feelings and the ability to discriminate among them and draw on them to guide behavior; knowledge of one's own strengths, weaknesses, desires, and intelligences.	Actor, novelist	Role playing a literary character to gain insight into one's own frustrations
8. Naturalist	Ability to spot and understand patterns in nature.	Geologist, explorer	Observation of patterns in the kinds of plant life in a forest setting

Source: Figure from p. 6 of "Multiple Intelligences Go to School" by H. Gardner and T. Hatch, *Educational Researcher*, vol. 18, no. 8, 1989. Reprinted by permission of American Educational Research Association.

ized brain damage on specific kinds of intelligences, distinctive patterns of development in each kind of intelligence across the life span, evidence from exceptional children (both gifted and low achieving), and the possible evolutionary history of the eight intelligences.

In a way, Gardner's theory is reminiscent of multiple-factor theories, such as Thurstone's theory of primary mental abilities. It specifies a list of abilities believed to be fundamental sources of individual differences. However, Gardner conceives of each intelligence as being truly a separate intelligence, not just another separate ability. Different intelligences, unlike abilities, use different symbol systems. For example, linguistic intelligence uses words in various combinations. Logical–mathematical intelligence uses numbers and logical symbols. Musical intelligence can use various kinds of musical notation. Moreover, Gardner views each intelligence as modular—that is, each intelligence originates from a distinctive portion of the brain (Shearer, 2004).

iMPLICATIONS FOR TEACHING

Gardner's theory has several implications for teachers who wish to apply the theory in their classrooms:

- **Take a broad view of what constitutes intelligence.** The theory of multiple intelligences would view the highly musical or athletic child not just as talented in a specific way, but rather as intelligent in a way that formerly would not have been thought of as representing intelligence. An expert teacher might also appreciate the physical skills and quick judgment needed to play on a competitive basketball team.
- **Include instruction that addresses underrepresented intelligences.** The multiple-intelligences theory suggests that instruction probably needs to be diversified more than it currently is. Traditional education tends to focus heavily on linguistic and logical–mathematical abilities. Teachers who recognize an imbalance in their instructional priorities can add activities to develop a variety of students' intelligences (see also Cuban, 2004; Goodrich Andrade & Perkins, 1998; Krechevsky & Seidel, 1998; Moran, Kornhaber, & Gardner, 2006; Parziale & Fischer, 1998).
- **Avoid trying to address each of the eight intelligences in every topic unit** (Hoerr, 1996)**.** For example, it just may not be feasible to build much bodily–kinesthetic content into most math lessons. Remember, not every topic can be approached through all eight intelligences.

■ THE TRIARCHIC THEORY OF HUMAN INTELLIGENCE

Whereas Gardner's theory of multiple intelligences has emphasized a set of relatively independent structures, Robert Sternberg's (1985, 1997a, 1999c, 2005) **triarchic theory of human intelligence** has emphasized a set of relatively interdependent processes.

1. *Metacomponents*: higher-order executive (metacognitive) processes used to plan what you are going to do, monitor it while you are doing it, and evaluate it after it is done. For example, to do their math projects, Tony Garcia's students need to decide on a topic and plan a strategy for getting the project done. They need to make sure that the project is working out—that they are finding enough information or have access to necessary materials, that they organize the information and materials in a coherent way, and that their projects are related closely enough to the content of the class. Finally, they must make sure, after they are done, that their projects show what they want them to show.

As this high school student becomes increasingly familiar with the skills of driving, the process of automatization takes place. A more intelligent person can more quickly and effectively automatize tasks, thus freeing attention for further learning.

Index Open

EXPERT TEACHER INTERVIEW

FOCUS ON: DIFFERENT LEARNING STYLES

BARBARA GILMAN: JOHN F. KENNEDY HIGH SCHOOL, TAMUNING, GUAM—GRADES 9–12 PHYSICAL EDUCATION

Barbara Gilman teaches physical education, elective dance classes, and ballroom dance classes at a high school in Guam. The high school also offers a program for the deaf, and deaf students frequently take her dance classes. Some of the dances she teaches are the cha-cha, foxtrot, swing, paso doble, tango, rumba, and Viennese waltz. It's common that each of the students in a dance pair uses a different technique to learn the same dance.

Why is dance class a more positive experience for your students than some of their other classes?

The students genuinely feel a part of the whole class; they don't feel isolated. In other classes, exceptional students are often isolated by their classmates. Dance partnering places the exceptional child in a situation in which he or she can be an integral part of a team. In dance, students are partnered all the time, so they have to find a way to communicate with each other for the dance to work. Each partner, whether an exceptional or general education student, must take an active role in communicating with each other. The burden is not left with only one child.

How is cultural and ethnic diversity represented in your classroom?

We have a mix of students from the United States, Guam, Micronesia, Taiwan, Japan, Korea, and the Philippines. While it is not verbalized, it is apparent that some cultural groups are ignored by others. If allowed, students will not select these children as partners. However, because partners in dance class change often, students of all cultures and abilities spend a great deal of time working together. As the students work closely together, they learn to appreciate one another's abilities and differences. By the end of the year, a special bond has developed among the dance students. As we conclude the year, everyone is hugging one another.

What are some of the different learning styles you work with in your classes, particularly those for exceptional and general education students?

Every student has areas of strength and areas of challenge. Some of my deaf students find that rhythm comes easily, while their hearing counterparts may struggle. Although dance is very visual, some students are not visual learners; they need tactile and/or auditory techniques to learn. I try to use a variety of ways of teaching a dance: counting verbally, as well as with my fingers; visually demonstrating; physically guiding students; repeating and practicing; partnering students with those who have stronger skills. I tack the dance routines on all four walls so students can see them as they change direction in the dance. Everyone learns differently—it's not necessarily the disability that makes the difference.

What are some ways you have adapted your instruction to accommodate the needs of students with physical disabilities?

To accommodate the needs of students with physical disabilities, I use a variety of teaching techniques. I sometimes modify a skill to allow a student with a disability access to the activity. Modifications may be very minor or very extreme, from adjusting footwork to accommodate a student with a limp

THINKING PRACTICALLY

What strategies might you use to encourage children to plan more thoroughly before doing tasks, monitor their performance on tasks more carefully, and check their work more diligently after they are finished?

SUGGESTION: One way is to tell students you especially value work that is carefully planned and, after it is completed, checked.

2. *Performance components*: processes used for implementing the commands of the metacomponents. For example, Tony's students demonstrate these processes when they are actually reading the books or articles about math, actually gathering the materials needed for the project, and actually writing or assembling the project once it has been planned.
3. *Knowledge-acquisition components*: processes used for learning how to solve problems in the first place. For example, Tony's students must learn how to do research in the library or on the Internet, learn how to organize such a project, and learn how to write or present visual materials in a way that is coherent and interesting.

These three information-processing components are interrelated. Metacomponents (1) allow us to decide what to do, and in turn activate the performance components (2) and knowledge-acquisition components (3). Components 2 and 3, in turn, provide feedback to component 1 (the metacomponents), enabling the metacomponents to adjust the individual's mental representations of information (e.g., in verbal form, such as the word "bird," or pictorial form, such as a mental image of a bird) and strategies for processing information. For example, a student may originally plan to write a term paper on a certain topic (metacomponent); learn about the topic (knowledge-acquisition components); try to write it (performance components); decide that the paper is not going well (metacomponents); and then decide on a new topic (metacomponents).

to moving a wheelchair in time to the music. The exceptional students I've had the most experience with have been deaf or blind.

When working with deaf students, I ensure that they are always partnered with hearing students. The interpreter helps both partners, hearing and deaf, learn signs for various steps. This helps the couple communicate if the interpreter is busy with another student. I encourage hearing partners to develop signals with their deaf partners. The hearing-challenged student might gently tap the rhythm as a signal to begin dancing or if the couple gets off beat. I keep my instructions as visual as possible by demonstrating footwork or sequences from various positions. I find that my deaf students have very good memories when learning new sequences or routines.

I often ask blind students what will help them. One blind student found it helpful to place his hands on the tops of my feet to feel the footwork. I try to ensure that they have physical contact with someone when the class is learning new footwork. I have found these students have excellent listening skills and good memories so I make every attempt to give clear verbal instructions. They learn faster than many of my sighted students because they accurately follow the verbal instructions.

Which experiences have been the most gratifying?

I believe the most gratifying experience I have working with exceptional students is when I watch them shine on the dance floor. I see smiles on their faces, bright eyes, and satisfaction in their accomplishments. I truly feel a sense of pride in their success and enjoy seeing the amazement of the audience as they watch these talented students. More often than not, the audience is unaware that the student has any disability.

All of my deaf students have successfully competed in our schoolwide ballroom dance competition. One young woman who is totally deaf participated in numerous presentations as well as competing in our top level of competition. It amazes people to find out she is deaf.

A blind student who, at his prior school had students take his cane and point him in the wrong direction, found enjoyment and satisfaction in dance class. He developed friendships and bonded with his classmates. During a class performance, he did such an outstanding job that the head of our school system was totally unaware that he was blind.

What advice do you have for new teachers to help them address different learning styles in their classes?

Get to know your students and help them all realize their full potential. Design projects and activities to involve the exceptional student; they are too often left out. Being in class by law doesn't make them a part of the class.

The teacher must set up situations that include these children, making them feel they are contributing members of the class and demanding their best.

Design projects and activities to involve the exceptional student; they are too often left out. Being in class by law doesn't make them a part of the class.

The three kinds of components all contribute to three relatively distinct aspects of intelligence in this "triarchy": analytical, creative, and practical.

- *Analytical abilities* are used to analyze, evaluate, critique, or judge, as when you decide whether a certain argument you or someone else has made is logical. A metacomponent, such as planning, might be used analytically to devise a strategy for solving a geometry problem.
- *Creative abilities* are used to create, invent, discover, and imagine. Examples are when you come up with new ideas for a paper topic or an idea for a scientific experiment. The metacomponent of planning might be used here to help design a building.
- *Practical abilities* are used to apply, utilize, and implement ideas in the real world. An example is when you decide that your psychology professor would probably rather read a term paper on something to do with a psychology topic than on the geological formation of the Himalayas. Mapping a route for climbing the Himalayas could be a practical use of the metacomponent of planning.

Research suggests that the three types of abilities—analytical, creative, and practical—are statistically relatively independent (Sternberg, 1985; Sternberg, Castejón, et al., 2001; Sternberg, Forsythe, et al., 2000; Sternberg, Grigorenko, Ferrari, & Clinkenbeard, 1999; Sternberg & Lubart, 1995).

THINKING PRACTICALLY

Drawing on your own experiences as a student or as a teacher, give three examples of how students try to shape their classroom environments to suit themselves better.

SUGGESTION: They might choose their own paper or project topics, indicate pleasure or displeasure at the way they are being taught or tested, and raise their hand to give their point of view on an issue.

Practical abilities serve three functions in real-world contexts: adapting ourselves to our existing environments, shaping our existing environments to create new environments, and selecting new environments. You use adaptation when you learn the ropes in a new environment and try to figure out how to succeed in it. For example, when you started college, you probably tried to figure out the explicit and implicit rules of college life. You also needed to learn how you could use them to succeed in the new environment. You further shaped your environment by deciding which courses to take and which activities to pursue. You even might have tried to shape the behavior of those around you. Finally, if you were unable either to adapt yourself or to shape your environment to suit you, you might have considered selecting another environment. In this case, you might have thought about transferring to another college.

According to the triarchic theory, we may apply our intelligence to many kinds of problems. For example, some people may be better at solving abstract, academic problems, whereas others may be better at solving concrete, practical problems. The theory does not define an intelligent person as someone who necessarily excels in all aspects of intelligence. Rather, intelligent persons know their own strengths and weaknesses. They find ways to capitalize on their strengths and either compensate for or correct their weaknesses. For example, a person who is strong in psychology but not in physics might choose as a physics project creating a physics aptitude test (as I did when I took physics!). The point is to make the most of your strengths and to find ways to improve upon, or at least to live comfortably with, your weaknesses.

iMPLICATIONS FOR TEACHING

How does one actually use the triarchic theory in a classroom? Here's how.

EXAMPLES OF TEACHING AND ASSESSING FOR ANALYTICAL LEARNING AND THINKING

- *Analyze* an issue, such as why genocides continue to occur even today, or why certain elements are radioactive, or why children today still find *Tom Sawyer* entertaining, or how to solve a particular algebraic factoring problem.
- *Evaluate* an issue, such as why unlimited political contributions can lead to corruption in a political system, how the Internet is vulnerable to catastrophic sabotage, which part of speech a certain word is, or how best to make a cake.
- *Explain* how the British Parliamentary system works, or how a wool blanket can produce static electricity, or how to solve an arithmetic word problem, or why a character in a short story acted the way she did.
- *Compare and contrast* two or more items, such as the systems of government in China and the United Kingdom, or igneous and sedimentary rocks, or two different ways of proving a geometric theorem, or two novels.
- *Judge* the value of characteristics of something, such as a law, or a scientific experiment, or a poem, or the metric system of measurement.

EXAMPLES OF TEACHING AND ASSESSING FOR CREATIVE THINKING

- *Create* a game for learning the names of the states, or a poem, or a new numerical operation, or a scientific experiment.
- *Invent* a toy, or a new way of solving a difficult mathematics problem, or a new system of government that builds on old systems of government, or a haiku.
- *Explore* new ways of solving a mathematics problem beyond those taught by the teacher, or how to achieve a certain chemical reaction, or different ways of reading so as to improve your reading comprehension, or the nature of volcanoes.
- *Imagine* what it would be like to live in another country, or what will happen if temperatures on the Earth keep rising, or what Picasso might have been thinking when he painted *Guernica*. or what might happen if the government of the United Kingdom made it a crime to speak ill of the government.

- *Suppose* that people were paid to inform on their neighbors to the political party in power (What would happen?), or that all lakes instantly dried up (What would happen?), or that schools stopped teaching mathematics (What would happen?), or that Germany had won World War II (What would have happened?).
- *Synthesize* your knowledge of the Gulf War and the recent war in Afghanistan to propose a set of battle techniques that is likely to work in many unfamiliar kinds of terrains.

EXAMPLES OF TEACHING AND ASSESSING FOR PRACTICAL THINKING

- *Put into practice* what you have learned about measurement in baking a cake, or your foreign-language instruction in speaking with a foreigner, or your knowledge of soils to determine whether a particular plant can grow adequately in a given soil.
- *Use* your knowledge of percentages or decimals in computing discounts, or a lesson learned by a character in a novel in living your own life, or your knowledge of the effects of particulate matter in the atmosphere on vision to figure out whether a car driving behind you in the fog is substantially closer than it appears to be.
- *Utilize* a physical formula to figure out the speed at which an actual falling object will hit the ground, or your understanding of cultural customs to figure out why someone from another culture behaves in a way you consider to be strange, or the lesson you learned from a fable or a proverb to change your behavior with other people.
- *Implement* a plan for holding a classroom election, or a strategy for conserving energy in your home, or what you have learned in a driver-education class in your actual driving, or a psychological strategy for persuading people while raising money for charity.
- *Apply* your knowledge of political campaigns in history while running for class president, or your knowledge of the principles of mixture problems while mixing paints to achieve a certain color, or your understanding of the principles of good speaking while giving a persuasive talk.

In a comprehensive study testing the validity of the triarchic theory and its usefulness in improving performance, Sternberg and his colleagues predicted that matching the way students are taught and assessed to their abilities would lead to improved performance (Sternberg, Ferrari, Clinkenbeard, & Grigorenko, 1996; Sternberg, Grigorenko, Ferrari, & Clinkenbeard, 1999). Students were selected for one of five ability patterns: high in only analytical ability, high in only creative ability, high in only practical ability, high in all three abilities, or not high in any of the three abilities. Students were assigned randomly to one of four instructional groups, which emphasized memory-based, analytical, creative, or practical learning, respectively. The memory-based, analytical, creative, and practical achievement of all students was then assessed. Students who were placed in an instructional condition that matched their strength in terms of pattern of ability (e.g., a high-analytical student being placed in an instructional condition that emphasized analytical thinking) outperformed students who were mismatched (e.g., a high-analytical student being placed in an instructional condition that emphasized practical thinking). Thus the prediction of the experiment was confirmed.

The multifaceted subtheories may make the triarchic theory seem complex. In reality, the theory can be put to use fairly easily to teach and learn, as the Flexible Expert feature demonstrates. See if you can match each expert teaching and learning behavior with the subtheory it demonstrates.

*i*MPLICATIONS FOR TEACHING

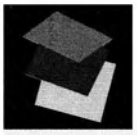
The triarchic theory is rich in educational implications. Some of the main ones are listed here. We consider others later in the section on helping children develop their intelligence.

- **Focus on both practical and academic aspects of intelligence.** Some subjects, such as geography or social studies, provide natural opportunities to encourage students to

apply contextual intelligence—to think about how they might fit into a different environment. Biology teachers can discuss parallels between the ways adaptation, shaping, and selection occur in humans and other animals.

- **Help students capitalize on their strengths.** People need to figure out what they do well and make the most of it. They also must figure out what they do not do well, and either make themselves good enough to get by (remediation) or find ways around what they don't do well (compensation). Students have at least some options in a school setting (e.g., programs of study). By choosing their options wisely, they can maximize the use of their intelligence and accomplish their goals.
- **Remember that experts are generally not good at everything.** Rather, they make the most of what they are good at. They also increase their utilization of their abilities, as we discuss later in this chapter.

■ **OTHER KINDS OF INTELLIGENCE** There may be multiple kinds of intelligence beyond those suggested by Gardner and Sternberg. Peter Salovey and John Mayer (1990; see also Mayer, Salovey, & Caruso, 2000; Salovey & Pizarro, 2003) have suggested the existence of *emotional intelligence*, which they define as "the ability to perceive and express emotion, assimilate emotion in thought, understand and reason with emotion, and regulate emotion in the self and others" (p. 396). There is good evidence for the existence of some kind of emotional intelligence (Cherniss, Extein, Goleman, & Weissberg, 2006; Ciarrochi, Forgas, & Mayer, 2001; Mayer & Salovey, 1997; Salovey & Sluyter, 1997), although some findings on this subject are mixed (Davies, Stankov, & Roberts, 1998; Waterhouse, 2006). The concept has become increasingly popular in recent years (Goleman, 1995, 1998). Research also shows that personality variables are related to intelligence (Ackerman, 1996) and that emotional intelligence is a good predictor of future success (Parker, Duffy, Wood, Bond, & Hogan, 2005; Parker, Hogan, Eastabrook, Oke, & Wood, 2006; Rosete & Ciarrochi, 2005).



THE FLEXIBLE EXPERT

TEACHING AND LEARNING ABOUT THE TRIARCHIC THEORY OF INTELLIGENCE

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Tam analyzes different forms of poetry to decide whether poems in each style would provide his tenth-grade English students with an appropriate level of novelty and challenge, or whether the forms would be just too new to the students to provoke their interest at all.

THE CREATIVE TEACHER: Tam has been assigned to a windowless, unattractive classroom for the remainder of the academic year. To shape the environment into one that is more stimulating and pleasant for himself and students, he puts up posters from the local Shakespeare company and designs a bulletin board where he can share a rotating selection of his favorite literary quotes.

THE PRACTICAL TEACHER: Tam assigns several short research papers, only one to two pages each, rather than one long paper, so his students will get the chance to practice the process of preparing a research paper several times. In this way, he hopes that research and writing will become more automatized for the students.

THE ANALYTICAL STUDENT: Every time Betsy reads a book, story, or play for English class, she considers how well she would fit into the role of one of the main characters, comparing her personality and strengths to those of the character.

THE CREATIVE STUDENT: Whenever Tam assigns the English class to write another short research paper, Betsy chooses a topic that will work as a chapter or episode in the novel she hopes to write someday. By the time she is ready to write a book, she hopes to have gathered a great deal of information and become an expert researcher.

THE PRACTICAL STUDENT: Betsy spent last summer in a South American rain forest with her parents, an environment in which she quickly realized that most of what she had previously known would not be very useful to her. She soon adapted to the environment, however, by learning several skills that were useful, such as navigating in the deep jungle and learning to avoid poisonous plants and animals.

Researchers have also proposed the notion of *social intelligence*—a kind of intelligence used in interacting effectively with other people (Kihlstrom & Cantor, 2000). Still other investigators have suggested a concept of *practical intelligence*, or the ability to function effectively in everyday life (Sternberg et al., 2000; Wagner, 2000). Some researachers have examined *cultural intelligence*, or knowledge of cultures and what is considered intelligent within a given culture. Intelligence and culture are discussed in greater detail later in this chapter (Ang, Dyne, & Koh, 2006; Sternberg & Grigorenko, 2006; Triandis, 2006).

Clearly, our concepts of intelligence are becoming much broader than they were just a few years ago. At the same time, not all psychologists accept these broader conceptions.

■ **CRITIQUE OF CONTEMPORARY SYSTEMS APPROACHES TO INTELLIGENCE** Contemporary systems theories of intelligence attempt to go beyond the scope of conventional psychometric theories in explaining intelligence. They are successful in doing so to some extent, but they are not without limitations. Since Gardner's theory of multiple intelligences was proposed in 1983, no published empirical tests of the whole of this theory have been published. Such tests are needed to verify the claims of the theory. Moreover, the claim that the multiple intelligences are independent is suspect because so many studies have found intercorrelations among abilities (see Carroll, 1993; Jensen, 1998; Sternberg, 2000b).

Sternberg's theory of intelligence has been tested (e.g., Sternberg, 2003a; Sternberg, Castejón, et al., 2001; Sternberg, Grigorenko, Ferrari, & Clinkenbeard, 1999), but is very broad. Some researchers and educators may prefer to view creative and practical skills as being beyond—rather than within—the domain of intelligence.

As we can see, contemporary theories have advanced educators' thinking about intelligence. Even as they have answered some questions, however, they have raised others.

CONSTRUCTING YOUR OWN LEARNING

Now that you have read about the various theories of intelligence, take a few moments to integrate what you have read with ideas of your own. Choose one of the theories. How would you teach students a concept in a way that takes key aspects of that theory into account? How would you teach students that same concept if you were including the ideas of a different theory of intelligence?

Current Educational Controversies in Intelligence

It's clear from the sheer number of theories of intelligence presented in the preceding section that theorists and researchers disagree about both the nature of intelligence and ways to assess it. There are also some major disagreements regarding other aspects of intelligence. Because the position teachers take on some of these issues can affect how they approach their students in the classroom, we cover three of these controversies in some detail.

- The first controversy regards the source of intelligence—the extent to which it is inherited versus the extent to which it develops in response to a person's environment.
- The second controversy relates to the extent to which a student's level of intelligence can be modified.
- The third controversy reflects differences of opinion about how teachers should best cope with varying levels of intelligence among their students. One common, but controversial, method is to group students according to ability level; another method is to have no grouping at all.

People in different cultures may have dramatically different ideas of what it means to be "smart." One of the more interesting cross-cultural studies of intelligence was performed by Michael Cole and his colleagues (Cole, Gay, Glick, & Sharp, 1971; Glick, 1975). They asked adult members of the Kpelle tribe in Africa to sort terms. In Western culture, when adults are given a sorting task on an intelligence test, intelligent people typically sort hierarchically. For example, they may place names of different kinds of fish together, and then the word "fish" over that, with the name "animal" over "fish" as well as "birds," and so on. Less intelligent Westerners will typically sort functionally. They might sort "fish" with "eat," for example, because we eat fish, or "clothes" with "wear," because we wear clothes.

Members of the Kpelle tribe generally sorted functionally even after investigators tried indirectly to encourage them to sort hierarchically. Finally, in desperation, one of the experimenters directly asked one of the Kpelle to show how a foolish person would do the task. When asked to sort in this way, the Kpelle had no trouble at all sorting hierarchically: He and the others had been able to sort this way all along. They just had not done so because they viewed it as foolish. Moreover, they probably considered the questioners rather unintelligent for asking such foolish questions. Why would they view functional sorting as intelligent? In ordinary life, we normally think functionally. When we think of a fish, we think of catching or eating it. When we think of clothes, we think of wearing them. However, in Western schooling we learn what is expected of us on tests. The Kpelle did not have Western schooling, and they had not been exposed to intelligence testing. As a result, they solved the problems the way Western adults might do in their everyday lives but not on an intelligence test.

The Kpelle are not the only people who might question Western understandings of intelligence. Work by Robert Serpell (1993, 1994) in Zambia shows that Zambians also have conceptions of intelligence quite different from those of North Americans, and research shows that many other such differences can be found around the world (Berry, 1974; Sternberg & Kaufman, 1998). Similarly, research has revealed that rural Kenyans have four different words associated with intelligence (Grigorenko et al., 2001). Only one of the four words refers to academic skills; the other three have to do with obedience and respect toward elders, social skills, good judgment in everyday situations, and, in general, everyday competencies. Thus we have to be careful when, as a society, we assume that what we mean by "intelligence" is the same as what people in other societies mean.

Implicit theories differ in Taiwan as well. There is evidence that Chinese people in Taiwan include both interpersonal and intrapersonal (self-understanding) skills as part of their conception of intelligence (Yang & Sternberg, 1997). Thus what might count as a comprehensive assessment of intelligence might vary from one culture to another (Sternberg & Kaufman, 1998).

Even within our own society, different groups can have different notions of intelligence. For example, Okagaki and Sternberg (1993) found that Anglo-American and Asian American parents in a school district in San Jose, California, tended to emphasize cognitive skills more and to emphasize social skills less in their conceptions of what it means to have a smart child. Latino-American parents showed the opposite pattern. Because teachers in the school adhered to a conception of intelligence that was closer to that of the Anglo-American and Asian American parents, they tended to view the Latino-American children as less intelligent. In short, groups have a fairly fixed conception of intelligence, and they are often quite ready to assume that their belief is correct not only for themselves, but for everyone else as well.

A study by Seymour Sarason and John Doris (1979) provides a close-to-home example of the effects of cultural differences on intelligence, particularly on intelligence tests. These researchers tracked the IQ scores of immigrant Italian Americans. Less than a century ago, first-generation Italian American children had a median IQ of 87, which is considered to be in the low-average range. Some social commentators and intelligence researchers of the day pointed to heredity and other nonenvironmental factors as the basis for the relatively low IQ scores. (Commentators today make a similar point about members of minority groups.) For example, a leading researcher of the day, Henry Goddard, pronounced that 79 percent of immigrant Italians were "feeble-minded." He also asserted that about 80 percent of immi-

grant Hungarians and Russians were similarly unendowed with intelligence (Eysenck & Kamin, 1981). Goddard (1917) further claimed that this deficit in intelligence was associated with moral decadence. He recommended that the intelligence tests he used be administered to all immigrants, with potential immigrants who had low scores being selectively excluded from entering the United States.

Today, Italian American students who take IQ tests show slightly above-average IQs; other immigrant groups that Goddard denigrated have shown similarly "amazing" increases (Ceci, 1996a, 1996b). Even the most fervent hereditarians would be unlikely to attribute such remarkable gains in so few generations to heredity.

HERITABILITY AND MODIFIABILITY OF INTELLIGENCE

General intelligence as it is traditionally defined is at least partially inherited (Plomin, 1997, 1999). At the heart of some controversies over the source and stability of intelligence are disagreements about the extent of genetic influences versus environmental influences on people (Plomin, 1999). Given these sometimes passionate debates, it is essential for teachers to understand clearly the concepts of genetic and environmental influences as they apply to intelligence.

Inherited (i.e., genetic) influences are biologically coded—programmed in an individual's DNA at the moment of conception. Every person has approximately 40,000 genes, which express their many influences—on skin color, body shape, and even aspects of intelligence, for example—in complex and interactive ways. Environmental influences, in contrast, are solely a product of experience.

■ TO WHAT EXTENT ARE DIFFERENCES DETERMINED BY GENES?

Heritability is the extent to which individual differences in a specific characteristic of a person are genetically determined independently of any environmental influences (Sternberg & Grigorenko, 1997a). Heritability is often expressed as a **heritability coefficient**—a number on a 0 to 1 scale. On this scale, a coefficient of 0 indicates that heredity has no influence at all on variation among people, whereas a coefficient of 1 means that only heredity—and nothing else—has an influence on such variation. As an example, height has a heritability of more than 0.9. It is very highly heritable, as is eye color. Weight is somewhat heritable, but less so than height.

Heritability does not measure whether intelligence itself is inherited. Instead, it merely assesses the extent to which individual differences in intelligence are inherited.

People have used a variety of methods to estimate the heritability of different aspects of intelligence. Most methods use some analysis of kinship patterns (Loehlin, Horn, & Willerman, 1997; Scarr, 1997). For example, one method studies identical twins who were separated at or shortly after birth. The idea is that such identical twins will share identical heredities (because they have the same genes), but not the same environment (because they have been raised apart). This method makes it possible to separate the effects of heredity from the effects of the environment.

A second method compares identical twins, who share all of their genes, with fraternal twins, who share half of their genes, but who are raised in what are assumed to be strictly comparable environments.

A third method looks at adopted children and compares attributes of these children with the attributes of both their biological parents and their adoptive parents. The idea behind this method is that the children will share genes but not environment with the biological parents, and environment but not genes with the adoptive parents.

All three methods can be useful for determining the heritability of aspects of intelligence, but none yields conclusive results (Grigorenko, 2000). The world does not usually lend itself to perfectly controlled natural experiments. For example, all of the separated identical twins spent at least nine months together—in the intrauterine environment—and most also spent at least some time together after birth. Moreover, adoption agencies do not really place adoptees at random. Instead, they generally look for a good home environment, and one that is roughly comparable to the environment from which the child originated. For these and a variety of technical reasons, we need to be cautious in interpreting the results of heritability studies. We also need to remember that the studies tend to use conventional tests of intelli-

THINKING ANALYTICALLY

What do you think is more important in leading someone to achieve good grades in school—genes or environment? Why?

SUGGESTION: Both genes and environment are important, and their interaction should be considered. But the classroom, family, and community are all important environmental influences, and only they can be changed.

gence based on conventional theories. Today, there are many broader theories that are not represented well by conventional tests, which might yield different results.

Many of the early theorists of intelligence simply assumed that intelligence is largely or entirely genetically determined (e.g., Terman, 1930). Thus intelligence tests were thought by many such theorists to measure largely an inborn, unchangeable trait. However, many estimates made using the methods we have described (such as the use of separated identical twins) suggest that intelligence is not entirely controlled by genes (Grigorenko, 2000).

Ultimately, different studies have produced somewhat different estimates of heritability. Studies of twins reared apart (e.g., Bouchard & McGue, 1981; Juel-Nielsen, 1965; Newman, Freeman, & Holzinger, 1937; Shields, 1962) suggest a heritability coefficient in roughly the 0.6 to 0.8 range (where 0 = no heritability and 1 = perfect heritability). Studies of identical versus fraternal twins suggest a heritability of roughly 0.7 to 0.8 (Bouchard, 1997; Bouchard & McGue, 1981). These numbers indicate that genetic influences affect individual differences in intelligence, but that these influences are not the only determining factor. Moreover, these results hold only for the populations under study, at the times they were studied, with the measures being used. Moreover, they hold only with the assumptions about intelligence and methodology made in the studies.

An interesting finding is that the heritability of intelligence appears to increase with age (Plomin, 1997)—that is, early individual differences in environments have less of an effect as individuals grow older. Heritability also differs with socioeconomic class. A recent study suggests that the heritability of intelligence may be about 0.7 in affluent families, with environment making only a very small contribution. In contrast, the heritability of intelligence may be about 0.1 in poor families, with genes making little contribution to its development (Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003). In other words, heredity matters more and environment less in more affluent families, whereas the reverse pattern holds for less affluent families.

The key implication of this discussion for teachers is that, although genetics certainly play a role in determining intelligence, a significant part of students' intelligence is attributable to environmental influences. School environment is a major aspect of these influences. In fact, greater and longer attendance at school is almost always associated with higher scores on intelligence tests (Ceci & Williams, 1997; Christian, Bachnan, & Morrison, 2001). Even work environments make a difference: Intellectually demanding work environments tend to facilitate the development of cognitive abilities, and unchallenging environments tend to diminish it (Schooler, 2001). Expert teaching definitely can make a difference. Next we discuss the ways in which teaching and other environmental forces can affect intelligence.

THINKING ANALYTICALLY

Explain how environment can affect an attribute, such as height, even if that attribute is highly heritable.

SUGGESTION: Heritability refers to patterns of individual differences, not levels of attributes. Height might be highly heritable both in Japan and in the United States, such that parents' heights predict children's heights. The heights of children may fluctuate more in Japan than in the United States, however, because of major changes in diet in Japan that have occurred over the past 30 years.

■ **CAN INTELLIGENCE BE MODIFIED?** At one time, virtually all psychologists believed that intelligence is fixed—what we are born with is what we have for life. Today, some psychologists still believe this notion, but many—including the authors of this text—do not. The key concept in the debate over the stability of intelligence is the idea of **modifiability,** or the extent to which an attribute is susceptible to change. Even after it was determined that intelligence is not entirely inherited, many psychologists and educators believed that intelligence is a fixed attribute. Most attributes are modifiable, however. That there may be genetic influence on these attributes does not change this fact.

For example, consider height. With a heritability coefficient of about 0.9, height is one of the most heritable attributes. Despite this fact, over the past several generations, heights have increased dramatically in the United States, and even more in other countries such as Japan. People's genetic codes for height have not changed in the last two or three generations, but heights have increased. What does this fact mean? Obviously, environmental factors such as nutrition and disease prevention have influenced the expression of the genes for height. If children receive inadequate nutrition and contract diseases, they are less likely to reach the full potential height their genes would allow (Sternberg & Grigorenko, 1997a). Nutrition and other environmental factors can have a large effect on development, whether or not an attribute is highly heritable (Sternberg, Grigorenko, & Nokes, 1997). The same logic applies to other attributes, including intelligence (Grotzer & Perkins, 2000; Mayer, 2000).

Another major concept is called **gene–environment interaction,** the idea that genetic and environmental influences can combine to produce results that might be unexpected on the basis of either factor alone (Grigorenko, 2000). Genes do not produce individual differences on their own. Rather, how they express themselves depends on the environment to some extent. Some theorists have proposed models of gene–environment reaction that include a **reaction range,** a spectrum of ways that an attribute can be expressed in the environment, bounded by genetic possibilities. A reaction range for intelligence as measured by conventional intelligence tests would suggest that the upper and possibly lower limits of a person's intellectual abilities are determined by genetics. Within the range between the person's upper and lower limits, however, environmental forces determine exactly which level of intelligence the person will attain.

For example, consider a student who has a genetic predisposition toward only moderate intelligence, but who is raised in a stimulating home atmosphere and who receives sensitive, appropriate instruction at school. This student might have a higher IQ than a student who inherits genes for high intelligence but who is raised in a deprived environment without a stimulating home or school life (Fiese, 2001; Schaie & Zuo, 2001) or who experiences discrimination in the society in which he or she lives (Ogbu & Stern, 2001).

Perhaps the best evidence for the modifiability of intelligence comes from research carried out by James Flynn (1987; see also Fernández-Ballesteros, Juan-Espinosa, & Abad, 2001; Neisser, 1998). This research suggests that ever since record keeping began early in the twentieth century, IQ scores have been increasing roughly 9 points per generation (every 30 years). This result is sometimes referred to as the *Flynn effect.* From any point of view, the increase in IQ is large. No one knows exactly why such large increases have occurred, although the explanation must be environmental because the period of time involved is too brief for genetic mutations to have had an effect. If psychologists were able to understand the cause of the increase, they might be able to apply what they learned to increase the intellectual skills of individuals within a given generation.

Further evidence supporting the malleability of intelligence can been seen in a study completed by Blackwell, Trzesniewski, and Dweck (2007). In this study, the researchers found a relationship between a junior high school student's belief that intelligence is malleable and improvements in mathematics achievement. The researchers also found that instruction concerning the malleable nature of intelligence can improve motivation and stop the decline of mathematics students' grades. These findings indicate not only that intelligence is malleable, but also that it is greatly affected by our expectations.

Exactly which kinds of environmental influences make a difference in intelligence levels?

■ HOW ENVIRONMENTAL INFLUENCES MAKE A DIFFERENCE: LESSONS FOR TEACHERS

Robert Bradley and Bettye Caldwell (1984) have argued that a child's home environment during the preschool years is particularly crucial to intellectual development. They found that high scores on tests of intelligence were associated with five factors:

1. Emotional and verbal responsivity of the primary caregiver and the caregiver's involvement with the child
2. Avoidance of restriction and punishment
3. Organization of the physical environment and activity schedule
4. Provision of appropriate play materials
5. Opportunities for variety in daily stimulation

Bradley and Caldwell found that these factors predicted intelligence test scores better than did either socioeconomic variables or family structure variables. These results have clear implications for structuring a preschool, or even a primary grade, environment that would foster children's intelligence. For example, teachers of young children need to be as

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Positive interaction between teachers and students is immediately apparent in this preschool classroom.

involved and responsive to each student as possible. Small class sizes, if possible, foster teacher–child involvement.

HEAD START. One preschool program that includes many of the intellectually stimulating qualities defined by Bradley and Caldwell is Head Start. Head Start, which was established in the 1960s, is probably the best-known program for developing intelligence. It is designed to provide preschoolers with an advantage both in their intellectual abilities and in their school achievements when they start school. Research reveals that children who participated in this program in its early years tended, on average, to score higher on a variety of scholastic achievement tests, to need less remedial attention, and to show fewer behavioral problems than children not in the program (Barnett & Hustedt, 2005; Lazar & Darlington, 1982; Ludwig & Miller, 2007; Ramey & Landesman Ramey, 2000; Ramey, Ramey, & Lanzi, 2001; Zigler & Berman, 1983). More recently, some debate has arisen as to how well these effects have held up over time and whether Head Start programs are worth their cost.

THINKING CREATIVELY

Suppose you want to improve your students' attitudes toward schoolwork. What might you do to help students feel more positive about themselves and their performance?

SUGGESTION: Ask students to identify strengths in their work, and then help them apply these strengths to other skills.

Some analysts (e.g., Herrnstein & Murray, 1994), using the argument that intelligence is partially genetically based, have suggested that programs such as Head Start are likely not to be very successful. They have suggested that improvements in performance are temporary, in any case. Thus, according to this view, any gains made by Head Start participants do not represent true changes in ability. Of course, there may be other reasons why these gains are temporary (Ramey & Landesman Ramey, 2000). For example, if an intervention is started but then a child is thrown back into an environment that does not carry through on the intervention, the effects of the intervention will almost inevitably be weakened. As an analogy, consider a diet. The diet can help you lose weight, but you will keep the weight off over the longer term only if you change your way of eating afterward, not just during the diet!

INSTRUMENTAL ENRICHMENT PROGRAM. Head Start was created to accomplish several different goals. In contrast, some other programs have been developed for the sole purpose of improving intelligence. One of the more notable programs is the Instrumental Enrichment program designed by Reuven Feuerstein (1980), which is intended to remedy deficiencies in cognitive processing and to increase students' internal motivation and feelings of self-worth. The data from this program are mixed, however (Arbitman-Smith, Haywood, & Bransford, 1978; Kaufman & Burden, 2004; Schnitzer, Andries, & Lebeer, 2007).

To teach these general "learning to learn" skills, Instrumental Enrichment instructors guide children through a set of exercises. They involve solving very abstract problems that have no clear connection to the problems found in particular course materials. The problems in these exercises closely resemble those found on IQ tests. The skills acquired through working on these problems can then, in theory, be applied to a broad range of more concrete, "realistic" problems with the help of an instructor.

For example, in one activity, called *orientation of dots,* children practice identifying and outlining sets of geometric figures embedded in a variety of two-dimensional arrays of dots. This exercise is expected to help children focus on information present in a situation and detect meaningful patterns.

The Instrumental Enrichment program also focuses on *bridging*, in which each teacher is charged with helping children extend the skills they have learned to concrete, everyday problems. Teachers are instructed to spend at least half their time in bridging activities.

ODYSSEY PROGRAM. The Odyssey program was constructed by a team of investigators at Harvard University and Bolt, Beranek, and Newman (Adams, 1986). Like the Instrumental Enrichment program, it has been shown to improve children's thinking skills (Feuerstein, 1980; Herrnstein, Nickerson, de Sanchez, & Swets, 1986).

IDEAL PROBLEM SOLVER. The IDEAL Problem Solver program (Bransford & Stein, 1984, 1993) aims to teach problem-solving abilities.

PRACTICAL INTELLIGENCE FOR SCHOOL. Not all programs attempt to develop all aspects of intelligence. For example, Practical Intelligence for School (Williams, Blythe,

White, Gardner, & Sternberg, 2002; Williams, Blythe, White, Li, Steinberg, & Gardner, 1996), a joint effort between Harvard and Yale Universities that combines aspects of the theory of multiple intelligences with aspects of the triarchic theory of intelligence, has been found to be successful at improving the adaptability of middle school children to the intellectual demands of reading, writing, homework, and test taking (Gardner, Krechevsky, Sternberg, & Okagaki, 1994; Sternberg, Okagaki, & Jackson, 1990).

In conclusion, good evidence indicates that teachers can have some effects on children's intellectual functioning through carefully constructed interventions.

iMPLICATIONS FOR TEACHING

- **Allow children to play and learn without too many limitations.** Small class sizes, if possible, foster teacher–child involvement. Expert teachers provide a clearly organized classroom with hazardous materials removed or locked, so children can safely learn and play without too many physical restrictions. They also provide plenty of toys and materials for all students, so that each child can have a variety of experiences.
- **Focus on each student's potential for improvement.** Embrace the concept that intelligence is modifiable. When students feel that they have no potential, their enthusiasm for learning diminishes. Expert teachers emphasize their students' potentials, thereby encouraging students to improve their abilities. Although the effects are not always dramatic, expert teachers can help improve the intelligence of any student.
- **Provide opportunities to practice skills that are part of intelligent behavior.** Many programs for improving intelligence include exercises designed to help students develop the skills that are part of overall intelligence (e.g., Feuerstein, 1980; Sternberg, Kaufman, & Grigorenko, 2008). Students may improve their overall intellectual functioning if they are able to improve even one aspect, such as the ability to monitor their performance while solving problems. A formal program might explain why self-monitoring skills are important and how to check answers to math problems, for example. Even without a formal program, though, teachers can provide similar instruction and practice.
- **Help students link skills to real-world needs.** The Practical Intelligence for School program emphasizes not only being "smart," but also knowing how and when to apply intelligence. Teachers who can help students see ways to effectively use their skills may help those students improve their chances of achieving their goals in life (Sternberg, 1996b).

CHILDREN AT RISK

Many factors can place children at risk. Usually, when people think about environment, they think about family, educational, economic, political, and similar influences. These influences are certainly important (Segal & Hershberger, 2005; Sternberg & Grigorenko, 2001), but environmental experience begins even before birth. Prenatal nutrition is an environmental influence, for example, as is prenatal exposure to toxic substances. A child born to a mother addicted to drugs, or whose mother has consumed even moderate quantities of alcohol, has experienced a harmful environment before birth (Mayes & Fahy, 2001; Willford, Leech, & Day, 2006). How genes express themselves depends in large part upon prenatal as well as postnatal environment. Postnatal nutrition is at least as important as prenatal nutrition (Arija, Esparó, Fernández-Ballart, Murphy, Biarnés, & Canals, 2006; Grantham-McGregor, Ani, & Fernald, 2001; Grigorenko, 2003; Hadders-Algra, 2005). Other environmental factors can also have effects on children's intellectual abilities, such as exposure to environmental pollutants (Bellinger & Adams, 2001; Perera et al., 2006), infectious diseases (Alcock & Bundy, 2001), radiation (Grigorenko, 2001), heavy metals (Axelrad, Bellinger, Ryan, & Woodruff, 2007; Hu et al., 2006), and family environment (Burchinal & Caskie, 2001; Evans, 2006; Guidubaldi & Duckworth, 2001; Marjoribanks, 2001). These environmental factors can affect how genes are expressed in an individual's development.

Some children are placed at risk because they have experienced major traumas. For example, in 1984, a toxic gas, methyl isocyanate, leaked from a Union Carbide plant throughout the city of Bhopal, India. As a consequence of this event, the entire population of children in the city was immediately placed at risk for serious physical and psychological trauma that could affect their school performance and their prospects later in life. This disaster was one of the largest human-made disasters in history, and its effects are still felt (Murthy, 2002). Radiation leaks can also cause major trauma, as happened at Chernobyl, Ukraine, in 1986 and, to a lesser extent, at Three Mile Island, Pennsylvania, in 1979 (Bromet & Litcher-Kelly, 2002). Exposure to violence is also associated with decreased measures of intelligence (Ratner, Chiodo, Sikil, Ager, & Delaney-Black, 2005; Saltzman, Weems, & Carrion, 2005). When major tramas occur, whether due to accidents or wars or famines, schools must make special provisions to deal with both the cognitive and emotional effects of those events.

Not all sources of risk are disaster related. Children can be at risk because of threats, whether or not those threats actually materialize. For example, many children today are frightened of the risks of terrorism (Mann, 2002). Divorce, poverty, maltreatment, hunger, and many other factors can all place children at risk.

Expert teachers need to be aware of factors in children's environments that may place them at risk for poor achievement or emotional problems. In certain cases, they may need to refer children for counseling when the problems are beyond what their education would sensibly enable them to handle.

TEACHING STUDENTS OF VARYING LEVELS: ABILITY GROUPING

Expert teachers know that people are malleable in their abilities. People are open to experience and change, rather than being fixed at an immutable level set at conception. Improvements in intelligence, however defined, do take time, as well as careful planning. Even so, many teachers must face the immediate question of how to teach students who are currently functioning at a variety of levels.

As a teacher, you may encounter substantial differences in your students' patterns of abilities. For example, if you ask the class to read a passage of text, and you then question the students about the material, you may notice that some students can answer your questions with such ease that they seem bored. Other students seem to be truly provoked into thought by your questions. Still others struggle to make out many of the words. How can you effectively teach students at varying levels of ability?

One method that has been widely used is **ability grouping,** the practice of assigning students to separate instructional groups on the basis of similar levels of achievement or ability in a subject. Ability grouping is very common at all educational levels in U.S. schools (Oakes, Quartz, Gong, Guiton, & Lipton, 1993; Wheelock, 1994). A variety of methods for grouping students according to ability have been developed.

Within-class grouping allows a single class of students to be divided into two or three ability groups for instruction, particularly in reading and math.

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■ METHODS OF GROUPING BY ABILITY

There are three main types of ability groups. The first is **within-class grouping,** in which a single class of students is divided into two or three groups for instruction in certain subjects. For example, an individual fourth-grade teacher may keep his or her entire class together for most of the day, but divide the class into three different groups for reading lessons. Within-class grouping is most common at the elementary school level (Goodlad, 1984; McPartland, Coldiron, & Braddock, 1987), where ability groups are often used for reading and sometimes for math (Mulkey, Catsambis, Steelman & Crain, 2005; Slavin, 1993).

A second method of ability grouping is **between-class grouping.** In this method, students are assigned to separate classes according to ability. Assignments

are often made on the basis of standardized intelligence or achievement tests. Using this plan, for example, seventh-grade students, such as Tony Garcia's, might be assigned to a lower level, mid-level, or high-level math course on the basis of their previous math performance or their standardized test scores. Between-class ability grouping is more common at the middle school and high school levels than at the elementary school level (McPartland et al., 1987).

Between-class ability grouping can be expanded into a practice known as **tracking,** or making assignments to all or almost all classes based on variations in ability levels and possibly interests. Often, students are assigned to a given track. They then stay in that track for all classes. For example, many high schools have separate college preparation and vocational preparation tracks (Braddock, 1990).

A third major method is known as **regrouping,** an ability-grouping plan in which students are members of two or more classes or groups at once. With this approach, students are assigned to a general, mixed-ability class for most of the day, but regroup (i.e., switch to ability-based groups) for certain subjects. Under a regrouping plan, for example, a fourth-grade student might stay with his or her main class group for social studies, English, art, music, and physical education, but study math with a different group of students during part of each day. Regrouping is often used in elementary schools.

There are several variations on the general regrouping idea. For example, ability groups in a regrouping plan may be made up of children who are all at the same age or grade level, or they may be composed of students from a range of ages and grade levels.

A regrouping plan in which students of various ages are assigned to the same ability-based group is known as the **Joplin Plan.** This approach uses nongraded, or cross-age elementary schools, in which students are not assigned to grade levels, such as first or second grade, but rather are grouped according to broad age categories, such as ages 5 to 7. Within the broad groups of nongraded schools, students of various ages may be grouped by ability for instruction in some subjects (Guitiérrez & Slavin, 1992).

■ **ADVANTAGES AND DISADVANTAGES OF ABILITY GROUPING** Ability grouping has several advantages for teachers and students. This practice can help teachers meet the need to adjust their teaching techniques to the varying levels of their students. For example, teachers can cover topics faster or slower, depending on students' needs. They can also match textbooks and other teaching materials more closely to students' abilities than they could in a mixed-ability classroom. Adjusting instruction to groups of students, rather than individualizing instruction for each pupil, also helps teachers make effective use of their limited time (Cotton & Cavard, 1981).

In addition, students may be helped in some subjects by being in groups with peers at similar achievement levels. In reading, math, and foreign languages, for instance, skills are acquired sequentially, with more advanced skills building on the foundation of basic skills. Students who are at various points in skill building can be grouped and taught the skills they currently need (Slavin, 1993).

The disadvantages of ability grouping may outweigh the advantages of this approach, however. Between-class ability grouping has the most problems.

- Students in between-class groups or tracks are often trapped in their assigned group for an entire school year, or longer, even if their skills have changed and the placement is no longer appropriate (Good & Marshall, 1984; Oakes, 1992). A less obvious problem is that students from lower socioeconomic levels and ethnic minority groups tend to be overrepresented in lower-ability groups. Higher-ability groups have higher percentages of white and higher-socioeconomic-level students (Braddock & Dawkins, 1993; Dornbush, 1994).
- Students in the lower-ability classes often receive lower-quality instruction, with less instruction on critical thinking skills and more emphasis on drills and routines, than do students in higher-ability classes (Gamoran, Nystrand, Berends, & LePore, 1995).
- Placement in a low-ability group can stigmatize students socially and lower their self-esteem (Oakes & Guiton, 1995; Page, 1991). Perhaps these disadvantages contribute to the greater likelihood that students in lower-ability tracks, as compared with other students, will drop out of school (Goodlad, 1984).

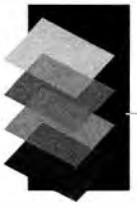
- Between-class grouping may not be effective. Some studies have found that lower-ability students who were placed in mixed-ability classes performed better than did lower-ability students who were assigned to homogeneous low-ability classes (Good & Brophy, 1994).
- Certain forms of ability grouping, and certainly tracking, are inconsistent with modern notions of cognitive expertise as comprising multiple abilities or even intelligences.

Within-class and regrouping plans are generally more successful than between-class grouping approaches (Slavin, 1987). These plans usually have more flexibility for moving students to new groups as the students' abilities develop than do between-class grouping plans (Mason & Good, 1993). Also, ability groups in within-class and regrouping plans are typically limited to one or two subjects—students remain in mixed-ability classes during the rest of the school day. Within-class plans can cause difficulties for teachers, however, as they must plan and monitor independent activities for some students while working in a group with others (Good & Brophy, 1994; Oakes, 1992).

Expert teachers take into account both the advantages and the disadvantages when deciding whether to use ability groups. Those who decide to use ability grouping, or who are assigned to ability-tracked classes, can also use some techniques to make their teaching more effective. Often, simple group activities work quite well, without the need for grouping by abilities for the groups to be effective (Slavin, 1995).

*i*MPLICATIONS FOR TEACHING

- **Target ability grouping carefully.** People often have stronger abilities in some areas than in others. Group assignments should, therefore, be made on a subject-by-subject basis.
- **Make assignments based on multiple measures.** Assignments should be based not only on test scores, but also on past performance, teacher observations, and other sources of information (Corno & Snow, 1986; Gamoran et al., 1995).
- **Assess student progress frequently and adjust group assignments according to progress.** Change group assignments as students' skill levels change. Elementary school teachers who use within-class reading or math groups can easily switch students to different groups. At the secondary level, where students may be tracked into an entire sequence of classes, teachers must be prepared to accommodate different ability levels, even within supposedly homogeneous groups.
- **Avoid comparing groups.** Discourage unfavorable remarks about lower-ability groups. If such comparisons do arise, you may wish to point out to students the compensatory nature of abilities, or the flexible nature of the groups. A student who is feeling discouraged about being assigned to the prealgebra class instead of the algebra class might be reminded of his or her other strengths.
- **Keep quality of instruction high for all students.** Lower-ability students may be learning earlier steps in the acquisition of subjects than higher-ability students. Teachers should not, however, reduce their enthusiasm or expectations for students in the lower-ability groups. Plan lessons carefully for groups at all levels to encourage participation, creativity, and critical thinking. Explain to students that they can go quite far just on the basis of their commitment to learning.



Cognitive Styles and Learning Styles

Despite the importance of responding to students' differing ability levels, expert teachers know that other factors besides intelligence can affect students' levels of achievement. Styles of thinking and learning often affect how students will behave in school

and which kinds of teaching and learning situations will be most effective for those students. Styles of thinking are different from abilities. Abilities are about what students *can do*, whereas styles are—at least in theory—about what they *prefer to do*.

The combination of personality with intelligence has been called cognitive style (Sternberg & Zhang, 2000). Two students may be equally capable. One may prefer to work on her own ideas and to write essays on topics she generates, however, whereas the other may await explicit direction from a teacher before attempting schoolwork. In Tony Garcia's class, for example, some students were content to do the homework problems and take the tests Tony assigned. Others relished the opportunity to think of their own ideas for class projects.

Similarly, one student may enjoy the details of an assignment, whereas the other may prefer thinking about the conclusions and what they mean rather than getting bogged down in details. One student may easily prioritize a list of tasks in a manner that matches the teacher's expectations, whereas the other is unable to see which tasks are more important and so jumps from task to task. In addition, two students may have differences in their preferred learning styles—that is, the ways they like to learn. One may enjoy a noisy classroom, with lots of talk and group action, whereas the other prefers quiet and solitude. Again, these two students may have similar levels of intelligence or even similar levels of multiple intelligences. The expression of their intelligence is affected by their differing personalities, leading to their different cognitive and learning styles.

COGNITIVE STYLES

A **cognitive style** (sometimes also called a **thinking style**) is an individual's preferred way of mentally processing information. Several differences in cognitive style have been explored. We briefly review a few of the main ones here (for more detailed reviews, see Grigorenko & Sternberg, 1995; Kozhevnikov, 2007; Messick, 1984; Sternberg, 1997a; Sternberg & Grigorenko, 2000a; Sternberg & Zhang, 2000), along with their implications for teachers.

■ FIELD INDEPENDENCE VERSUS FIELD DEPENDENCE

A **field-independent** person is able to separate self, or objects viewed, from the surrounding context. For example, a field-independent person might be better able to read text upside down than a field-dependent person. A **field-dependent** person has trouble separating self, or objects, from the surrounding field. A typical test for field independence asks a person to detect a particular shape embedded in the context of other, surrounding shapes, such as a hidden triangle in a set of intersecting lines. Field-independent people can separate the target shapes from the background, or field, more quickly and easily than can field-dependent people (Witkin, 1973; Witkin, Dyk, Faterson, Goodenough, & Karp, 1962; Witkin, Oltman, Raskin, & Karp, 1971).

Students' level of field independence can be related to their performance in school (Davis, 1991).

- Field-dependent students tend to be more attuned to the social aspects of school situations. They may perform better at group tasks than field-independent students, for example. They may prefer academic subjects, such as literature and history, that require them to perceive broad patterns. Teachers may sometimes need to help field-dependent students see the key elements of a problem or set their priorities for an unstructured task.
- Field-independent students are able to separate and analyze components, or parts, of a larger pattern by ignoring irrelevant details. These students may prefer subjects such as math or science that require their analytical abilities (Wapner & Demick, 1991). Field-independent students may need help seeing how their actions affect the group as a whole or perceiving how several isolated facts can fit together into a larger pattern.

Because teachers are unlikely to know their students' styles, they must plan to teach in diverse ways to all students.

Field independence was formulated as a cognitive style. However, higher levels of it are associated with higher levels of spatial ability—meaning that it does not quite function the way a style should (see Ferrari & Sternberg, 1998; Sternberg, 1997a).

Laima Druskis/PH College

Students' levels of impulsivity often affect their performance in school. Impulsive children, for example, frequently offer incorrect solutions to reasoning problems and visual discrimination. With expert teaching, these students can learn to be more reflective without losing their enthusiasm.

■ **REFLECTIVITY VERSUS IMPULSIVITY** A **reflective** person tends to consider alternative solutions before reaching a decision (Rozencwajg & Corroyer, 2005). An **impulsive** person tends to produce quick answers without carefully thinking about them first (Kagan, 1965, 1966). A person's level of reflectivity or impulsiveness seems to be a general stylistic trait that appears early in life and affects the individual's behavior in a variety of situations.

Students' levels of impulsivity can affect their performance in school (Spinella & Miley, 2003). Impulsive children tend to make more errors in reading and memory tasks, and they more frequently offer incorrect solutions to reasoning problems and visual discrimination tasks (Stahl, Erickson, & Rayman, 1986). With expert teaching, students can learn to be more reflective. To keep impulsive students from cutting short the thoughts of more reflective students, you may want to consider using turn-taking systems for group question-and-answer sessions. During individual tasks, encourage impulsive students to talk to themselves mentally as they are working on problems. For example, on multiple-choice tests, students can remind themselves to cross off each answer choice as they consider it, so as to avoid making a premature answer choice. Teach students how to check their work on math or science problems. Consider rewarding evidence of self-checking when grading papers and tests.

■ **MENTAL SELF-GOVERNMENT** People, like towns or countries, need to organize and govern themselves. The **theory of mental self-government** (Sternberg 1988, 1994a, 1994b, 1997b) distinguishes among 13 main learning styles. Three of the styles are listed in Table 4.2, along with the kinds of instructional and assessment activities that tend to be oriented toward each of the styles. These three styles are as follows:

- *Legislative*: A student who enjoys creating, formulating, and planning problem solutions and likes to do things his or her own way.
- *Executive*: A student who likes to implement plans, follow rules, and choose from established options.
- *Judicial*: A student who enjoys evaluating rules, procedures, or products.

The theory of mental self-government can help explain why some ways of teaching and assessing students tend consistently to benefit students with certain styles at the expense of students with other styles. Research shows that teachers tend to give better evaluations to students whose styles more closely match their own. This tendency may reflect teachers' tendencies to overestimate the extent to which students share their own styles of thinking. Given this opportunity for bias, whenever possible, teachers should try to include methods and activities that appeal to a broader variety of self-government styles. The idea is not to label students, but rather to teach to all styles. Of course, not all schools value the same styles. In fact, large differences have been found in which styles are preferred in which schools (Sternberg & Grigorenko, 1997b).

LEARNING STYLES

Students' individual preferences or needs for different learning conditions are called **learning styles,** or **learning preferences.** Learning styles can range from straightforward preferences for physical surroundings to more fundamental differences that may be rooted in culture or personality. We examine some key aspects of learning styles here, starting with the basics.

TABLE 4.2 Three Styles of Mental Self-Government

Style Name	Description of a Student Who Works in This Style	Teaching Implications
Legislative	Enjoys creating, formulating, and planning problem solutions. Likes to do things his or her own way.	Legislative students enjoy the opportunity to choose their own topics for papers or projects, devise their own experiments, or organize their own study time.
Executive	Likes to implement plans, follow rules, and choose from established options. Prefers structured problems.	Executive students would prefer to choose from a set of suggestions for paper topics, or to take multiple-choice exams, rather than generate their own paper topics or essay answers.
Judicial	Enjoys evaluating rules, procedures, or products.	Judicial students would likely welcome papers or exam questions that require them to compare and contrast two things, or to analyze a single point of view.

Uncomfortable physical surroundings can distract students from their subject matter. Different students will inevitably have different preferences for aspects of the classroom environment such as lighting, hard or soft seating, or level of noise (Dunn & Dunn, 1987). A quiet corner with soft furniture might be some students' ideal reading environment, whereas others might prefer bright lighting and a desk on which to lay out their work. You may not be able to provide each student with his or her ideal physical environment, but you can often offer a variety of study and learning conditions, all within a single classroom. For example, you might provide headphones so that some students can listen to music or audiotaped books without disturbing those who wish to work quietly. To help students develop flexibility, provide some instruction that fits students' learning styles but other instruction that challenges them to adjust the way they learn.

Some of the styles expressed as physical preferences may actually be culturally related differences in learning (Watkins, 2000). For example, some Native American, African American, and rural students may come from families that favor spoken learning over written learning. These students might learn better by listening to a book on tape as they read it, rather than just reading it alone (Bennett, 1995). Some Asian American and African American students may have a cultural background that encourages interdependence among people, rather than the independent achievements traditionally encouraged by U.S. schools. (For more about cultural differences in learning styles, see Chapter 6.) To meet all their students' needs, expert teachers provide opportunities for students to learn in groups, or through cooperative projects, as well as independently.

Individual differences in personality, as well as cultural background, can affect the way different students approach the same learning task. One personality difference in learning style is the depth to which students prefer to process information (Snow, Corno, & Jackson, 1996). Some students take a deep-processing approach, seeking the underlying concepts, or meaning, of activities or lessons. Others take a surface-processing approach, focusing on memorization rather than analysis and understanding. Some researchers have found that students' preferences for depth of processing are more likely to be stable across situations and subjects (Biggs, 2000; Boulton-Lewis, Marton, & Wilss, 2000; Entwistle, McCune, & Walker, 2001; Pintrich & Schrauben, 1992). Students who take a surface approach tend to be motivated by grades and other external rewards, whereas those who take a deep approach seem to enjoy learning for the sake of learning. The latter students are less concerned with external evaluations and learn more from their studying (Marton & Booth, 1997).

As with cognitive styles, such as impulsivity, teachers can encourage students toward taking either a deeper or more surface approach. For example, designing tests that emphasize key concepts of lessons, rather than just surface features, such as key terms, can encourage deeper processing. As Tony Garcia discovered, projects that require students to apply the ideas from a lesson to another context also encourage deeper processing. For example, a teacher might ask students to apply the idea of hubris, or excessive pride, learned from studying Shakespeare, by finding examples of hubris demonstrated in current events or movies.

Students who process information more deeply may also be able to produce more creative work than can surface processors. We explore individual differences in creativity next.

Understanding Individual Differences in Creativity

Creativity is the ability to produce work that is novel, high in quality, and appropriate (Barron, 1968; Jackson & Messick, 1965; MacKinnon, 1962; Ochse, 1990; Sternberg & Lubart, 1999). A product is novel when it is original and unexpected. A product is appropriate when it provides a usable solution to a task.

Creativity—your own as well as your students'—is very important to you as a teacher. As this chapter on individual differences has demonstrated, you sometimes must become an expert in inventiveness to teach each of your students effectively. You will also find it very rewarding to develop your students' creativity.

On an immediate level, grading projects can become more fun and interesting when students are asked to develop creative solutions, as Tony Garcia, the math teacher described at the beginning of the chapter, noticed! Teachers who encourage students to display their creativity are likely to discover that some of those students possess abilities the teachers had never noticed before. On a deeper level, you receive the reward of knowing you are preparing your students to think and act in novel and appropriate ways to solve problems they will face throughout their lives—problems we may not even be able to imagine today.

To help your students be as creative as possible, you must first broaden your own understanding of creativity. Several different approaches to creativity have been proposed (Albert & Runco, 1999; Runco, 2004; Runco & Pritzker, 1999; Scott, Leritz, & Mumford, 2004; Sternberg & Lubart, 1996). We consider four such approaches next.

THINKING CREATIVELY

Some people feel as though they are guided by a muse, although the effects of this perceived muse can be explained by scientific means. What kind of scientific explanation might account for the subjective perception of a muse?

SUGGESTION: Because people do not understand where ideas come from, they hypothesize a muse.

THE MYSTICAL APPROACH

In the mystical approach to creativity (the oldest approach known), creativity is seen as the result either of divine intervention or of other unexplainable forces. For example, Plato argued that a poet creates only as allowed by his or her muse (a goddess who presides over the arts). The writer Rudyard Kipling referred to a "Daemon" as guiding his pen. To this day, many people believe their creative ideas are somehow divinely inspired. They believe the ideas are under the control of forces that are supernatural, or at least not understandable through scientific means. The problem with this approach is that it lends itself neither to scientific investigation nor to educational interventions.

THINKING ANALYTICALLY

To encourage students to think about stories they've read, ask them to explore how authors develop characters with different personalities and different motives. Explain what students are learning about creative thinking in this activity.

SUGGESTION: Students can learn that, for any one story, there are many different ways an author can depict a character (divergent thinking), but usually only one way that seems right given the story and the conflict the character may be called on to resolve (convergent thinking).

THE PSYCHOMETRIC APPROACH

In the psychometric approach to creativity, the central emphasis is on measuring creative abilities in much the same ways as other abilities, such as intelligence, are measured (Garaigordobil & Pérez, 2005; Plucker & Renzulli, 1999). This approach to creativity is best exemplified by the Torrance Tests of Creative Thinking (Torrance, 1974), which are fairly widely used in assessing creativity. Examples of exercises in the Torrance tests include looking at a picture and thinking of questions one could ask about it, thinking of ways to change a toy monkey so children will have more fun playing with it, and expanding empty circles into different drawings and then titling these drawings.

J. P. Guilford (1950) especially emphasized the role played in creativity by **divergent thinking,** or the ability to generate many different ideas in response to a problem. The opposite of divergent thinking is **convergent thinking,** the process of finding a single correct answer. Convergent thinking is the more common kind of thinking required in schools. Like others who take a psychometric approach, Guilford attempted to measure individuals' divergent thinking abilities. For example, in one of Guilford's creativity tests, called "Unusual Uses," a test taker has to think of as many unusual uses as possible for fairly common objects, such as a brick or a paper clip. Guilford (1967) was also well known for his theory of intelligence.

SOCIAL-PSYCHOLOGICAL APPROACHES

Social–psychological approaches to creativity focus on aspects of the environmental that influence creative thinking. For example, Teresa Amabile (1983, 1996) and some other researchers (Crutchfield, 1962; Golann, 1962; Perry-Smith, 2006) have emphasized the relevance to creative thinking of environments that foster **intrinsic motivation**—the desire to do something because you really want to do it, not for the sake of any external rewards. The opposite of intrinsic motivation is **extrinsic motivation,** or doing something just to achieve rewards, such as praise, good grades, or a paycheck, from an external source. Creative people are generally people who love what they are doing. Helping children find what they love to do is one of the single best ways teachers can enhance their creativity—and their motivation to learn, as you will find in Chapter 10. Creative people often generate ways to find extrinsic rewards for what they are intrinsically motivated to do.

Dean Simonton (1984, 1988, 1994, 1999) has analyzed society's role in the development of creative thought. For example, Simonton (1988) has shown that the odds of an eminent creative person emerging in a given generation increase with the number of creatively eminent figures in the preceding two generations. Simonton has also argued that people who are thoroughly exposed to two or more cultures have a creative advantage over those who are fully exposed to just a single culture. In other words, growing up multiculturally, or at least with exposure to multiple cultures, facilitates creativity.

A CONFLUENCE APPROACH

Many of the ideas just discussed have been integrated into a single **investment theory of creativity** (Sternberg & Lubart,1991, 1995, 1996, 1999). This theory describes creative people as good investors in the world of ideas who "buy low and sell high." That is, the creative individual finds an idea that is undervalued by contemporaries ("buys low") and then develops that idea into a meaningful, significant creative contribution. Once the creator has convinced other people of the worth of that idea, he or she then moves on to the next unpopular idea ("sells high").

The investment view of creativity represents a coming together, or confluence, of a number of research and theoretical strands to fashion a composite picture of creativity (see also Amabile, 1996; Barron, 1988; Collins & Amabile, 1999; Costa & McCrae, 1985; Frensch & Sternberg, 1989; Ghiselin, 1952/1985; Golann, 1962; Hayes, 1989; Mayer, 1999; McClelland, 1953; McCrae, 1987; Roe, 1953). Creative people, according to this theory, have the following characteristics:

1. They do not accept traditional ways of seeing problems, but rather try to see problems in new ways.
2. They know something about the field to which they wish to contribute, but are usually not "walking encyclopedias" of knowledge in the area or at least do not allow their knowledge to interfere with their seeing things in new ways.
3. They like being creative.
4. They persevere in the face of obstacles.
5. They are open to new experiences.
6. They are willing to take sensible risks.
7. They are intrinsically motivated.
8. They find environments that support and reward their creative work.

THINKING ANALYTICALLY

How might the school environment either facilitate or impede creative work on the part of students or teachers?

SUGGESTION: Schools facilitate creativity when they encourage students to take intellectual risks, and they impede creativity when they discourage such risks.

IMPLICATIONS FOR TEACHING

- **Model creativity.** Provide students with profiles of creative individuals in different fields, including artists, writers, scientists, historians, and mathematicians (see, for example, Gardner, 1993a; Gruber & Wallace, 1999; Policastro & Gardner, 1999). Expert

teachers actually demonstrate creativity themselves. Other ways of bringing creativity into the classroom include involving students in writing, in acting in plays, or in story-like demonstrations that illustrate a concept covered in class.

- **Encourage students to question assumptions.** Ask questions that provoke students to question common assumptions or to imagine someone else's viewpoint. Let students work together in groups on some projects, so they have the benefit of hearing several viewpoints on a single problem.
- **Encourage sensible risk taking.** Expert teachers take steps to counter thinking that is wholly risk avoidant. Train students to distinguish sensible risks, such as an unusual choice of topic or approach for a paper, from senseless risks, such as dropping out of school or taking drugs. Encourage sensible risk taking by praising the effort, even when you must provide negative feedback on the result.
- **Promote persistence.** Creative thinkers need to develop an attitude toward objections to new and unpopular ideas as normal responses to creative thinking. You can help students in this regard by modeling persistence and by pointing out other models who triumphed through perseverance. You can also reward persistence through encouragement and even grading practices such as "second chances"—opportunities to resubmit assignments after improvements have been made.
- **Allow mistakes.** Children who have developed a tolerance for risk and are willing to face the possibility of failure actually choose to attempt to solve harder problems. They also score higher on standardized tests than do children who are less willing to take risks (Clifford, 1988). Expert teachers can use mistakes to reinforce creativity. Discuss students' mistakes to help them see how a good idea may have gotten off-track or what could be improved in their next effort.
- **Model and encourage divergent thinking.** Ask the class to predict the results of a scientific experiment before they conduct it. Brainstorm ideas for alternative conclusions when discussing current events, historical events, or story plots (Richards, 1999). It may soon become clear to students that the more they learn about a subject, the more ideas they are able to generate when a question or problem arises.
- **Allow time and opportunities for creative thinking.** Allow students to experiment with using classroom materials, or combining subjects, in novel ways. Expert teachers do not assume that students who seem to be doing nothing are actually unoccupied. Instead, the students may be planning or thinking about a problem.
- **Reward creativity.** Although intrinsic motivation is important in creativity, teachers can sometimes reward students' creative work without damaging their desire to continue. Praise students for the diversity of ideas shared in a class brainstorming session, or include a grading component for creativity on some projects. Create an environment in which creativity is allowed to flourish (Sternberg & Lubart, 1995).

There are many ways to teach creativity. Steps people can take to enhance the creativity of their work are shown in Table 4.3.

Wisdom

A topic of growing interest in schools is that of wisdom. Wisdom can be defined as the "power of judging rightly and following the soundest course of action, based on knowledge, experience, understanding, etc." (*Webster's New World College Dictionary*, 1997, p. 1533). Such a power would seem to be of vast importance to everyone who wishes to act in a responsible way.

The most extensive program of research on wisdom has been conducted by Baltes and his colleagues. Baltes (Baltes & Staudinger, 2000) emphasized the role of knowledge in wisdom.

TABLE 4.3 Teaching for Creativity

Implication	Example at Preschool/ Primary Level	Example at Elementary School Level	Example at Middle School Level	Example at High School Level
Model creativity	Feel free to use "unrealistic" colors or pictures for bulletin boards, handouts, or computer programs.	Demonstrate ways to combine ideas from subjects that are usually covered in the school day. For example, use chemical reactions to produce a musical instrument of some kind.	Provide examples of creative individuals in different subjects. Use your desk or office space to express your own creativity. Publicly acknowledge students who dress, eat, play, or work creatively.	Model divergent thinking by brainstorming with students to list a number of possible solutions to demonstration problems.
Encourage students to question assumptions	Imagine with students what classic stories would be like if the main characters' roles were changed. For example, what if a little "Goldy-Bear" came into the house of three people?	Consider assigning students to read "wacky" children's books that question common ideas, such as *Cloudy with a Chance of Meatballs*, about a town where food falls from the sky.	Ask students to write alternative endings or alternative versions of assigned stories, or books.	Consider assigning students to develop spoofs or current adaptations of classic literature.
Encourage sensible risk taking	Provide a safe environment for young children to try new physical skills.	Help children distinguish sensible from dangerous risks, to help students decide if the idea is too risky. For example, discuss "What is the worst thing that could happen?" if the class decided to implement the idea.	Encourage students to develop ideas for creative paper topics or projects, and help them evaluate which ideas present acceptable creative risks.	Encourage students to attempt seemingly difficult courses or projects.
Promote persistence	Model persistence when your own first attempts fail. Praise students when they are noticeably trying hard to learn new skills.	Encourage students to try again if they give a wrong answer during a question-and-answer session.	Point out instances of persistence by creative role models in various fields. For instance, describe how hard professional athletes must train and practice to make their movements seem beautifully effortless.	Consider allowing "second chances" on homework or projects—opportunities to re-submit improved work for a potentially higher grade.
Allow mistakes	Encourage young children to try new activities, even though they may not be good at them.	Praise students for trying to answer a question or work on a problem in class, even if the solution is not correct.	To avoid unduly penalizing students for creative risk taking, consider grading schemes that allow students to drop their worst quiz, project, or assignment from their overall grade.	Help students learn from mistakes by providing specific feedback on how an unsuccessful essay, project, or assignment could be improved.
Provide time and opportunities for creative thinking	Whenever possible, let children use toys and classroom materials, like popsicle sticks and construction paper, in novel ways—such as building three-dimensional shapes or new toys like kites.	Allow students to experiment with classroom materials, such as computer graphics programs or art supplies, during free time.	Allow free time for global planning before beginning a class experiment or project.	Encourage students to take responsibility for planning their own creative time, by scheduling free time periods into their school days.
Reward creativity	Praise creative efforts on art or other projects, as well as technical accomplishments.	Display creative work and recognize students' creative successes publicly when possible.	Consider adding a creativity component to the grade for some projects or assignments.	Help students see the possibilities of tangible rewards for some creative efforts. For example, encourage students to submit particularly creative essays or poetry to magazines and newspapers.

According to Baltes, wisdom is reflected in five components:

- *Rich factual knowledge*: general and specific knowledge about the conditions of life and its variations
- *Rich procedural knowledge*: general and specific knowledge about strategies of judgment and advice concerning matters of life

- *Life span contextualism*: knowledge about the contexts of life and their developmental relationships
- *Relativism*: knowledge about differences among people in their values, goals, and priorities
- *Uncertainty*: knowledge about the relative indeterminacy and unpredictability of life and ways to manage

Over time, Baltes and his colleagues (e.g., Baltes, Smith, & Staudinger, 1992; Baltes & Staudinger, 1993; Baltes & Staudinger, 2000; Glück & Baltes, 2006) collected a wide range of data showing the empirical utility of the proposed theoretical and measurement approaches to wisdom. For example, Staudinger, Lopez, and Baltes (1997) found that measures of intelligence (as well as personality) overlap with, but are not identical to, measures of wisdom in terms of constructs measured. Staudinger, Smith, and Baltes (1992) showed that human services professionals outperformed a control group on wisdom-related tasks. They also showed that older adults performed as well on such tasks as did younger adults, and that older adults did better on such tasks if there was a match between their age and the age of the fictitious characters about whom they made judgments. Baltes, Staudinger, Maercker, and Smith (1995) found that older individuals nominated for their wisdom performed as well as did clinical psychologists on wisdom-related tasks. They also showed that until the age of 80, older adults performed as well on such tasks as did younger adults. In another set of studies, Staudinger and Baltes (1996) found that performance settings that were ecologically relevant to the lives of their participants and that provided for actual or "virtual" interaction of minds increased wisdom-related performance substantially.

Sternberg (2001, 2003b; see also Sternberg, Reznitskaya, & Jarvin, 2007) has proposed a different view of wisdom. He suggests that wisdom is the application of intelligence, creativity, and knowledge as mediated by positive ethical values toward the achievement of a common good through a balance among (1) intrapersonal, (2) interpersonal, and (3) extrapersonal interests. That is, wisdom is not simply about maximizing one's own or someone else's self-interest, but rather about balancing various self-interests (intrapersonal) with the interests of others (interpersonal) and other aspects of the context in which one lives (extrapersonal), such as one's school, city, or country.

Problems requiring wisdom always involve at least some element of all three interests (i.e., intrapersonal, interpersonal, and extrapersonal). For example, one might decide that it is wise to take a particular teaching position, a decision that seemingly involves only one person. In truth, many people are typically affected by an individual's decision to take a job—significant others, children, perhaps parents and friends. Also, the decision always has to be made in the context of a whole range of available options.

Which kinds of considerations might be included under each of the three kinds of interests? Intrapersonal interests might include the desire to enhance one's popularity or prestige, to make more money, to learn more, to increase one's spiritual well-being, to increase one's power, and so forth. Interpersonal interests might be quite similar, except that they apply to other people rather than oneself. Extrapersonal interests might include contributing to the welfare of one's school, helping one's community, or contributing to the well-being of one's country. Different people balance these interests in different ways. At one extreme, a malevolent dictator might emphasize his or her own personal power and wealth. At the other extreme, a saint might focus only on serving others and God.

Sternberg and his colleagues have developed a program to teach for wisdom at the middle-school level. The program is taught in the context of American history. For example, a lesson might focus on the meaning of a term such as "settler." What one group of people might view a settler might appear to be an invader to another group of people who already occupy the land to be settled. Differences may arise between groups because of their differing perspectives on what the other group is doing.

WHY UNDERSTANDING INDIVIDUAL DIFFERENCES IS IMPORTANT TO TEACHERS

- Various kinds of individual differences contribute to human diversity. From a teacher's viewpoint, some of the most important are differences in intelligence, in cognitive styles, in creativity and in wisdom.

UNDERSTANDING INDIVIDUAL DIFFERENCES IN INTELLIGENCE

- The modern study of intelligence dates to the work of Alfred Binet, who developed the intelligence test used for determining which schoolchildren should be placed in special classes. An updated version of Binet's test is still used today for measuring people's intelligence quotients (IQs).
- Researchers have disagreed about what intelligence actually is. Spearman suggested the existence of a general factor of intelligence; Thurstone proposed a theory of seven primary mental abilities; and Guilford proposed as many as 180 different abilities based on the crossing of processes, contents, and products.
- Hierarchical theories of intelligence, which propose both a general factor and varying numbers of group factors that apply to limited ranges of tests, represent a widely accepted current view. Cattell suggested fluid intelligence and crystallized intelligence as two important group factors.
- Systems theories of intelligence attempt to integrate psychometric and information-processing approaches. Gardner's theory of multiple intelligences posits eight distinct and relatively independent intelligences. Sternberg's triarchic theory of successful intelligence suggests that intelligence involves, in part, applying component processes to relatively novel tasks for the purposes of adaptation to, shaping of, and selection of environments.

CURRENT EDUCATIONAL CONTROVERSIES IN INTELLIGENCE

- Controversial issues in intelligence include the extent to which intelligence is heritable, and the extent to which it is modifiable. Intelligence seems to be at least partly genetically transmitted. The influence of genes on individual differences in intelligence or other attributes is stated by means of a heritability coefficient. At the same time, environment affects an individual's actual expression of intelligence through gene–environment interaction, often within a given reaction range. Several programs, including Head Start, have been successful in modifying students' intelligence test scores, at least modestly and sometimes only temporarily.
- Another controversial issue in intelligence is the effectiveness of grouping students by ability level. Teachers often rely on ability-based grouping to improve efficiency in instruction. Students can be grouped by abilities in a variety of ways, including between-class grouping, within-class grouping, and various regrouping plans such as the Joplin Plan and ungraded elementary schools. Between-class ability grouping has several disadvantages. For example, tracking causes some students to become trapped within a group that may no longer be appropriate. Within-class and regrouping plans are usually more flexible than between-class grouping plans and may, therefore, be more successful than between-class grouping. Careful and flexible placement, along with high-quality teaching and frequent evaluation, seems to be key in using ability groups successfully.

COGNITIVE STYLES AND LEARNING STYLES

- Cognitive (thinking) styles and learning styles are relevant to how students perform in school. Cognitive styles that have been studied include field dependence versus field independence and reflectivity versus impulsivity. Sternberg's theory of mental government proposes that a variety of thinking styles exist.
- Learning styles range from preferences for certain physical environments to cultural- and personality-based styles, such as a preference for group learning, or for surface versus deep processing of information and materials. Teachers can often structure lessons and classrooms to meet the variety of learning preferences of their students.

UNDERSTANDING INDIVIDUAL DIFFERENCES IN CREATIVITY

- Creativity—that is, the ability to produce work that is novel, high in quality, and appropriate—is an essential attribute for success in today's world. Early mystical approaches to creativity have been replaced by analyses of the cognitive, personality, and social variables that affect creative functioning, such as divergent versus convergent thinking or intrinsic versus extrinsic motivation. The investment theory emphasizes that creative people are ones who go against the crowd.
- Teachers can enhance their own creativity as well as the creativity of their students by finding models of creativity, trying out alternative viewpoints, taking sensible risks, practicing divergent thinking, allowing time for creative thinking, and rewarding creative efforts.

WISDOM

- Wisdom is the use of one's abilities for the common good.

KEY TERMS AND DEFINITIONS

- **Abilitygrouping** Practice of assigning students to separate instructional groups on the basis of similar levels of achievement or ability. Page 142
- **Between-class grouping** Method of ability grouping in which students are assigned to separate classes according to ability. Page 142
- **Cognitive style (thinking style)** An individual's preferred way of mentally processing information. Page 145
- **Convergent thinking** Ability to generate a single correct solution to a problem. Page 148
- **Creativity** Ability to produce work that is novel, high in quality, and appropriate. Page 166
- **Crystallized intelligence** Accumulation of knowledge, as measured by tests of vocabulary and general information. Page 124
- **Divergent thinking** Ability to generate many different ideas in response to a problem. Page 148
- **Extrinsic motivation** Desire to do something so as to achieve rewards from an external source. Page 149
- **Field dependence** Inability to separate oneself, or objects viewed, from the surrounding context. Page 145
- **Field independence** Ability to separate oneself, or objects viewed, from the surrounding context. Page 145
- **Fluid intelligence** Ability to understand abstract and novel concepts. Page 124
- **Gene–environment interaction** Idea that genetic and environmental influences can combine to produce results that might be unexpected on the basis of either factor alone. Page 139
- **General factor (*g*)** Hypothetical single intelligence ability that applies to many different tasks. It was first suggested by Charles Spearman, who theorized that general ability is supplemented by a number of specific abilities, each applying to a different task. Page 122
- **Group factors** Subfactors of Spearman's general factor (*g*) of intelligence that apply across classes of tasks. These subfactors include fluid intelligence and crystallized intelligence. Page 124
- **Heritability** Extent to which individual differences in an attribute are genetically determined, strictly speaking, independently of any environmental influences. Page 148
- **Heritability coefficient** Number between 0 and 1, used to describe the extent to which individual differences in an attribute are due to genetic factors. A coefficient of 0 indicates that heredity has no influence at all on variation among people, and a coefficient of 1 means that heredity is the only factor that has any influence. Page 137
- **Impulsive** Cognitive style characterized by a tendency to produce quick answers without first carefully thinking them through. Page 146
- **Intelligence** Ability to produce goal-directed, adaptive behavior. Components of intelligence include the ability to learn from experience, the ability to adapt to one's surroundings, and metacognition—the ability to understand and control one's own thinking processes. Page 121
- **Intelligence quotient (IQ)** Numerical score that compares the intelligence test performance of each student with an average, or standard, performance. Page 121
- **Intrinsic motivation** Desire to do something simply for the reward of doing it, rather than for the sake of external rewards. Page 149
- **Investment theory of creativity** Theory that describes creative people as those who find an idea undervalued by contemporaries ("buys low") and then develop that idea into a meaningful, significant creative contribution. Page 149
- **Joplin Plan** Regrouping plan in which students of various ages are assigned to the same ability-based group. Page 143
- **Learning styles (learning preferences)** Students' individual preferences or needs for different learning conditions. Page 146
- **Metacognition** People's understanding and control of their own thinking processes. Page 121
- **Modifiability** Extent to which an attribute is susceptible to change. Page 138
- **Psychometric theories of intelligence** Views of intelligence based on statistical analyses of the results obtained on conventional tests of intelligence, requiring students to show a knowledge of basic vocabulary, mathematical ability, and reasoning skills. Page 122
- **Reaction range** Spectrum of ways that an attribute can be expressed in the environment, bounded by genetic possibilities. Page 139
- **Reflective** Cognitive style characterized by a tendency to consider alternative solutions before reaching a decision. Page 158
- **Regrouping** Ability-grouping plan in which students are members of two or more classes or groups at once. Students are assigned to a general, mixed-ability class for most of the day, but regroup, or switch to ability-based groups, for certain subjects. Page 143
- **Theory of mental self-government** Robert Sternberg's theory of thinking styles. This theory suggests there are 13 different main styles that people use to organize and govern themselves so as to learn and think. Page 146
- **Theory of multiple intelligences** Howard Gardner's theory suggesting the existence of at least eight distinct and relatively independent intelligences: linguistic, logical–mathematical, spatial, musical, bodily–kinesthetic, interpersonal, intrapersonal, and naturalist. Page 127
- **Theory of primary mental abilities** Louis Thurstone's theory that seven basic interrelated factors, or mental abilities, make up the core of intelligence. These primary abilities are verbal comprehension, verbal fluency, inductive reasoning, spatial visualization, number skills, memory, and perceptual speed. Page 123
- **Tracking** Practice of making assignments to entire sets of classes based on variations in ability levels and interests. Page 143
- **Triarchic theory of successful intelligence** Robert Sternberg's theory of intelligence that emphasizes relatively interdependent processes. The theory suggests the existence of three related aspects of intelligence: analytic, creative, and practical abilities. Each aspect is described in its own subtheory: the componential subtheory, the experiential subtheory, and the contextual subtheory. Page 129
- **Within-class grouping** Method of ability grouping in which a single class of students is divided into two or three groups for instruction in certain subjects. Page 142

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

1. How could you develop students' awareness of their problem-solving strategies—in other terms, their metacognition—in the course of a math unit on multiplication?
2. What are some methods you would use to encourage students in the primary grades to become more reflective in general, and to engage in more global planning before starting projects, tests, or assignments?
3. How could you encourage student creativity during a fifth-grade unit on electricity?
4. What are some ways you could include Gardner's musical and bodily-kinesthetic intelligences in a second-grade math unit?
5. What are some criteria you would choose for deciding when to switch students to different reading ability groups in your fourth-grade classroom?

IN MIDDLE SCHOOL

1. Design a unit on the Revolutionary War that includes activities using as many as possible of Gardner's eight intelligences.
2. According to Sternberg's triarchic theory of intelligence, students should begin to automatize familiar tasks. How can a middle school math teacher assess the extent to which students have automatized multiplication and division? How can the teacher help students who have not automatized multiplication or division?
3. How could a unit on cellular biology be structured for students who have a field-dependent cognitive style? Could the same unit be designed for field-independent students as well?
4. What are some ways you could encourage divergent thinking in an eighth-grade Spanish-language class?
5. Most of the students in your higher-track seventh-grade English class seem to be highly extrinsically motivated, or perhaps they are only interested in surface processing of the class information. Every time you discuss a topic, it seems the first question is, "Will this be on the test?" How can you present the material in a way that makes learning it more intrinsically rewarding for students?

IN HIGH SCHOOL

1. If you were assigned to teach the lower-track math class, what are some strategies you would use to ensure the quality of instruction equals that offered to the fast trackers in the school?
2. Design a unit on the branches of the U.S. government that would include activities to appeal to the three styles of mental self-government described by Sternberg's theory.
3. What are some ways a high school math teacher can model and encourage creativity in a physics class?
4. How could you provide opportunities for students in your world governments class to use Gardner's interpersonal and intrapersonal intelligences? Do you think this class would provide appropriate opportunities for using musical, bodily–kinesthetic, or naturalist intelligences? Why or why not?
5. Several of the students in your tenth-grade chemistry class seem to be rather impulsive, and you are concerned they may leap too quickly into activities that could be dangerous in the lab. How could you get them to slow down and plan their laboratory work with safety in mind?

Individual Differences

5

EXCEPTIONAL CHILDREN

Teaching Exceptional Children

Major Laws and Legal Rights: No Child Left Behind

Special Education Services: Where Can You Go for Extra Help?

Referring Students for Special Education

Extremes of Intellectual Functioning: Giftedness

Ideas About Giftedness

Identifying Gifted Students

Teaching Gifted Students

Extremes of Intellectual Functioning: Intellectual Disability

Causes of Intellectual Disability

Levels of Intellectual Disability

Characterizations of Intellectual Disability

Challenges to Learning

Learning Disabilities

Attention-Deficit/Hyperactivity Disorder

Emotional and Behavioral Disorders

Health Disorders

Sensory Impairments

Communication Disorders

Perceptual Deficits

Learning and Memory Deficits

Are There Distinct Deficits Due to Hemispheric Specialization?

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this chapter:

- Who are exceptional children, why do they have special needs, and why do teachers need to be aware of and responsive to these needs?
- Which laws protect children with special needs, and how have these laws been implemented?
- How can students with special needs best be served in schools, and what kinds of resources are currently available to them?
- What is meant by a *gifted child*, and what are the means by which we can respond to the needs of gifted children?
- What is meant by *intellectual disability?* What defines children as having intellectual disability, and can we improve the school performance of these children?
- What does *learning disability* mean? How can teachers help students who have learning disabilities?
- What is attention-deficit/hyperactivity disorder (ADHD)? What are the problems that teachers are likely to encounter with such students in the classroom?
- What special knowledge is needed by teachers of students who have physical conditions and illnesses that require attention in the classroom?

Karen Schultz watched as the students filed into her third-grade classroom. "This certainly wasn't what I expected during teacher training," she thought. Only a few years ago, Karen's view of teaching was that if she knew effective teaching techniques and the content of what she was supposed to cover—and if she enjoyed young people—she would have what it takes to become a good teacher. But the reality of her situation proved very different. Karen's class included many different types of children: one student who participated in the school's program for gifted children, one student with mild intellectual disability, one with a hearing impairment, one student who had a reading disability, and another who had been diagnosed with attention-deficit/hyperactivity disorder (ADHD).

Instead of using straightforward teaching tips to present content, Karen found herself dealing with children whose abilities and needs required her to understand a lot more than how to teach typical students. She had to know how to challenge gifted students who were working alongside students with mental disabilities. She had to know how to help the child with a reading disability keep up with the increasing amount of reading children encounter in third grade, and she even hoped to help her overcome her disability. Karen also had to know what to do when the student with ADHD just could not sit still in class, and she had to help her student with a hearing impairment compensate for a physical challenge. In addition to the pressures she felt from the students, she felt pressure from the school administration to meet the requirements of the No Child Left Behind Act, which required her students to achieve at higher levels than many had shown in the past.

After a number of years in the classroom, Karen had learned that succeeding as a teacher meant acquiring broad knowledge and skills. She also had realized that the psychological theories she had studied in her preparation as a teacher were now useful to her in dealing with such a diverse group of students.

Exceptional children present many perplexing challenges to teachers, particularly if they are new to teaching. To develop into an expert teacher, you need to know the content and subject matter of the subjects you teach. You also need to develop general techniques designed to help you communicate this material to your students. And, like Karen Schultz, you need specific knowledge and techniques for dealing with the exceptional students you encounter. The goal of this chapter is to show you that exceptional students can become expert learners, just as typical students can—and it is within your power to provide the help and support they need to actualize their potential.

At one time, most teachers did not need to be especially aware of how to meet the challenges of students with disabilities, but that situation has now changed. Formerly, these students—whether diagnosed with intellectual disability, learning disabilities, physical handicaps, or a variety of other conditions—were placed in *special classes* (Detterman & Thompson, 1997). Today, however, special education teachers are not the only ones who work with exceptional children. The trend toward *full inclusion* of all children in the regular classroom has resulted in almost every teacher becoming a teacher of students with special educational needs. As a result, all teachers need to know how to handle the challenges these students provide.

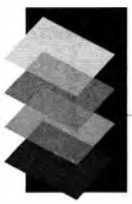
Every student is *exceptional* in multiple ways. Some students are exceptional athletes, while others are exceptional musicians or artists; some are exceptional interpersonally, others are exceptional in their appearance, and still others exceptional because they seem so unexceptional that they are unusual in being so undistinctive! In this text, we define *exceptional* more specifically: An **exceptional child** is one who is unusual in one or more ways, and whose unusual characteristics create special needs with respect to identification, instruction, or assessment. In other words, exceptional children—whether with gifts or disabilities—are ones who for educational reasons, and sometimes for legal reasons, need to be identified and educated as such.

Consider three hypothetical examples. Marlon is a very rapid learner and often feels bored in class, especially in mathematics. A teacher will want to give him especially challenging work in mathematics so that his gift for math flourishes, rather than withers. Tamara, in contrast, finds mathematics extremely challenging and frustrating, although

she has no problems with other subjects. She has a disability in mathematics. Chris finds almost all subjects difficult and learns slowly, pretty much without regard to what he is trying to learn. He has been diagnosed with borderline intellectual disability.

Unless exceptional children with disabilities receive appropriate instruction, they are in danger of failing to gain the skills they will need to succeed—not only in school, but in life in general. This group of **at-risk children** includes children with all of the exceptionalities described in this chapter. It also includes children with other exceptionalities, such as emotional and physical problems, and special forms of learning disabilities. These students need special kinds of interventions inside or outside the classroom to help them reach their potential. They may also need special kinds of assessments (for example, in the case of individuals with visual handicaps or hearing impairments) to allow them to show what they have learned.

In this chapter, we provide an overview of the main types of exceptionalities that can affect the students you teach. First, we highlight the legal implications of working with exceptional children, along with strategies for teaching them effectively.



Teaching Exceptional Children

Special education refers to any program that provides distinctive services for students identified as having special needs. During the first half of the twentieth century, special education as we have come to know it hardly existed at all. Exceptional children received few or no services in the schools. Pupils with sufficiently severe problems to cause discomfort to those educating them were placed into institutions that varied greatly in quality and quantity of services provided. For example, the Southbury Training School, in Southbury, Connecticut, which is still in existence, was founded as a school for individuals with developmental disabilities. It has changed greatly in form—for the better—since its inception.

By the late 1960s, critics argued that students with a variety of disabilities were being shut away in institutions that often did not provide adequately for them. These critics said the institutions often left students without the skills they would later need to become an integral part of society (e.g., Dunn, 1968). Clearly, change was needed. In the 1970s, the first of a series of major special education laws was enacted to bridge this gap.

MAJOR LAWS AND LEGAL RIGHTS: NO CHILD LEFT BEHIND

In 1975, the U.S. Congress passed **Public Law 94-142,** better known as the Education for All Handicapped Children Act, which required states to provide "a free, appropriate public education for every child between the ages of three and twenty-one (unless state law does not provide free public education to children three to five or eighteen to twenty-one years of age) regardless of how, or how seriously, he may be handicapped." Because schools were already educating most children, this law primarily targeted those in need of special education. The law applied to all children, regardless of how or how seriously the children might be challenged. It meant that states could no longer hide from the issues of dealing with children having special needs.

In 1986, **Public Law 99-457** extended these rights to all children ages 3 to 5. It applied regardless of state laws, and added programs addressing the needs of infants with serious disabilities. In 1990, **Public Law 101-476** changed the name of Public Law 94-142 to the **Individuals with Disabilities Education Act (IDEA),** and required that schools plan for the transition of adolescents with disabilities into either further education or employment at age 16.

IDEA also replaced the term *handicapped* with the term *disabled.* "Handicapped" as a label had acquired a stigma. Lawmakers apparently felt "disabled" would be less negatively stereotypic. In time, however, the word "disabled" came to be seen as stigmatizing. Many individuals formerly called "disabled" chose to refer to themselves as "physically challenged"

Index Open

IDEA enabled children with disabilities to participate fully in the public school experience, including riding on a school bus.

or "differently abled" or as "having a disability." Unfortunately, it is difficult to create a term that prevents people who are not members of the group previously termed "handicapped" from drawing negative and prejudicial conclusions about the capabilities of people in the group. No matter how tactfully chosen, a label can become a stereotype.

In your own work as a teacher—and particularly when you speak to your class—you need to make it clear that that each of us has strengths and each of us has weaknesses. Of course, some people's weaknesses are physically easier to observe. Individual children are just that—individuals—and should be described as individuals and treated as individuals, not as bearers of a label.

The **No Child Left Behind Act** of 2001 does not apply only to special education, but it does have implications for special education and so is described in this chapter. The description here is drawn in large part from the following Web site: http://www.iedx.org/article_1.asp?ContentID=EN736&Section GroupID=NEWS (retrieved December 24, 2003). This Act reinforces the Elementary and Secondary Education Act of 1965, which formerly had been the principal law with regard to education in kindergarten through grade 12. The earlier Act was oriented primarily at students who are disadvantaged, but it also contained provisions concerning educational research and development. The No Child Left Behind Act strengthens the role of the federal government in all K–12 education. In a nation that has been dominated by local control of schools, it represents perhaps the first time in the country's history that the federal government has become involved in close monitoring of school quality.

The No Child Left Behind Act has four major provisions:

- *The role of accountability.* Each state must create and implement a system of accountability for the achievement of all students in the public schools. States are required to meet national standards for reading and mathematics. All students in grades 3 through 8 must be tested on an annual basis to ensure that all students reach specified levels of proficiency within 12 years. States must also maintain separate accountings for various groups that are officially considered to be disadvantaged, based on criteria such as ethnicity, disability, and limited English proficiency. If a school district or school fails to show acceptable progress in meeting standards, it will be subject to sanctions and corrective actions to get it back on track.
- *The role of scientific research.* The Act places special emphasis on the role of scientific research in demonstrating the effectiveness of educational programs. Governmental support for research and development is, however, contingent on scientific rigor in the evaluation of educational programs.
- *The role of parents.* Parents of students have enhanced options with regard to their children's schooling. Parents whose children are in Title I schools (schools entitled to special assistance from the government as a result of their having children from poor families who are in need of educational assistance) have the option of moving their children from an under-performing school to a better-performing one in their school district if the school does not improve.
- *The role of local control.* States and school districts have greater leeway in how they can spend federal funds, such as in implementing educational innovations.

Collectively, special education laws have given students with disabilities and their parents a number of legal rights that they did not previously enjoy. For example, parents must be notified about all conferences and decisions regarding the child's placement. They may file a grievance against a school district if they believe the child's special educational needs have been improperly handled. In addition to expanded legal rights for students and parents, the special education laws provide for two other innovations that are particularly relevant for classroom teachers: *least restrictive placement* and *individualized educational programs (IEPs).*

■ **LEAST RESTRICTIVE PLACEMENT** **Least restrictive placement** means that a child must be placed in a setting that is as normal as possible. Partly as a result of this provision, and partly as a result of evolving educational philosophies, exceptional students have increasingly been included in regular classrooms, such as Karen Schultz's class. This goal is accomplished in various ways.

MAINSTREAMING. The method known as **mainstreaming** places exceptional students in regular classes as soon as they are able to meet fundamentally the same requirements as typical students (Friend & Bursuck, 1996). Students with more severe disabilities may be mainstreamed part of the time. They are then placed in special classes for the rest of the time so they can receive services that are not available in the regular classroom.

FULL INCLUSION. In the method known as **full inclusion,** schools place all students—even those with severe disabilities—into regular classes. The schools must make accommodations as necessary to enable the exceptional students to succeed. Many politically and educationally based arguments have been made both for and against full inclusion. Advocates of full inclusion argue that students with disabilities benefit because they learn how best to interact with their peers without disabilities. Their peers, in turn, learn how to interact with them (e.g., Stainback & Stainback, 1992). Opponents, however, argue that in severe cases, no one's interests are served. Students who have severe disabilities are never really able to interact well or be accepted by their peers without such disabilities. At the same time, the needs of other children are not always met because so much attention must be devoted to those children with disabilities. Often, the addition of extra personnel and special procedures are required in the classroom.

THINKING PRACTICALLY

Name one advantage and one disadvantage of full inclusion.

SUGGESTION: An advantage is that the student with special needs is less likely to receive a watered-down curriculum. A disadvantage is that other students may receive less attention.

FINDING A BALANCE. Sometimes educational trends swerve from one extreme to another, without trying to find a sensible and balanced middle ground. For example, until the 1970s, students with severe disabilities were routinely excluded from regular classes. Today, however, some experts argue that all students can be served in regular classrooms. A more balanced approach to inclusion of students with severe disabilities is to make decisions on a case-by-case basis. Such a procedure should take into account the needs of all students (including but not limited to the ones with disabilities in the classroom). It also needs to consider the needs of the teacher to teach effectively and the available resources in the school. Moreover, decisions need to be reviewed regularly. What is the right decision at one point in time may not remain the right decision as a result of changing circumstances.

Even in schools that do not try to achieve full inclusion, many students with special needs are included in regular classes. The Flexible Expert feature, "Teaching and Learning in Inclusive Classrooms," shows how some expert teachers and students adjust to a classroom that includes students with a variety of abilities and disabilities.

THINKING ANALYTICALLY

How might a school draw up a rational policy that protects the rights of all students, including both those with and those without exceptional needs?

SUGGESTION: A rational policy would recognize that inclusion is desirable up to the point that it encroaches on the needs of students other than the ones with the disability.

■ **INDIVIDUALIZED EDUCATION PROGRAM (IEP)** The special education laws require that each student with special needs have an **individualized education program (IEP).** The IEP defines the goals and objectives set to improve the student's level of achievement. It also states how these goals and objectives will be achieved. The IEP is written by a team consisting of the student's teacher or teachers, a qualified school psychologist or special education supervisor, the parent(s) or guardian(s), and, where possible, the individual student. Typically, school principals—and, where they are available, guidance counselors—also become involved. Karen Schultz, the teacher described at the beginning of the chapter, probably participates in planning the IEPs for her students with special needs.

Figure 5.1 includes an example of part of an IEP. The individualized education program must be updated annually and, as the figure shows, must state in writing all of the following:

- The student's current level of achievement.
- Annual goals and short-term *measurable* instructional objectives that will result in the attainment of these goals.
- Specific services to be provided to the student, including when the services will be initiated.

FIGURE 5.1 Example of an Individualized Education Program

Excerpt from an individualized education program (IEP) that was developed for a nine-year-old girl. This section of the plan focuses on following the teacher's directions and on reading.

STUDENT: Amy North AGE: 9 GRADE: 1 DATE: October 17, 1995

1. UNIQUE CHARACTERISTICS OR NEEDS: NONCOMPLIANCE

1. PRESENT LEVELS OF PERFORMANCE
   - *Frequently noncompliant with teacher's instructions.*
   - *Complies with about 50 percent of teacher requests/commands.*
2. SPECIAL EDUCATION, RELATED SERVICES, AND MODIFICATIONS
   - *Implemented immediately, strong reinforcement for compliance with teacher's instructions (Example "Sure I will" plan including precision requests and reinforcer menu for points earned for compliance, as described in The Tough Kid Book, by Rhode, Jenson, and Reavis, 1992); within 3 weeks, training of parents by school psychologist to use precision requests and reinforcement at home.*
3. OBJECTIVES (INCLUDING PROCEDURES, CRITERIA, AND SCHEDULE)
   - *Within one month, will comply with teacher requests/commands 90 percent of the time; compliance monitored weekly by the teacher.*
4. ANNUAL GOALS
   - *Will become compliant with teacher's requests/commands.*

2. UNIQUE CHARACTERISTICS OR NEEDS: READING

2a. Very slow reading rate
2b. Poor comprehension
2c. Limited phonics skills
2d. Limited sight-word vocabulary

1. PRESENT LEVELS OF PERFORMANCE

2a. Reads stories of approximately 100 words of first-grade level at approximately 40 words per minute.
2b. Seldom can recall factual information about stories immediately after reading them.
2c. Consistently confuses vowel sounds, often misidentifies
2d. Has sight-word vocabulary of approximately 150 words.

2. SPECIAL EDUCATION, RELATED SERVICES, AND MODIFICATIONS

2a–2c Direct instruction 30 minutes daily in vowel discrimination, consonant identification, and sound blending: begin immediately, continue throughout schoolyear.

2a and 2d. Sight-word drill 10 minutes daily in addition to phonics instruction and daily practice; 10 minutes practice in using phonics and sight-word skills in reading story at her level; begin immediately, continue for schoolyear.

3. OBJECTIVES (INCLUDING PROCEDURES, CRITERIA, AND SCHEDULE)

2a. Within 3 months, will read stories on her level at 60 words per minute with 2 or fewer errors per story; within six months, will read 80 words per minute with 2 or fewer errors; performance monitored daily by teacher or aide.

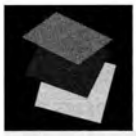
2b. Within 3 months, will answer oral and written comprehension questions requiring recall of information from stories she has just read with 90 percent accuracy (e.g., Who is in the story? What happened? When? Why?) and be able to predict probable outcomes with 80 percent accuracy; performance monitored daily by teacher or aide.

2c. Within 3 months, will increase sight-word vocabulary to 200 words; within 6 months, will increase to 250 words; assessed by flashcard presentation.

4. ANNUAL GOALS

2a–2c. Will read fluently and with comprehension at beginning-second-grade level.

Source: From Figure 1-6 (p. 37) in *Exceptional Learners: Introduction to Special Education,* 7th ed., by Daniel P. Hallahan and James M. Kauffman. Copyright © 1997 by Allyn & Bacon. Reprinted by permission. See also Hallahan, Kauffman, & Pullen (2008).



THE FLEXIBLE EXPERT

TEACHING AND LEARNING IN INCLUSIVE CLASSROOMS

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Because Aisha will have a student with mild intellectual disability in her class next term, she is taking time now to plan how class assignments can be divided into small, manageable steps that will not exceed the student's attention span or frustration level.

THE CREATIVE TEACHER: Aisha develops a private "sign language" system so she can let a student with ADHD know when he needs to return to his seat or be more quiet, without disrupting the whole class to correct the student's behavior.

THE PRACTICAL TEACHER: Aisha assigns students to project groups based on an alphabetical rotation so every student gets the chance to be in a group with every other student, regardless of individual differences.

THE ANALYTICAL STUDENT: Because Ronald already knows the material his math classmates are learning, he develops a plan for working ahead, and asks his teacher if they can work together to implement the plan.

THE CREATIVE STUDENT: Josie's cerebral palsy affects her ability to speak clearly, so she uses the computer to make animated thank-you notes for the peer aides who help her get around the school building every day.

THE PRACTICAL STUDENT: Because Wyeth knows his reading disability means he needs extra time for homework, he plans fewer after-school activities on days he has a lot of reading to do.

- A specification of how and how fully the student will participate in the regular instructional program of the school.
- A description of how long the special services will be needed.
- A statement of how progress toward objectives will be evaluated. For those children age 16 and older, a description of needed services to provide a transition to either further education or work.

THINKING ANALYTICALLY

Why are IEPs a useful resource in guiding and evaluating the special education program for a child having exceptional needs?

SUGGESTION: The IEPs provide a clear set of procedures for educating the students so as to eliminate ambiguities as much as possible.

SPECIAL EDUCATION SERVICES: WHERE CAN YOU GO FOR EXTRA HELP?

Which types of special education services are available to exceptional children in U.S. schools? Schools typically provide a variety of special education services for students who need them. These services form a hierarchy based on the amount of extra help or service provided. Services range from simple teaching consultations all the way to providing entirely special schools, and include the following measures:

- Special education teachers, trained in teaching students who have various kinds of learning challenges, often consult on a one-to-one basis with regular classroom teachers. They may suggest ideas to regular teachers who are working with students with mild disabilities or other learning problems.
- Many school districts provide resources that meet special needs, for students without as well as with disabilities. For example, mathematics or reading resource rooms are common across the United States. These resource rooms are staffed by resource teachers. They specialize in teaching one subject matter area, such as math or reading, to a variety of children.
- Students with special needs may be assigned fixed times to work with teachers who are subject matter specialists, whether or not in special resource rooms, to help meet their special needs.
- Special education teachers or teachers who are subject matter specialists may join a regular teacher daily to teach a class in which some of the students have special needs and others do not. Special education and regular teachers may team teach, with each leading part of the lessons. Alternatively, a special education teacher may provide extra help to exceptional students while the regular classroom teacher leads lessons.

- Exceptional students may be placed in special education classes for part of the day. These classes are typically taught by subject matter specialists or general special education teachers. In some cases, students may need to attend special education classes for all subjects. Some districts place special education classes in the same buildings as regular classes, whereas other districts use separate facilities.

The quantity and quality of services vary dramatically across schools and school districts. Teachers who are seeking special services for one or more of their students should investigate the opportunities available in their own schools.

REFERRING STUDENTS FOR SPECIAL EDUCATION

An observant teacher is always on the lookout for students with special needs. Referrals for diagnosis usually come from teachers who recognize that the relatively poor performance of a student has no readily apparent explanation. In today's world—for legal, educational, and ethical reasons—teachers must be sensitive to the needs of all pupils, including those who risk missing out on an education because of their exceptionalities. How do you, as a teacher, initiate special services when you believe one or more of your students has needs that are not being met? Pullen and Kaufman (1987) have made several suggestions for such referrals, which are summarized in Figure 5.2.

As the referral procedure shows, the first step is to contact the student's parent(s) or guardian(s). Parents may be able to provide information that can help the teacher meet the student's needs. Even if they cannot provide helpful information, parents must—for legal reasons—be notified of, and preferably involved in, all further steps in a referral. Next, make a thorough check of all the student's school records, looking for indications of previous problems and the results of any earlier testing of the student. Third, talk with other teachers who have worked with the child. Double-check your perceptions of the child and discuss ideas for working successfully with him or her. Finally, before making a referral, document the strate-

FIGURE 5.2 Referring a Child for Special Services: An Example of a Procedure

Step 1

Contact the student's parents or guardians. Discuss the student's problems with the parents before you refer.

Step 2

Before making a referral, check all the student's school records.

Has the student ever:

- Qualified for special services?
- Been included in other special programs (for example, for disadvantaged children, or speech and language therapy)?
- Scored far below average on standardized tests?
- Been retained?

Do the records indicate:

- Good progress in some areas, poor progress in others?
- A medical or physical problem?
- That the student is taking medication?

Step 3

Talk to the student's other teachers and professional support personnel about your concern for the student.

- Have other teachers also had difficulty with the student?
- Have they found ways of dealing successfully with the student?

Document the strategies you have used in your class to meet the student's educational needs. Your documentation will be used as evidence that will be helpful to or required by the committee of professionals who will evaluate the student. Demonstrate your concern by keeping written records. Your notes should include items such as the following:

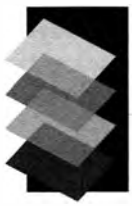
- Exactly what you are concerned about
- Why you are concerned about it
- Dates, places, and times you have observed the problem
- Precisely what you have done to try to resolve the problem
- Who, if anyone, helped you devise the plans or strategies you have used
- Evidence that the strategies have been successful or unsuccessful

Refer a student only if you can make a convincing case that the student may have a handicapping condition and probably cannot be served appropriately without special education. Referral for special education begins a time-consuming, costly, and stressful process that is potentially damaging to the student and has many legal ramifications.

Source: "Referring a Child for Special Services: An Example of a Procedure" from *What Should I Know About Special Education? Answers for Classroom Teachers,* by P. L. Pullen and James M. Kauffman, Pro-Ed, 1987. Reprinted by permission of James M. Kauffman.

gies you have used with the student. Not only is this a legal requirement, but it can be helpful to the team of professionals who will evaluate, and perhaps work further with, the child.

Who are students with special needs? What exactly should teachers be observing when they are trying to decide whether to refer a child for special services? Exceptional children may have unusually high or low levels of intellectual ability, as determined by tests and usually other means, such as interviews. They may also be confronted by any of a variety of learning challenges. We first examine children who function at the extremes of intellectual capacity: the gifted and the mentally disabled.



Extremes of Intellectual Functioning: Giftedness

A **gifted child** is one with exceptional abilities or talents (Callahan, 2000). Estimates of the number of gifted children in U.S. schools vary, but it is likely that 3 to 5 percent of students are gifted (Mitchell & Erickson, 1980). Thus, if you are a high school teacher who teaches 100 students per day, typically, 3 to 5 of your students are likely to qualify as gifted.

IDEAS ABOUT GIFTEDNESS

Some scholars differentiate among levels as well as kinds of giftedness. These differentiations can be made on the basis of level of measured intelligence, level of accomplishments, or kind of accomplishments. For example, Joseph Renzulli (1986, 1994a, 1994b) believes that traditional notions of giftedness deal with schoolhouse giftedness—that is, unusually high performance in areas such as language skills and math. These areas are the ones that are most prized in traditional educational settings. Renzulli distinguishes between schoolhouse giftedness and creative-productive giftedness, the kind of giftedness observed in adults as well as children who actually produce works of art or literature, theater, scientific research, or other accomplishments that are valued in the world beyond the school (Renzulli, 2005; Renzulli & Reis, 2007). He argues that those who are schoolhouse gifted are not necessarily creative-productively gifted, and vice versa. Thus identifying children as gifted only in the schoolhouse manner may miss those children who could sooner or later make major creative contributions to society.

Other researchers (Sternberg, 1993; Sternberg & Zhang, 1995; Tannenbaum, 1986) have pointed out how much sociocultural values shape our conceptions of giftedness: What one sociocultural group values as gifted, another may not. For example, schools in the United States tend to value conventional intelligence tests and the kinds of abilities measured in them. These abilities include verbal comprehension (typically measured by a vocabulary test), abstract reasoning (typically measured by a test of the examinee's ability to manipulate abstract symbols, as when a set of figures is shown and the examinee must indicate which one does not belong with the other), and mathematical reasoning (typically measured by arithmetic word problems). Other societies do not use these tests and may not value as highly the abilities they measure (Taylor & Kokot, 2000). One society may value the exceptional hunter; another may prize the person with exceptional physical strength. Even within our own society, work such as that by Lynn Okagaki and Robert Sternberg (1991, 1993), by Shirley Brice Heath (1983), and by Wade Boykin (1994; Serpell & Boykin, 1994) has shown how different sociocultural groups within U.S. society may have different ideas about giftedness (see also Chapter 6). Thus we need to be aware of how and how much our own cultural values shape our notions of what giftedness is all about.

IDENTIFYING GIFTED STUDENTS

Many schools seek to identify gifted children. Usually, the purpose of such identification is to provide special services to these students. In some states, identification is mandated by the

state department of education. The methods teachers and schools use to identify gifted students depend on the ways they conceptualize giftedness. As mentioned earlier, various conceptions of giftedness have been proposed.

■ **INTELLIGENCE AS ONE MEASURE OF GIFTEDNESS** One view suggests that intelligence, as it is measured by conventional intelligence tests, is the central attribute of giftedness (e.g., Gallagher & Courtright, 1986; Gallagher & Gallagher, 1994; Humphreys, 1986; Terman, 1925). Advocates of this view usually rely heavily on the results of conventional intelligence tests, believing that, although not all abilities are measured by such tests, the ones that are measured are probably the most important (see Jensen, 1980). Schools that follow this line of reasoning use conventional tests of intelligence as their exclusive or primary ways to identify the gifted. They might, for example, identify as gifted those children in the top 1 or 2 percent on certain intelligence tests. Typically, these tests will be administered individually rather than in groups to ensure greater accuracy of the results.

Such identification, however, is based on a fairly narrow view of what it means to be gifted (Tannenbaum, 2000). It also tends to identify as gifted what some educators view as a relatively high proportion of white middle-class students relative to members of other groups. To overcomes this bias, in the early 1970s, a government commission headed by then-U.S. Commissioner of Education Sidney Marland, Jr., proposed a broader view of giftedness (Marland, 1972). The **Marland Report** outlined six areas as worthy of consideration in identifying gifted children:

- General intellectual ability
- Specific academic aptitude
- Creative or productive thinking
- Leadership ability
- Visual and performing arts ability
- Psychomotor ability

The report emphasized that children who are exceptional in one or more of these areas should be identified and provided with special services.

Although the last category, psychomotor ability, was dropped soon after the report was published, the Marland Report became a guide many school districts used to decide what abilities to identify. These abilities can be assessed through school-based perfromance (VanTassel-Baska, Feng, & Evans, 2007).

A gifted student displays a model of a marine habitat that she has made from household objects.

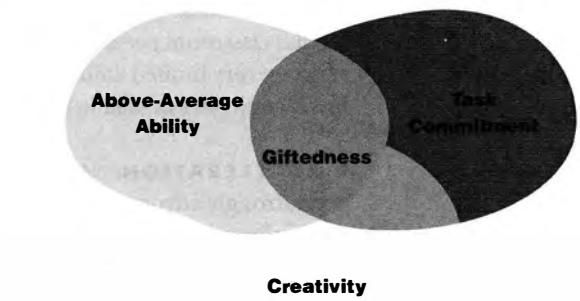
Prentice Hall School Division

■ **AMPLIFIED CONCEPTS OF GIFTEDNESS** Today, most schools use intelligence tests and some other kind of assessment, such as school performance as measured by grades or achievement test scores, teacher recommendations, tests of creativity, or signs of unusual motivation. Some schools are now using Howard Gardner's (1983, 1993a, 1993b, 1999, 2003, 2006) theory of multiple intelligences (see Chapter 4) to identify the gifted. When they adopt this perspective, students who show exceptionally high levels of linguistic, logical–mathematical, spatial, musical, bodily–kinesthetic, naturalist, interpersonal, or intrapersonal intelligence, or some combination of these intelligences are identified as gifted. Tests based on the triarchic theory (Sternberg, 1985, 1988b, 1997b, 1999) also have been used to identify analytically, creatively, and practically gifted students.

One of the most widely used conceptions of giftedness is based on the three-ring model developed Joseph Renzulli (1977, 1986, 1994a, 1994b). According to Renzulli, giftedness occurs at the intersection of three attributes, as shown in Figure 5.3: (1) above-average ability, (2) creativity, and (3) task commitment. According to this model, a gifted individual has above-average, but not necessarily exceptional levels of traditional kinds of abilities. Renzulli (1986) believes that being in the top 15 to 20 percent of individuals is sufficient to satisfy this criterion. Beyond these abilities, however, a gifted person needs to show a fairly high level of creativity as well as task commit-

ment or motivation to follow particular pursuits. One also might use a broader conception of abilities in implementing this model.

FIGURE 5.3 The Renzulli Three-Ring Model of Giftedness



Source: Figure 3.1, p. 66, from "The Three-Ring Conception of Giftedness: A Developmental Model for Creative Productivity," by J. S. Renzulli, in *Conceptions of Giftedness*, ed. by R. J. Sternberg and J. E. Davidson. Copyright © 1986. Reprinted by permission of Cambridge University Press.

■ **IDENTIFYING GIFTED STUDENTS IN THE CLASSROOM** What do these guidelines mean to you as a teacher? How can you identify gifted children among the students you teach? What will these students be like? Pressley (1995) reviewed a wide number of studies on how gifted children differ from their average counterparts in the classroom. These characteristics overlap highly with our characterization of experts in Chapter 1. He concluded that gifted students are experts in a number of respects, as described in Table 5.1.

Perhaps most importantly, gifted students do not simply solve problems defined by others, but rather create new problems to solve and ask new types of questions. For example, a gifted student in a middle school biology class might go beyond learning about the way that water quality affects fish to explore the quality of water in the area of his or her own school, or even to look for ways to improve the water quality of local fish habitats.

Teachers can look for other signs of giftedness and talent as well—unusual accomplishments in writing, mathematics, music, art, athletics, dance, or other domains. Likewise, unusual creative or practical accomplishments of any kind are signs of giftedness. One should not rely solely on formal tests for the identification of gifted and talented students. Accomplishments may tell teachers as much or more.

These characteristics of gifted students may challenge a teacher who struggles to keep up as the gifted student races ahead of the other students in the class. A variety of special education techniques have been developed to try to meet the needs of gifted children. In addition, we offer some ideas for working with gifted students in regular classes.

THINKING ANALYTICALLY

How would you conceptualize giftedness? What do you believe "gifted" means? Be as specific as possible.

SUGGESTION: Each student must answer for himself or herself.

TEACHING GIFTED STUDENTS

Gifted students are not covered by the federal special education laws. That is, schools are not legally required by the federal government to provide special education to help gifted students reach their potential. Nevertheless, many school districts do provide special education programs for these children. Several different types of programs for gifted and talented students have met with varying degrees of success.

■ **PULL-OUT PROGRAMS** Probably the best-known—and perhaps the most widely used—technique is the pull-out program. In this approach, gifted children are placed in a normal classroom but are taken out of the classroom at regular intervals for special instruction

TABLE 5.1 Characteristics of Gifted Students

- Gifted students have more and better learning strategies.
- Gifted students exhibit metacognition (the ability to think about and organize their own thinking and problem solving).
- Gifted students have knowledge about other people.
- Gifted students are motivated to learn and excel.
- Gifted students process information quickly and efficiently.
- Gifted students readily transfer what they know how to do to new situations.
- Gifted students have more and better insights during problem solving (Schneider, 2000).

Source: Based on Pressley, M. (1995). More about the development of self-regulation: Complex, long-term, and thoroughly social. *Educational Psychologist, 30*(4), 207–212.

by a teacher, often one with special training in gifted education. For example, the gifted student in Karen Schultz's third-grade class might go to special classes for an hour or two on three days of the week. Such programs allow gifted children to have time to interact both with their regular classroom peers and with their gifted peers. However, the programs usually give gifted children very limited amounts of special instruction. The children often have to make up the instruction they missed in their regular classroom while they were in special classes.

■ **ACCELERATION** Another kind of program for the gifted is acceleration, which has been strongly advocated by Julian Stanley (1996; Stanley & Benbow, 1982, 1986a, 1986b; see also Colangelo & Assouline, 2005). With this approach, students are given a normal course or program, but the presentation of material is speeded up. As a result, gifted children cover basically the same material that would be covered in a normal course, but in much less time. For example, a gifted student might cover both the third- and fourth-grade math curricula during the time span of a single academic year.

A related idea is curriculum compacting (Renzulli, Smith, & Reis, 1982). This procedure also involves teaching an essentially normal course, but deleting what students already know. Consider compacting a math curriculum for a gifted third grader as an example. Such a program might involve pretesting the student to determine what he or she already knows, then assigning lessons that cover only those parts of the third-grade math curriculum the student has not already learned. Research shows that gifted students can learn a whole course worth of material in much less time. With curriculum compacting, the teacher does not burden them with material that is merely a review of what they have already learned. The time gained can then be used for acceleration or enrichment activities.

■ **ENRICHMENT** In the enrichment approach, children are taught a normal course, but activities are added to enhance their understanding and to afford them opportunities to apply what they have learned. Enrichment is sometimes depicted as an "either-or" alternative to acceleration programs. In truth, the two approaches are complementary and can be used at the same time.

Renzulli (1986) has described three specific types of enrichment:

- Type I enrichment involves invitations to more advanced levels of involvement in a topic and, therefore, is designed to interest students in pursuing a topic further.
- Type II enrichment consists of activities designed to develop higher-level thinking skills, as well as research skills, reference-using skills, and personal and social skills.
- Type III enrichment involves individual and small-group investigations of real problems drawing on what the students have learned.

As an example of how enrichment works, consider students in a literature class who are reading a book by Charles Dickens. Type I enrichment involves asking gifted students to read some of Dickens's other works. Type II enrichment includes assigning gifted students to find out more about the times in which Dickens lived. Type III enrichment involves investigating current social conditions in inner cities to see how they compare to those of nineteenth-century London. This type of enrichment enables students especially to apply their creative skills.

Renzulli suggests using the three types of enrichment with what he refers to as a revolving-door model of identification and instruction (Renzulli, 1994a, 1994b). Here, different students are given enrichment activities at different times according to their particular strengths. In this model, multiple groups are identified as gifted in different areas. They are then given opportunities as appropriate to develop those skills in which they have particular gifts.

Do gifted children actually benefit from special identification and assessment? Much of the research suggests that they do (see, for example, Feldhusen, 2005; Fetterman, 1994; Horowitz & O'Brien, 1986; Neihart, 2007; Sternberg & Davidson, 1986). There is also evidence that if gifted children are given instruction tailored to their particular form of giftedness, they will do even better than if they are merely identified as "gifted" and placed in a special program (Sternberg, 1994a; Sternberg & Clinkenbeard, 1995; Sternberg, Ferrari, Clinkenbeard, & Grigorenko, 1996).

THINKING CREATIVELY

If you were to design a gifted program for a school where you were teaching, what form would the program take?

SUGGESTION: Each student must answer for himself or herself.

CONSTRUCTING YOUR OWN LEARNING

You may not be an expert teacher of the gifted, but you already know enough to begin to evaluate programs for identifying and teaching the gifted. Try out your skills. Evaluate the program described in the following scenario as if you were a consultant to the school district. What would you change, if anything, about the way gifted students in this district are identified and taught?

A school district in a suburban town with a population of 35,000 has implemented a program in which all first-grade children are screened for giftedness. They are given an intelligence test made up only of pictures because some of the children are not yet readers. The test is given to children in large groups. The children must follow directions, and make appropriate X's on pages where the pictures have certain attributes. The district then selects for its gifted program children in the top 2 percent of the national sample that was administered the test. The cutoff is uniformly and strictly enforced to avoid complaints from parents of favoritism on the basis of less objective criteria.

The children selected through this process become a part of the gifted program. It consists of a pull-out program once a week for two hours at a time. The program continues until grade three, at which point the district no longer provides special services for the gifted.

The gifted program consists of a variety of mind-challenging games. These games have been taken from books and other sources that are intended to encourage the children to think. Children seem to like the program, and parents are happy to have their children in a gifted program. Because the program pulls out children only for limited amounts of time, there have been few complaints from teachers.

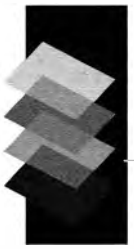
*i*MPLICATIONS FOR TEACHING

- **Reward gifted students' motivation to learn more.** Allow them freedom to go further than their classmates. Let them read extra books and write reports on them, seek out additional sources, and cover higher-level work. Allowing gifted students to work ahead during review sessions reinforces their desire to learn and do more.
- **Help gifted students find problems to solve.** Suggest some ways they could find more information by themselves. Guide them to problems in their less developed as well as more developed areas of strength.
- **Keep gifted students challenged.** Try to help them gain access to the most challenging activities and instruction available. Peers with the same or greater abilities may challenge the gifted students to perform even better. A network of gifted children's programs may provide help to a teacher who feels overwhelmed by his or her students' needs.
- **Work with families of gifted students.** At times, you may encounter parents of gifted students who do not accept or reinforce their children's positive behaviors. In dealing with the parents of gifted children, expert teachers stress that the children need environmental reinforcement, support, and challenge if they are to develop to their full potential. When family support is lacking, a teacher may ask the school guidance counselor to play a more active role in supporting a gifted student.
- **Reinforce gifted students' self-esteem.** It might seem that such students would be the last to need bolstering of their self-esteem, but that is not the case. Expert teachers can support gifted students' self-esteem in many ways. Do not encourage them to rely on comparisons to classmates, which can make gifted students feel conspicuously "brainy." Instead, help them compare their current levels of achievement with their own past performance. Avoid making gifted students feel embarrassed about being different or allowing them to be teased because of their exceptionalities.

THINKING ANALYTICALLY

Why might gifted girls develop lower self-esteem than do gifted boys? Which steps could teachers take to improve the self-esteem of gifted girls?

SUGGESTION: Gifted girls may be more frequent targets of teasing and negative stereotypes. Teachers should give adequate recognition and praise to gifted girls.



Extremes of Intellectual Functioning: Intellectual Disability

Intellectual disability (also known as *mental retardation*) refers to low levels of mental competence in general (Detterman, Gabriel, & Ruthsatz, 2000). The American Association on Intellectual and Developmental Disabilities (AAIDD, 2008) defines intellectual disability as a condition that involves substantial limitations in current functioning. Its definition is:

> *"Intellectual disability is a disability characterized by significant limitations both in intellectual functioning and in adaptive behavior as expressed in conceptual, social, and practical adaptive skills. This disability originates before the age of 18" (The AAIDD Definition, 2008, http://www.aamr.org/Policies/pdf/AAIDDFAQonID.pdf, retrieved 9/13/08).*

THINKING ANALYTICALLY

What are the advantages and disadvantages of labeling a child as having "intellectual disability"?

SUGGESTION: One advantage is being able to identify who needs special services of a given kind. A disadvantage is possible stigmatization.

Including the word "current" is important to emphasize that intellectual disability should not be diagnosed on the basis of performance at some past time. Similarly, it should not be diagnosed on the basis of behavior one expects a child to show in the future, absent current deficits. Including adaptive competence in this definition of intellectual disability is also essential. Children can show "schoolhouse retardation," with deficits in academic skills, yet adapt quite well to everyday life (see, for example, Campione, Brown, & Ferrara, 1982).

Because children can be stigmatized, most schools are careful these days about applying the label "intellectual disability" or "mental retardation." They reserve it for use only when practical competence as well as academic or IQ deficits are shown. As a teacher, bear in mind that a student's doing well in school is only one part of his or her functioning effectively in life. When evaluating a child suspected to have intellectual disability, be sure to consider the student's ability to get along in the world at large—not just the world inside your classroom (Luckasson, 1992).

The actual level of performance that constitutes "intellectual disability" may vary with both time and place. In Chapter 4, we discussed the Flynn effect, whereby IQs rose about 3 points every 10 years during much of the twentieth century. This effect implies that the test performance that constitutes a given level of IQ, including a level that might be classified as typical of intellectual disability, can vary from time to time. Moreover, performance that might be viewed as acceptable in one place might not be considered acceptable in another. Given these potential sources of variation, we need to realize that labels refer not to absolutes, but rather to societal standards.

Intellectual disability provides, in many ways, a contrast to the notion of expertise that we laid out in Chapter 1. Children with intellectual disability generally lack large, rich schemas of declarative and procedural knowledge, at least in academic and some domains required for adaptive competence. They often need help in figuring out how to represent a problem, prior to beginning work on its solution. They may be able to choose a strategy for problem solution, especially if guided, but often cannot transfer it to a new domain. Also, they may have only weakly automatized many of the skills necessary for success in reading and mathematics, for example. Because of their weak metacognitive skills, they may find it hard accurately to predict the difficulty of solving particular problems and to monitor their accuracy in problem solving. They also may have difficulty in solving novel kinds of problems. When they do problem solve, their accuracy and speed are likely to be reduced relative to children of their age with higher levels of cognitive skills.

Even with these deficits, individuals with intellectual disability may have some very useful skills. Consider the following example (Edgerton, 1967). A man who was regarded as having intellectual disability because he had scored low on tests of intelligence was unable to tell time—an indication of some kind of cognitive deficit. However, he used a clever compensatory strategy: He wore a nonfunctional watch. Whenever he wanted to know the time, he could stop, look at his watch, pretend to notice that it did not work, and then ask a stranger who had observed his behavior to tell him the correct time.

In this section, we look at the causes and degrees of intellectual disability. We also consider how students with intellectual disability differ from their classmates.

CAUSES OF INTELLECTUAL DISABILITY

The causes of intellectual disability are not all known. Those that are known can be divided into two groups: *familial* and *organic* (Hodapp & Zigler, 1999; Zigler, 1982, 1999).

Familial intellectual disabililty, as the name implies, tends to run in families. If one child in a family shows it, another child in that family is more likely to show it than a child selected at random.

Organic cases do not run in families (see also Hodapp, 1994), but rather are associated with traumatic events or abnormalities. Causes of this type of intellectual disability may include chromosomal disorders, such as Down syndrome; metabolic disorders; prenatal developmental abnormalities; prenatal exposure to toxins such as alcohol or cocaine consumed by the mother; brain diseases; birth trauma or other birthing problems; and poisoning, malnutrition, or trauma during early childhood. Perhaps as many as half of all cases of intellectual disability could be prevented if organic causes were eliminated (Campbell & Ramey, 1994; Hardman, Drew, & Egan, 1996; Smith & Luckasson, 1995). Poor living environments, whether caused by poverty, environmental toxins, poor nutrition, or other factors, can reduce performance beyond what it might otherwise be in a more adequate environment.

Several sex-linked syndromes can cause intellectual disability. [Our discussion of them is drawn largely from Money (1994).] These syndromes affect the presence or distribution of the X and Y chromosomes. A normal female has two X chromosomes (referred to as "XX"), whereas a normal male has one X and one Y chromosome (referred to as "XY"). Not everyone follows this pattern, however.

Individuals with *Turner's syndrome* are missing a sex chromosome. These persons have just a single X chromosome (referred to as "X") and are phenotypically (physically) female. Estimates of the prevalence of Turner's syndrome range from 1 in 240 to 1 in 4900 live births. This syndrome has little or no effect on verbal measures of intelligence but a potentially severe effect on nonverbal and performance-based measures of intelligence. For example, people with Turner's syndrome would have difficulty in performing mental rotation of spatial images, reading maps, or drawing a floor plan of a familiar room.

People with *Klinefelter's syndrome* have at least one Y chromosome and an extra X chromosome (referred to as "XXY"). They are phenotypically male. The incidence of this mutation in the general population is roughly 1 in 900. People with Klinefelter's syndrome often show a deficit in verbal IQ but normal performance and nonverbal IQ. They may exhibit learning disabilities that are linguistic in nature, such as problems with reading and spelling. Incarcerated males show a higher proportion of this syndrome than does the male population as a whole. People with this syndrome also have a thinner cerebral cortex as compared to same-aged peers (Geidd et al., 2007).

Individuals with *fragile X syndrome* have a n abnormal X chromosome. They may be phenotypically male or female. The incidence of this syndrome in the general population is approximately 1 in 2000 in males and 1 in 4000 in females (http://www.ikm.jmu.edu/Buttsjl/ISAT493/Fragile%20X%20Syndrome/fragilexincidence.html, retrieved December 27, 2003). About one-third of females with fragile X syndrome show an IQ deficit. In boys, IQ and other aspects of cognitive functioning are almost always severely reduced. Fragile X syndrome may be the cause of as many as 10 percent of all cases of intellectual disability in males (Tzschach & Ropers, 2007).

LEVELS OF INTELLECTUAL DISABILITY

No matter how it is defined, intellectual disability varies in terms of its degree of impact. There are many different ways of determining a student's level of intellectual disability. One widely used classification includes four levels of intellectual disability—mild, moderate, severe, and profound—and is based on individual IQ scores. Individuals with different levels of intellectual disability perform, on average, at very different levels.

Anthony Magnacca/Merrill

With structural environmental support and supervision, individuals with moderate retardation can often complete unskilled or highly routinized, semi-skilled vocational activities.

■ **MILD INTELLECTUAL DISABILITY** Individuals with mild intellectual disability have IQs in the 50 to 70 range (the average person's IQ is 100). These people represent 80 to 85 percent of the total population with intellectual disability, and they account for roughly 2 percent of the general population. The vast majority of students with intellectual disability who are mainstreamed fall into this category. They are often the only students with intellectual disability whom non–special education teachers are likely to have in their classes. For example, the student in Karen Schultz's class has a mild level of intellectual disability. Given special educational assistance, these students may eventually master academic skills at or below the sixth-grade level. With suitable training and a supportive environment, they can often acquire various vocation-related skills.

■ **MODERATE INTELLECTUAL DISABILITY** Individuals with moderate intellectual disability have IQs in the 35 to 50 range. They represent 10 percent of all persons with intellectual disability and approximately 0.1 percent of the general population. These students require considerable educational assistance. When provided with this kind of help, they may eventually master academic skills at the fourth-grade level. With structured environmental support and supervision, these students may be able to complete unskilled or possibly very routine, semiskilled vocational activities.

■ **SEVERE AND PROFOUND INTELLECTUAL DISABILITY** The remaining 5 percent of individuals with intellectual disability suffer from severe or profound intellectual disability, meaning they have IQs below 35. People with severe intellectual disability are unlikely to benefit from vocational training. People with profound intellectual disability are generally able to respond to training only for very limited tasks, such as walking or using a spoon. Most teachers will not encounter children with severe or profound intellectual disability in their classes.

■ **SLOW LEARNERS** An IQ of 70 is used in this traditional classification (which is incomplete, because it does not take adaptive skills into account) as the cutoff point to determine who has intellectual disability. Expert teachers realize, however, that people with IQs from 70 to 85 are at greater risk for failure in school than average-intelligence individuals (Zetlin & Murtaugh, 1990). There are four times more people with IQs of 70 to 85 than there are people with IQs below 70. Thus you will inevitably encounter these students with lower IQs in your teaching. They are also sometimes called slow learners (Petrus, 1997). Students with lower-than-average IQs (70 to 85) can be helped with many of the same teaching techniques that help children with intellectual disability.

■ **HOW MUCH HELP IS NEEDED?** Other classifications for intellectual disability have also been developed, reflecting the fact that intellectual disability involves more than just a low IQ score alone. The AAIDD, for example, has developed a classification based on the amount and types of support, or help from others, an individual needs to function. This system is summarized in Table 5.2. As the table shows, four levels of support are distinguished:

- Intermittent support, which is provided only occasionally during times of stress
- Limited support, which is provided on a regular, but perhaps not daily, basis
- Extensive support, which is provided daily to allow the person to function at work, school, or home
- Pervasive support, which consists of constant help in accomplishing basic tasks, such as eating and toileting

TABLE 5.2 Levels of Support for Persons with Intellectual Disability

Level	Description	Example
Intermittent	Supports are provided on an "as-needed basis." Characterized by episodic nature, the person not always needing the support(s), or short-term supports needed during life-span transitions (such as job loss or an acute medical crisis). Intermittent supports may be high or low intensity when provided.	A student may need extra help coping with academic demands after a medical absence from school.
Limited	Characterized by consistency over time and how it is time limited but not of an intermittent nature. May require fewer staff members and less cost than more intense levels of support.	A student may need help making the transition from school to work.
Extensive	Supports characterized by regular involvement (perhaps daily) in at least some environments (such as work or home) and not time limited.	Long-term home living support or daily instruction from a special education teacher.
Pervasive	Supports characterized by their constancy, high intensity, and provision across environments. Potential life-sustaining nature. Pervasive supports typically involve more staff members and intrusiveness than do extensive or time-limited supports.	Full-time help needed for feeding, dressing, toileting, and other tasks of daily living.

Source: Table entitled "Levels of Support for Persons with Mental Retardation" from *Mental Retardation: Definition, Classification, and Systems of Support*, by AAMR Ad Hoc Committee on Terminology and Classification, 1992, Washington, DC: Copyright 1992 by AAMR.

CHARACTERIZATIONS OF INTELLECTUAL DISABILITY

How do students with intellectual disability differ from their average-IQ classmates? Researchers have proposed several ways of how best to describe intellectual disability. Their ideas about intellectual disability have, in some cases, influenced training programs, designed to help children with intellectual disability better develop their cognitive skills.

Zigler (1982, 1999) argued that people with familial intellectual disability simply show slower mental growth than do people of normal intelligence. For example, Karen Schultz might find that her student is still working on the prereading skills the rest of the third-grade students learned in kindergarten or first grade. Zigler contrasted his theory of developmental delay with difference theories. Difference theories state that individuals with intellectual disability are not merely slower in development than are other individuals, but rather are different in some way.

Several theories about these differences have been proposed. For example, one view holds that individuals with intellectual disability are more rigid in their thinking (Kounin, 1941). Another suggests that they show deficits primarily in learning and memory (Ellis, 1963). Earl Butterfield and John Belmont (1977) have emphasized the importance of higher-order mental functioning. According to this view, people with intellectual disability have particular trouble with higher-order processes such as planning, monitoring, and evaluating their cognitive strategies (Campione et al., 1982). Without help, people with intellectual disability are less likely to develop a variety of strategies to use during learning and problem solving (Ellis, 1979; Pressley, 1995). For example, children with intellectual disability do not spontaneously rehearse lists of words (say the words over and over to themselves) when they are asked to memorize them (Brown, Campione, Bray, & Wilcox, 1973). Even when such children are trained to memorize a given kind of list, they do not transfer that strategy to memorizing other kinds of lists (Butterfield, Wambold, & Belmont, 1973).

Another view, proposed by Robert Sternberg and Louise Spear (1985), is that children with intellectual disability show deficits not only in complex mental processing, but also in coping with novelty and in adaptive competence in everyday life. For example, suppose a child with intellectual disability is given an unfamiliar toy to play with. He typically is not able to figure out what to do with it. He also may not enjoy receiving a strange object.

Those who believe in the importance of higher-order mental processes have concentrated on training at this higher-order cognitive level. For example, Ann Brown and Joseph Campione (1977; Campione & Brown, 1979 focused on teaching higher-order (sometimes called "executive") processing strategies for monitoring and evaluating performance, as well

THINKING ANALYTICALLY

What are the advantages and disadvantages of viewing intellectual disability in terms of performance rather than of people?

SUGGESTION: The focus is placed on improving performance rather than on labeling the performer. A possible disadvantage of viewing intellectual disability in terms of performance is the development of higher than appropriate expectations by the teacher of the performer.

as for learning, such as thoughtfully rehearsing what one has learned. John Belmont, Earl Butterfield, and John Borkowski (1978) took a similar approach. These programs have had at least some success in helping children with intellectual disability perform better. At the same time, it has often been difficult to get the children to transfer what they learn from one domain to another.

Not all definitions of intellectual disability view it as a trait—that is, as a permanent characteristic of a person. Reuven Feuerstein (1979, 1980), for example, has viewed it as a state—that is, as a temporary status. For this reason, he has referred to "retarded performers" rather than to "retarded people." Feuerstein believes intellectual disability is a result of lack of mediated learning experience (see Chapter 2) of the environment by parents for children. In other words, the children have not had the environment sufficiently interpreted for them as they have grown up. To overcome this shortcoming, Feuerstein's (1980) program called *Instrumental Enrichment* concentrates on mediation.

IMPLICATIONS FOR TEACHING

- **Teach learning strategies.** Students with intellectual disability can be taught learning and problem-solving strategies successfully. Simple checklists that students help to create could serve as reminders of these strategies.
- **Divide lessons into small, clearly defined steps.** With step-by-step guidelines and teacher support, students with intellectual disability can improve the regulation of their use of strategies. For example, expert teachers encourage students to think of a goal, make a plan to attain it, try the plan, and ask themselves if the plan worked.
- **Help students learn self-regulation.** Expert teachers teach students with intellectual disability to regulate their own behavior (sometimes called "self-regulation"), monitor their progress, and correct themselves when necessary. Expert teachers strongly encourage their students to plan as much as possible.
- **Make lessons concrete and applicable to daily life.** Lessons that allow students to see the connection to concrete objects help. For example, in doing mathematical problems that involve measurements, it will be helpful to the students to have the actual objects to measure. Pressley (1995) also recommended using material that is functionally important to the daily lives of people with intellectual disability to make instruction and learning "real" to them.
- **Help students raise their self-esteem.** Expert teachers repeat the message that "You can succeed—you are competent. With effort, you can overcome difficulties." In your teaching, help students with intellectual disability to focus on effort more than on outcome. Reward them with praise and recognition for even small steps in the right direction. Bolster their low sense of self-esteem. Make them feel competent and in control of their own learning and performance.

Challenges to Learning

A variety of specific conditions unrelated to intellectual disability can make learning difficult for students. These conditions include learning disabilities; attention-deficit/hyperactivity disorder; emotional and behavioral disorders, and related problems such as autistic disorder; health disorders, including seizure and cerebral palsy; sensory impairments, such as vision and hearing difficulties; and communication disorders. Of these disorders, the ones involving language skills are typically the most common.

We describe these challenges next, in order from the most commonly encountered to the least commonly encountered. We then suggest some ways in which teachers can help students who are trying to overcome learning challenges.

LEARNING DISABILITIES

Some children show generally high levels of performance at the same time that they show a deficit—sometimes a glaring one—in a specific aspect of their school performance. As they recognized this fact, educators as well as scientists and parents sought a diagnostic label that would distinguish such children from children whose performance was depressed in all areas of academic and other kinds of functioning. The result was a new kind of classification, that of learning disabilities.

■ DEFINING LEARNING DISABILITIES

Learning disabilities (LD) typically are diagnosed when performance in a specific subject matter is substantially worse than would be expected from a child's overall level of measured intelligence. These disorders typically first manifest themselves during childhood. However, they can and often do occur throughout the life span (National Joint Committee on Learning Disabilities, 1999).

Learning disabilities have also been defined as "a subset of instances in which individuals cannot master skills important in school success, such as reading, spelling, mathematics, communication, or social skills" (Forster, 1994, p. 647). For example, a child with an average or high IQ but notably poor reading skills might be identified as having a **reading disability.**

The definition of learning disabilities is often problematic (Spear-Swerling & Sternberg, 1996; Sternberg & Grigorenko, 1999). First, many educators question whether the tests used to assess general intelligence really provide an adequate measure of intelligence (e.g., Gardner, 1999; Sternberg, 1999). If the intelligence tests are inadequate, the discrepancies between intelligence and performance calculated on the basis of these scores will be flawed.

THINKING ANALYTICALLY

Why is it important to distinguish specific learning disabilities from intellectual disability?

SUGGESTION: The problems are different and the needed interventions are different as well. Intellectual disability produces a much more pervasive deficit in performance.

Second, even if one does accept the intelligence test scores as valid, discrepancy scores do not seem to serve equally well at all points along a continuum of abilities. Consider as an example the learning problems of students whose IQs put them in the gifted range but whose reading scores merely put them in the above-average range. These problems do not seem comparable to the problems of students whose IQs put them in the below-average range and whose reading scores are still poorer.

Third, differences in scores are plagued by statistical problems, only one of which is low reliability (that is, consistency from one time of measurement to another). The statistical problems make some educators question the usefulness of information provided by these differences in test scores.

Finally, there is sometimes an overlap between the skills required for intelligence tests (e.g., vocabulary) and the skills required on tests of specific skills (e.g., reading, which can require high levels of vocabulary). Thus comparing the two scores (e.g., an IQ score and a reading score) may not yield measures of entirely different things.

Differences across language groups in frequency of diagnosis of learning disabilities have also been noted. For example, diagnosed reading disabilities are more common in children who read languages that are phonetically challenging, such as English, than in children who read languages that are phonetically more transparent, such as Spanish. English has many exceptions to phonetic rules. For instance, why is "tough" pronounced as *tuf,* or "ghost" as *goast?* Although English is widely spoken, it is among the hardest languages to learn to read. As a result, children reading English are more susceptible to difficulties.

■ PROBLEMS WITH SPECIAL SERVICES

The exact criteria used to identify children as having a learning disability can differ substantially from one state, or even one community, to another. This difference substantially reduces evenhandedness in who is identified as having a disability. This issue becomes particularly problematical when parents view the "disability" as the only way to get special services for their children. They may view their children as needing but not receiving such services. Thus parents who can afford to do so may seek a diagnosis from a private diagnostician or actually may move from one school district to another to ensure that their child will receive special services.

The special services themselves can create issues of equity (Kelman & Lester, 1997). Children identified as having disabilities may get special accommodations, such as substantial extra time for taking tests as well as a distraction-free special room in which to take these tests

EXPERT TEACHER INTERVIEW

FOCUS ON: WORKING WITH INCLUSION STUDENTS

CATHY DOWNEY, STECK ELEMENTARY SCHOOL, DENVER, COLORADO—GRADES K–6, SPECIAL EDUCATION

Cathy Downey has been teaching for 15 years. She was certified as an Exceptional Needs Specialist by the National Board for Professional Teaching Standards in 1999, the first year special education certification was available.

What are some of the challenges faced by your students?

The children I teach now are all included in the regular classrooms. I teach children who have learning disabilities and mild cognitive disabilities. The children with learning disabilities that I teach all have average or above-average intelligence, but something is preventing them from learning. I work with them to find out what it is. I test to see if they might have a problem with auditory or visual processing, difficulty making sense, or perceiving, what they physically hear or see. I also test to see if they might show symptoms of ADHD. Maybe they can't learn because they can't attend in class. Since ADHD is a medical diagnosis, I always suggest to the parents of a student who might show some signs of it that the child be evaluated by a doctor.

I have some children who have mild to moderate emotional or behavioral disorders. I have one student now who has Asperger's syndrome, a kind of high-functioning autism. He is absolutely the most delightful child in the world! He is extremely intelligent, and I work with him on the social problems caused by his Asperger's.

Can you describe the identification and individual education plan (IEP) process?

The process starts when a student's classroom teacher becomes concerned about something. The teacher will come to me to ask advice. We put together a peer assistance team, including me, the referring teacher, and one other teacher. Parents are always involved, too. We develop some strategies the classroom teacher can try. I work with him or her to implement these strategies for four to six weeks. If the child is still having problems, we begin a more formal identification process, including thorough testing. A school psychologist does cognitive testing, a social worker takes a social history of the child's home environment, and a school nurse checks for physical problems. After that, we meet to determine the child's eligibility for special education services. If the child needs special education, all these people—and, often, the child himself or herself—work together on an IEP. Special education works much more efficiently if everyone has a well-defined role, so my IEPs tend to be very lengthy and detailed.

How do you go about working with children with special needs included in regular classrooms?

I'm very involved at all stages of working with the children in my school, from helping identify children who might need special education, to developing IEPs, to teaching on a day-to-day-basis. I work with students in their regular classroom. I also pull students out for as long as 30 minutes at a time for special lessons with me.

I do a lot of different things with the children, depending on their needs, but I work with all of them on motivation and self-esteem. Self-esteem is a huge part of learning. Some students have failed so often at learning that they just see themselves as failures and won't even try anymore. I start by finding the highest level at which each child has learned in a subject, such as reading. Then I give them each an assignment that will be really easy, something that moves them forward, but builds in success. Once they feel they can succeed, they are much more motivated, and we continue to move forward in small, sequential steps.

(see the Forum feature, "What Is the Best Way to Teach Students with Learning Disabilities?", later in this chapter). Because other students also would benefit from such measures, society must decide how it can fairly allocate them.

Another problem relates to differences in the types of LD-related services provided, which are not the same for all students. In some districts, especially wealthy ones, the LD label may lead to substantial benefits. In other districts (and especially some impoverished ones that lack adequate funds), students labeled as having learning or other disabilities may be dumped into inadequate classrooms. These special classes may feature a watered-down, inadequate curriculum that causes these students to fall further behind.

Still another problem can arise from undifferentiated remediation. Often children with very different learning difficulties are lumped together as having specific disabilities. Such loose classifications are prejudicial to the children, because they do not receive interventions that are appropriate for their particular kind of difficulty. Consider five hypothetical children: Tom, Dick, Harriet, Hato, and Josefina, all of whom have tested as average in

I use a lot of ways to keep students motivated. I help them develop their own learning strategies, so they can feel ownership and involvement in learning. Sometimes we play games. On Fridays, we have literacy games like Sight-Word Bingo. If I have to, I use tangible rewards to help get students motivated.

How do you coordinate with the classroom teachers?

I work with a lot of really great teachers, and all of them are interested in the learning of all their children. I like to work very closely with the classroom teachers. I encourage informal consultations in the hallway at any time. Of course, we work together on IEPs. I also coordinate my lessons so that what I'm doing with students reinforces what their classroom teacher is doing. I also develop strategies and lessons a student's classroom teacher can use. I always try to keep the whole class in mind and suggest things that the whole class could benefit from. I also work with students when they're in their regular classes.

What do you do when you work with students in their classrooms?

I work differently with the different teachers, depending on their needs. For example, one teacher here is in her first year. She is teaching a combined fifth and sixth grade, and seven of her sixth graders need special education. Because she has so many students who need extra help, I play a fairly large role when I'm in the room with this teacher. When she divides the class for reading groups, for example, I'll take one of the groups, the one with the special education kids. I've also taught the whole class a lesson on note-taking. This is a skill that students at this age need, and it was a big problem for my students. It turned out several students had difficulties learning to take notes, so I adapted my lesson for that whole class.

Other teachers have different needs. I also work with one highly experienced third-grade teacher whose class is very well organized and structured. My student with Asperger's syndrome is in her class, and the predictability makes it a great place for him. I don't need to play a big role. I go and sit with my student in this teacher's class, to work with him as she teaches. I also consult with the teacher on areas of his behavior that are puzzling or cause concern.

What advice would you give to new teachers?

Well, I love what I do. I think it's an under-recognized field and certainly understaffed, so I always try to encourage teachers to consider special education. We joke that you don't go into special education for the glamour and the money, but it can be very rewarding. I get letters from children I taught who have now grown up and had children of their own, and are making their way in the world.

My advice to students who want to be regular classroom teachers would be to take special education electives in college. The numbers of students who need special education services are rising, and it will really help you to develop an awareness of children with special needs.

Classroom teachers should feel comfortable consulting a special education teacher when children have problems that concern them. Don't be afraid to ask the special education teacher. He or she may be able to develop interventions even for kids who do not need special education. You just can't have too many people helping kids.

Self-esteem is a huge part of learning. Some students have failed so often at learning that they just see themselves as failures and won't even try anymore.

Self-esteem is a huge part of learning. Some students have failed so often at learning that they just see themselves as failures and won't even try anymore.

intelligence, but whose reading-comprehension scores are far below average. Tom has a phonological-decoding deficit: He has difficulty properly determining correspondences between sounds and the letters that represent them. Dick has a verbal-comprehension deficit: He can decode the sounds represented by letters, but his understanding of the facts and ideas in what he reads is deficient. Harriet has a working-memory deficit: She cannot organize what she reads in a coherent fashion. Hato is test anxious when he takes group tests, and he did poorly on the reading-comprehension test because his anxiety got the better of him. And Josefina is a native Spanish speaker who has not learned the English-language reading skills she needs to keep up with her peers. The danger is that all of these children might be lumped together as having a generalized "reading disability" and receive the same instruction—instruction that may be relevant to none of them in particular.

Although all these problems are probably not insurmountable, they pose a serious challenge for society, school districts, and individuals. Until these problems are resolved to a sufficient extent, society will not be able to provide an adequate education for all students.

■ **MAKING SENSE OF READING DISABILITIES** Reading disabilities are by far the most commonly recognized kind of learning disability (Shaywitz & Shaywitz, 2005; Sternberg & Spear-Swerling, 1999). Several explanations of reading disability have been proposed (see Ramus, Rosen, Dakin, Day, Castellote, White, & Frith, 2003). One of the earliest views—that reading disability is attributable to deficits in visual perception (Orton, 1937)—is still widely believed, despite its having been thoroughly discredited (see Vellutino, 1978).

PROBLEMS WITH SOUNDING OUT LETTER COMBINATIONS. A second view is that people with reading disabilities have difficulty in in being able to sound out letters and letter combinations (called phonemic processing) (Liberman, Mann, Shankweiler, & Werfelman, 1981; Mann, 1991; Torgesen, 1999; Wagner & Garon, 1999). For example, a child with a reading disability might have difficulty sounding out the artificial word *gleak*. A normal reader would not. The child with a reading disability might also have difficulty in answering the question of how *blanket* would be pronounced if the first letter were removed.

PROBLEMS WITH AUTOMATIZATION. Still another view emphasizes problems in automatization (LaBerge & Samuels, 1974; Samuels, 1988, 1999; Sternberg & Wagner, 1982). Proponents of this perspective suggest that students with reading disabilities may have trouble making the skills of reading—which at first are applied consciously, deliberately, and rather slowly—become largely unconscious and rapid. According to this view, children with reading disabilities never get beyond the stage where reading is highly labored and in need of their full attention and effort.

A FAILURE OF TEACHING. A fourth view is that "reading disability" is a label that society has created in an attempt to explain its own failure in teaching some children to read. According to this view, the problem lies not with the individual, but with society (Christensen, 1999; Skrtic, 1997). Some believe that reading-level expectations may have risen too high. For example, a child who has not yet reached the expected reading level for her age group might be considered as having a reading disability, despite her steady reading progress.

■ **CAUSES AND KINDS OF LEARNING DISABILITIES** Overall, evidence suggests that reading disability is not a single phenomenon, but rather one with multiple causes. For example, the reading disability of the student in Karen Schultz's class might stem from a very different cause than the reading disability of the child in another teacher's class.

Most likely, both biological and environmental factors play a role in the development of reading disabilities, and typically these two factors interact. In other words, both intrinsic and extrinsic factors can matter. Whatever the cause of their learning disability, children with reading disabilities are typically taught in the same manner as other poor readers, although there seems to be an emphasis on training in phonics for many individuals with learning disabilities.

One thing seems clear: Once a child is labeled as having a learning disability, the child is at risk for what has been referred to as a Matthew effect, whereby his or her position successively worsens with respect to peers (Stanovich, 1986, 1999). A Matthew effect is essentially a self-fulfilling prophecy. Teachers expect little of the student, and as a result, get little. They then expect even less, and get less. In this way, a cycle is created whereby achievement with respect to peers worsens over time.

Although reading disability is by far the most common categorization among the specific learning disabilities, it is not the only one. Other kinds of disabilities have also been suggested, including dyscalculia, difficulty in mathematics, and dysgraphia, marked difficulty with spelling (Fischer-Baum, Rapp, & McCloskey, 2007; Kan, Biran, Thompson-Schill, & Catterjee, 2006; Shalev, Manor, & Gross-Tsur, 2005; von Aster & Shalev, 2007). For example, children identified as having mathematical disabilities do well in many areas of functioning but have great difficulty in dealing with numbers and problems that require various types of mathematical thinking. Nevertheless, there is substantially more disagreement regarding the nature and specifics of the identification of the various nonreading learning disabilities. For example, some diagnosticians are convinced that specific foreign-language or reasoning disabilities exist, whereas others are not (Kelman & Lester, 1997). The issues regarding just which kinds of discrepancies should be regarded as genuine disabilities in learning or other processes still need to be resolved.

A special category of student with a learning disability is a student who is simultaneously labeled as being gifted and as having a learning disability. Such students are sometimes referred to as "gifted LD." In other words, even otherwise gifted students can have specific learning disabilities (Lupart, 2004; Nation, 2004). Individuals with this type of condition may be either children or adults (Tallent-Runnels & Layton, 2004). To be identified in this way, they must show giftedness in either general or particular areas, and they must also be assessed as having a disability in a particular area, resulting in an extremely uneven profile of performance (Brody & Mills, 2004; Reis & Ruban, 2004). For example, a child might be gifted in the verbal domain, but show a disability in mathematics, or vice versa.

Some schools have started special programs to teach these "twice-exceptional" children (Newman & Sternberg, 2004; Wright, 1997). Teaching strategies in such cases need to be relevant to specific needs, such as helping certain children with reading disabilities improve their phonological awareness (understanding of mapping between written letters and their sounds).

■ **APPROACHES TO TEACHING LD STUDENTS** The ideal focus of education for students with learning disabilities has been a topic of debate among educators. Should programs for these students focus on remediation—that is, on correcting students' areas of weakness? Or should it focus on compensation—that is, on helping students find ways to work around their areas of disability? A combination of both approaches seems to make sense. Students who have difficulty forming letters when they write by hand, but who can think and compose papers clearly, can use a computer word processing program so they are not penalized unnecessarily for illegible handwriting. At the same time, of course, these students should practice their handwriting skills. The techniques described in Chapter 4 for helping all students concentrate on their learning strengths are especially important when teaching students with learning disabilities.

Sometimes students' strengths may lie outside the classroom. It may be hard to use excellent social skills or athletic abilities to compensate for a mathematical disability. Remember that labeling of children can be inconsistent and sometimes confusing, so pay attention to actual weaknesses in performance, not ones you might assume exist (perhaps falsely) on the basis of a label.

As mentioned earlier in this chapter, federal laws apply to the teaching of students with learning disabilities. Teachers may need to work with a team to prepare IEPs for their students who have specific learning disabilities. In many cases, the laws have been interpreted to require that schools and teachers adapt assignments or teaching methods to accommodate the needs of students who have learning disabilities. As the Forum feature in this chapter points out, sometimes these accommodations can have unintended results.

FORUM

WHAT IS THE BEST WAY TO TEACH STUDENTS WITH LEARNING DISABILITIES?

Students with learning disabilities are covered under IDEA and other federal and state special education laws. As a consequence, federal funding is available for special education for these students. Instruction and assessment must also be adapted, if necessary, to accommodate the special needs of students with learning disabilities. However, such adaptations may bring about a whole new set of problems.

FIRST VIEW: TOO MUCH HELP. Some people assert that students with learning disabilities are getting too much help. They claim that the accommodations made for students with learning disabilities are so attractive that parents have lied about their children's disability status to give them advantages. Examples of such advantages include having extra time to complete the standardized tests used by many colleges, law schools, and medical schools as part of their acceptance criteria (Borow, 1996). Although students who have trouble learning need extra training to surmount their difficulties, they must also face the challenge of

obtaining the basic skills they need to get along in the world. Generous accommodations may help students gain better grades and test scores in the short run, but they are harmed in the long term if they finish their education without ever gaining the skills they will need to succeed outside of school.

SECOND VIEW: THE NEED FOR EXTRA HELP. Supporters of special accommodations argue that adapted tests and lessons are needed to determine the true extent of students' abilities. Students with learning disabilities may have mastered the material tested by the SAT, for example, and may be able to do well in college. However, they may not be able to demonstrate their mastery under ordinary testing conditions, perhaps because of the pressure of working under the time constraints and the possible distractions created by the presence of potentially hundreds of other test takers. Rather than setting up students to fail, accommodations for their disabilities allow them to succeed. In addition, accommodations may be the only strategy to keep many students with learning disabilities in school. Repeated failure at lessons that have not been adapted to accommodate their disabilities puts such students at high risk for developing low self-esteem, having low motivation for attending classes, and eventually dropping out of school (Hallahan, Kauffman, & Lloyd, 1995).

THIRD VIEW: A SYNTHESIS. As in many other areas of education, the key to teaching students is flexibility. Each student's individual needs must be thoroughly and regularly evaluated. Students who have a learning disability at one time may not need to receive extra help for the rest of their academic careers. They may learn to use cognitive and learning strategies well enough to overcome the disability. Alternatively, they may develop strengths that let them compensate for any limitations caused by their specific disabilities. Accommodations in testing and instruction should be used to help students find their strengths and make the most of them. Teachers must communicate their high expectations to all students, including those with learning disabilities. They should find ways to motivate the students with disabilities to work at the peak of their abilities.

*i*MPLICATIONS FOR TEACHING

- **Make your teaching strategies relevant to specific needs.** Learning disabilities are specific. Expert teachers are conscious of the fact that students who have learning disabilities are usually of similar intelligence, overall, to typical students. They do not have intellectual disability.
- **Teach learning strategies.** Encourage students to plan and monitor learning. Students with learning disabilities, like students with intellectual disability, are less likely to use helpful strategies during learning and problem solving. Expert teachers explain and stress the use of strategies to ensure that students who have learning disabilities understand and actually put the strategies into action. They remind students with learning disabilities to think about what they are doing, step by step, in advance if possible. They urge these students to focus on the path to the solution that will be best for a given problem.
- **Foster self-esteem and provide motivation for learning.** Teachers need to improve the motivation of students with learning disabilities. These students tend to lack self-esteem, and they often consider themselves failures at school. Expert teachers know that they must help these students see that success or failure is not an inevitable outcome of who the students are as people. Rather, they are results of the strategies, approaches, and amount of work the students invest. It is essential to stress and reward effort and improvement relative to one's own past performances rather than relative to the performance of one's peers. A teacher's enthusiasm is especially vital for students with learning disabilities.
- **Help students find their learning strengths and use those strengths to compensate for their weaknesses.** An expert teacher can call on these strengths when helping stu-

dents work on their weaknesses. For example, a problem requiring a student to compute the area of a figure can be solved either by using a formula, by using a pictorial representation that shows the area as comprising equal-sized portions of the geometrical figure, or by using a combination of the algebraic and geometric representations of the problem.

ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

The term **attention-deficit/hyperactivity disorder (ADHD)** applies to children who have a significant problem with attention, impulsive behavior, and hyperactivity. These children have trouble controlling their attention. Sometimes they may have trouble focusing on important things, such as the teacher's words. They often seem to act without thinking first. They also show what is considered excess physical activity. As Karen Schultz has noticed, students with ADHD often cannot stay in their seats at school. They may constantly fidget or twist in their chairs, tap their fingers, or simply seem very restless. They also have trouble finishing what they start. They may be disorganized in their work.

■ SYMPTOMS OF ADHD

Symptoms of ADHD tend to wax and wane in intensity. The exact symptoms also may change with age. For as many as two-thirds of the people who have it, ADHD can continue into adulthood (Khouzam, 1997). Signs of a significant problem are usually identified by age 7 or 8, but are sometimes diagnosed much sooner. Teachers are often the first to notice signs of ADHD, because school requires more focused attention and self-control than many other situations. Among students with ADHD, academic and disciplinary problems in school are common. In particular, high rates of off-task behavior are observed in children with this disorder (Lauth, Heubeck, & Mackowiak, 2006). Signs of learning difficulties become more apparent and seem to worsen as the material to be learned becomes more complex (Ward, 1994). Students with ADHD may also experience social problems, because impulsive behavior can make it hard to form friendships. Social skills training is often used to address this issue (de Boo & Prins, 2007).

THINKING ANALYTICALLY

Have you encountered any children diagnosed with ADHD in your classes, either as a teacher or as a student? If so, how did their behavior differ from that of other students?

SUGGESTION: The children tend to have trouble paying attention and sitting still.

In recent years, the number of children diagnosed with ADHD in the United States has grown significantly, although the reason for this increase remains unknown. One suggested explanation is that the number of cases correctly diagnosed rather than missed—especially for girls—has increased. Other explanations include the increased level of violence and/or faster pace of television shows and movies, increased use of food additives, increased demands upon children at younger ages, and increased sugar consumption. Current estimates indicate this disorder occurs in 6 to 9 percent of all school-age children, and in 5 to 7 percent of the general population (Ward, 1994).

Boys are five to nine times more likely to be diagnosed with ADHD than girls. The disparity in the incidence between boys and girls may reflect the tendency of boys to display the hyperactive and impulsive behaviors characterizing the disorder, whereas girls with ADHD are more likely to show inattentive behavior (Livingston, 1997). Expert teachers are aware of the gender differences in ADHD diagnoses, and they strive to evaluate fairly the behavior shown by all students.

■ TREATING ADHD

Children with mild cases of ADHD are generally treated through a combination of counseling and special educational assistance. Moderate and severe cases are typically treated with a combination of behavioral intervention and stimulant drugs.

Treatment with stimulants may seem counterintuitive. Nevertheless, when treated with such drugs, children with ADHD tend become less physically active and have increased attention spans (Rapoport et al., 1980). Among the stimulants most commonly prescribed for this purpose are Ritalin (methyphenidate), Dexedrine (dextramphetamine), and Cylert (pemoline) (Ward, 1994). Unfortunately, stimulant drugs can have negative side effects, including increased heart rate and blood pressure, nausea, insomnia, and interference with growth and weight gain (Livingston, 1997).

Wellbutrin or Zyban (buproprion) is also used to treat some individuals with ADHD. A new medication used to treat ADHD that is not a stimulant is Strattera (atemoxetine

hydrochloride). Strattera and other nonstimulant medications have been shown to be effective treatments for ADHD (Banaschewski, Roessner, Dittmann, Santosh, & Rothenberger, 2004).

A number of writers and parents' groups have expressed concern that stimulant drugs are overprescribed. They believe that other ADHD treatment techniques (e.g., behavioral therapies) should be emphasized instead of medication-based therapies (Livingston, 1997; Price, 1996; Smelter, Rasch, Fleming, Nazos, & Baranowski, 1996). Another problem associated with the use of these drugs is that some people use them without a doctor's prescription.

■ **TEACHING STUDENTS WITH ADHD** Even the most expert teachers may find it challenging to teach students with ADHD. The following techniques may help (adapted from Hogan, 1997, and "How to Manage your Students with ADD/ADHD," 1997):

- *Carefully structure the classroom environment.* Seat students with ADHD as far from distractions (such as the door, windows, and pencil sharpener), as possible. It may help to seat a child with ADHD next to students who are good workers. Children with ADHD sometimes have trouble staying organized, so elementary school teachers can help by providing a clearly organized classroom. Color-code or label materials and the places where they belong, and help students set up their own organization systems as well.
- *Structure activities.* Students with ADHD can become impatient if they do not know what is expected of them. Creating a daily routine helps students know what is coming next. In addition, teachers should state rules clearly—even posting visual reminders of expected behavior, if necessary. Provide some sort of structured escape for students who easily tire of routine. Standing helps some students to pay better attention than when they are sitting, so some teachers allow students to choose to stand in the back of the class. Such methods should be used only if they do not distract the other students.
- *Help students focus attention.* Some teachers work with their students with ADHD to devise private signals that are used to bring attention back to the classroom. For example, a teacher might touch the student on the shoulder as he or she passes, to ensure the student stays focused on the teacher's words. Nonverbal cues, such as clapping hands or holding up an index finger before beginning to speak, help attract attention from all students. Clapping of hands should be used sparingly, however, or it loses its effect.
- *Help students develop awareness of their behavior.* Creating checklists of steps for assignments can help students recognize desired behaviors, as can charts of target behaviors, whether good or bad. Give clear feedback to help students become aware of what they are doing and whether their behavior is appropriate for the situation.
- *Provide opportunities to use excess energy.* Elementary school teachers, such as Karen Schultz, might alternate highly physical activities with sedate lessons. Even in middle school and high school, teachers may want to allow some movement in classes. For example, science classes can be set up with exploration centers. Literature classes can include occasional opportunities to dramatize the works that are studied.

Keep in mind that inattentive or hyperactive behavior may occasionally be a signal of something other than ADHD—for example, an emotional or behavioral disorder. Also be aware that some students may demonstrate attention-deficit disorder without hyperactivity (ADD).

EMOTIONAL AND BEHAVIORAL DISORDERS

During your teaching career, you will probably encounter students who show symptoms of emotional and behavioral disorders. In this section, we define and discuss the kinds of disorders that teachers need to understand to help students succeed in school.

■ **DEFINING AND CATEGORIZING BEHAVIORAL DISORDERS** **Emotional and behavioral disorders** are defined in the Individuals with Disabilities Education Act (IDEA), or Public Law 101-476. They include problems such as behavior inappropriate to the cir-

cumstances and pervasive unhappy moods. In each case, they are relevant only if they adversely affect a child's education performance and cannot be explained by intellectual, sensory, or health factors. Several names are used interchangeably for emotional and behavior disorders, such as *emotional disturbance* or *social maladjustment*. Many teachers and schools prefer to use the term *behavioral disorder* because it focuses attention on a student's behavioral problems, rather than on his or her general character.

The IDEA definition of behavioral disorders leaves room for uncertainty. For example, "normal circumstances" for one student may be highly unusual circumstances for a different student. Some students are comfortable in operating in noisy environments, for instance, whereas others find noise distracting. Another problem with this definition is that it is so vague it describes the behavior of nearly all students at one time or another (Bower, 1982).

Generally, a behavioral disorder is diagnosed only when a student's behavior becomes a problem because it is unusually severe, displayed frequently, and chronic (i.e., long-lasting; Coleman, 1996). A teacher who believes a student may have a behavioral disorder should seek the help of a school psychologist or other professional to make a diagnosis. Teachers also need to realize that dull or overly restrictive environments can incite acting-out behavior in children. These same children may display behavior that is acceptable in a more interesting or less restrictive environment.

Laima Druskis/PH College

Most teachers will encounter students who show symptoms of emotional and behavioral disorders.

Differing definitions of emotional and behavioral disorders are probably the reason for the wide range of estimates of the number of children affected by such disorders. The U.S. Department of Education (1994) has reported that approximately 1 percent of U.S. schoolchildren have a behavior disorder severe enough to require special education. Other estimates range as high as 20 percent of all schoolchildren. Most experts suggest the problem affects about 6 to 10 percent of students (Coleman, 1996). Nearly three times as many boys as girls are diagnosed with behavioral disorders (U.S. Department of Education, 1994). The incidence of behavioral disorders also seems to be increasing. Some evidence suggests that these disorders emerge early and are consistent across childhood (Egger & Angold, 2006).

Behavioral disorders can be classified into two main categories: internalizing and externalizing (Coleman, 1996).

■ **INTERNALIZING DISORDERS** An internalizing behavioral disorder is characterized by shyness, withdrawal, or depression. Students with this type of disorder may be fearful and anxious, apathetic, sad, or overly self-conscious and self-criticizing. They may avoid group participation, or seem preoccupied and inattentive (Coleman, 1996). A teacher may not notice that a student has such a disorder unless it disrupts the student's academic performance. For example, Lorraine seems merely shy to her teachers. In fact, she dreads having to interact with others, whom she fears will criticize her.

Teachers of students who have internalizing types of disorders may find it useful to include group projects as a natural and nonthreatening part of their lessons. Before starting group projects, clarify rules for respectful treatment and inclusion of all group members. In addition, some children can be helped by lessons in specific social skills, such as joining groups. Their anxiety and timidity may have prevented them from picking up these skills earlier.

■ **EXTERNALIZING DISORDERS** In contrast to individuals with internalizing disorders, students who have an externalizing type of disorder are usually quite noticeable to teachers. Such students tend to demand teachers' attention. They are disruptive, disobey rules, and may be openly defiant of teachers. They may also engage in illegal or self-destructive behavior, such as lying, theft, or drug use. These students may also be aggressive toward other students or destructive of school property (Coleman, 1996).

One category of externalizing emotional disorders has been clearly defined. **Conduct disorder** is described as "a distinctive pattern of antisocial behavior that violates the rights of others" (Coleman, 1996). Students who have a conduct disorder are often aggressive. They may get into physical fights with teachers and other students, and they show little regard for

rules. Also, they repeatedly disobey instructions. Without intervention, they may go on to a life of crime (Brodkin & Coleman, 1996). For example, Harry, a student with conduct disorder, often does not show up for class, is a frequent troublemaker when he does show up, and constantly picks fights with other students.

A related externalizing disorder is oppositional defiant disorder. Oppositional defiant disorder is characterized by uncooperative, negative, and defiant behavior toward others, especially authority figures (Nock, Kazdin, Hiripi, & Kessler, 2007; Rowe, Maughan, Costello, & Angold, 2005).

Students with externalizing disorders can prove quite challenging for teachers. Teachers must take the time to structure the class to avoid the possibility of disruptive behavior. Seat students who are likely to act out where they can be easily seen by the teacher and are unlikely to hurt other students or themselves. Behavioral techniques, such as those explained in Chapter 7 (e.g., linking learning with positive emotions, shaping behavior, giving time-out), also may be helpful. Other recommended tools include checklists of behavior, which can help students monitor their behavior; rewards for positive class behavior, which can shape how the students act; and clearly stated penalties for negative behavior, which can help both student and teacher see progress.

■ **MAKING SENSE OF AUTISTIC DISORDER** One specific disorder often considered under the general category of behavioral disorders is autism. **Autistic disorder,** also called *autism* or *Kanner's syndrome*, is a pervasive developmental disorder characterized by the following features:

- Marked lack of interest in other people, accompanied by strong interest in the inanimate environment
- Emotional distance and avoidance of eye contact
- Failure in the development of peer relationships
- Delayed or practically nonexistent development of language
- Stereotyped and often seemingly purposeless and repetitive movements, such as rocking of the body or flapping of the hands
- Self-injurious behavior
- Intellectual disability, sometimes accompanied by isolated skills in which the autistic individual shows great talent (Kanner, 1943; Volkmar, 1996)

THINKING ANALYTICALLY

How might having autism have predisposed Mel to develop his painting talents?

SUGGESTION: Mel concentrated heavily on developing this talent, often to the exclusion of many others.

Not all children with autism have all of these characteristics. For that reason, autism is often referred to as a *spectrum disorder*. Children can fall on various points along a broad spectrum, ranging from a few minor symptoms to many major symptoms. Most children with autistic disorder, however, have social and language impairments (Frith, 1993). For example, Mel, a child with autism, seems to live in a world of his own. He rarely interacts with others and has limited speech. He repeats many stereotyped movements that seem to have no useful purpose. Mel is very concerned that objects be in their proper places, yet he is also a gifted watercolor artist.

Symptoms of autistic disorder usually become noticeable shortly after birth or at least within the first year of life. Many children, however, are not diagnosed properly until past age 3. Autism has sometimes been confused with childhood schizophrenia, but it is, in fact, a distinct disorder. Autism spectrum disorder occurs in approximately 20 of every 10,000 children (Williams, Higgins, & Brayne, 2006). It is four to five times more common in males than in females (Volkmar, 1996). There is no known cure for the disorder. Treatment usually consists of a combination of psychotherapy, especially behavior modification techniques, and special education.

Teachers who have children with autism in their classes might need to adapt assignments so these students can respond in nonverbal ways. Typically, only children with mild forms of autism are found in conventional classrooms. It is difficult for a teacher to teach a child with full-blown autism in the context of a normal classroom. If a child with autism cannot interact with a group, a teacher may need to assign that student individual work in place of group assignments. Behavioral approaches to learning, covered in greater detail in Chapter 7, often work to help children with autism learn appropriate social behavior and language skills. They also help to decrease inappropriate or self-injurious behavior (Lovaas, 1987).

HEALTH DISORDERS

Health disorders include physical conditions such as drug use and acquired immune deficiency syndrome (AIDS), which are discussed in Chapter 3. Seizure disorders and cerebral palsy are discussed here. Some other relevant health disorders include the following conditions:

- *Diabetes mellitus* is a chronic disease caused by insufficient production of insulin by the body. It results in abnormal metabolism.
- *Spina bifida* is a congenital defect in which the spinal column is imperfectly closed and partly protrudes. It can result in various neurological disorders.
- *Muscular dystrophy*, any of a group of progressive and chronic muscle disorders caused by a genetic abnormality, results in gradual and irreversible wasting of skeletal muscles.
- *Cystic fibrosis* is a genetically caused disease characterized by the production of abnormally dense mucus in the affected glands. It usually results in chronic breathing difficulty and impaired pancreatic functioning.
- Damage to children may occur as a result of their parents' addictions to chemical substances, such as is seen in *fetal alcohol syndrome.*

Of course, students may have many other health disorders, such as allergies, asthma, and various autoimmune disorders. Teachers need to be aware of all health disorders in students that may affect their adaptations to the classroom environment.

Teachers of children with physical exceptionalities should learn as much as they can about the children's conditions from parents and school medical personnel. In addition, they need to know what to do in case a child has a health emergency. Teachers of children with physical conditions should be aware of the children's limitations. Expert teachers keep their focus on each child's abilities so they can challenge children to perform to the best of their ability.

■ **MAKING SENSE OF SEIZURE DISORDERS** Some of the most misunderstood physical conditions are seizure disorders. Teachers who are not familiar with the causes and proper responses for seizures may be nervous or alarmed about teaching a child with a seizure disorder. With information and training, however, teachers can overcome any fears they may have.

GENERALIZED AND PARTIAL SEIZURES. **Seizure disorders** (collectively referred to as **epilepsy**) are characterized by excessive discharges of electrical energy in parts of the brain (Hallahan & Kauffman, 1997). Two main types of easily observable seizures are distinguished: *generalized seizure* (formerly called *grand mal seizure*) and *partial seizure* (formerly called *petit mal seizure*). The generalized form involves much of the brain, whereas the partial form involves only a small part of it. Partial seizures are often unnoticeable, except to trained observers. In contrast, a generalized seizure is extremely obvious.

A full-blown generalized seizure is typified by uncontrolled jerking movements that can last from two to five minutes, followed by deep sleep or, in rarer cases, coma. During the seizure, the person loses consciousness. He or she may shake, jerk violently (which you will not be able to control), and appear very rigid. Upon waking, the person may be confused or disoriented. If a child has such a seizure, you must take action, including the following steps (Hallahan & Kauffman, 1997; Heward & Orlansky, 1980):

- Ease the child gently to the floor, away from furniture, other nearby objects that the child might strike, and walls.
- Loosen the child's collar and any tight clothing.
- Place something soft under the child's head.
- Remove any hard or sharp objects nearby or on the child's person that might be sources of injury.
- Gently turn the child's head to one side so that saliva can be released.
- Allow the child to rest upon regaining consciousness.
- Call for medical help if the seizure lasts more than a few minutes or if the child experiences several seizures in succession.

ABSENCE SEIZURES. Another type of seizure, an *absence seizure*, is very brief (see Blumenfeld, 2005). In fact, it may not even be observable. In some individuals, an absence seizure may look like daydreaming followed by a period of disorientation and loss of memory for what happened during the time of the seizure. During such seizures, the individual may have a blank look and appear to stare. The child may not even be aware that the seizure occurred. Children who are prone to absence seizures may miss information presented during the time they are "absent." Teachers should double-check with these students to make sure they understand lessons and instructions. Teachers should then repeat information for them if necessary.

DEALING WITH SEIZURE DISORDERS. Seizures can be caused by various illnesses. Hence, if they are unexpected, they must be brought to the attention of appropriate medical personnel. For example, seizures can be associated with hypoglycemia (reduction of blood glucose well below normal levels) or can be a complication of diabetes, especially if the illness is undiagnosed or not adequately treated.

When not subject to seizures, a child with epilepsy will show no particular signs of the condition. Seizures can be partially controlled through medication. Other children are not at risk, because epilepsy is not contagious. Generalized seizures can be traumatic to see, however. They can be especially frightening in the case of young children. Unfortunately, they also can result in a child's being ostracized by her peers. An expert teacher knows that if a child with epilepsy is in class and likely to have seizures, it is better to confront the possibility in advance, both with that student and with other students. In this way, they will be informed and will not panic if a seizure occurs. The teacher may choose to discuss with students some of the reasons why seizures might scare them. The class can then plan ways to face seizures with courage and compassion.

■ **MAKING SENSE OF CEREBRAL PALSY** **Cerebral palsy** is a motor impairment caused by damage to the brain. Typically, oxygen deprivation before, during, or shortly after birth causes the brain damage. The child with cerebral palsy usually has difficulty moving and coordinating different body parts (Koman, Smith, & Shil, 2004). He or she may have speech and hearing problems as well (Kirk, Gallagher, & Anastasiow, 1993). The brain damage can, but does not necessarily, cause intellectual disability. Teachers of children with cerebral palsy should keep this distinction in mind. Sometimes an excellent mind is caged in a dysfunctional body, and it can be freed with expert teaching.

Cerebral palsy is not contagious. As a disease, cerebral palsy is not progressive. Its symptoms may change over time, however, sometimes becoming worse. The extent of the symptoms is highly variable. They may range from an almost undetectable lack of motor coordination to severe difficulty in coordination. In serious cases, the individual may require use of a brace or a wheelchair. He or she also may have difficulty in speaking.

Teachers should always remember that, for students with physical disabilities, it is the body, not the mind, that is disadvantaged.

Many prosthetic devices and computer technologies are available to help students with cerebral palsy who have severe movement and communication problems. Teachers should become familiar with the workings of any physical aids their students use, just as they should become familiar with devices that aid children who have sensory and cognitive impairments, which we discuss next.

Scott Cunningham/Merrill

SENSORY IMPAIRMENTS

Sensory impairments refer to difficulties in intake of information through the sensory systems of the body. These impairments are primarily visual and auditory—problems seeing and hearing.

■ **SEEING PROBLEMS** A **visual impairment** is a serious, uncorrectable problem of seeing. Approximately 1 in 1000 U.S. children has a visual impairment. Children with such impairments can be helped by large-print books or special glasses, including, but not limited to, magnifying glasses. A smaller proportion—roughly 1 out

every 2500 children—is educationally blind. That is, the child must use hearing and touch (as through Braille, a language for the blind that uses raised dots and is decoded through the sense of touch) to learn.

A variety of tools are available to help students with visual impairments, including large-print and Braille books, books and lectures on audiotape, special calculators and typewriters, and special measurement devices. In gathering and preparing materials for visually handicapped individuals, remember it is not just the size of the print that matters, but also the quality of print. Take special care with the quality of print in reproductions or other sources given to these children. Place children with visual impairments at the front of the room, where they will best be able to see words on the blackboard or items shown from the front of the classroom. Lisa, for example, has a visual impairment. Although she sits in the first row of her fourth-grade classroom, she still has difficulty seeing what is written on the blackboard. For this reason, her teacher is careful to write with large, clear letters on the blackboard.

Be aware of signs of possible visual problems that may not yet be diagnosed. Examples of such signs include these issues:

- Holding reading material very close to or very far from the eyes
- Failing to pay attention when a chalkboard or other visual aid is used
- Frequent questioning about things that have been presented via visual channels
- Great sensitivity to glare
- Physical problems with the eyes, such as swelling, redness, or crusting, or excessive rubbing of the eyes

If you suspect a visual problem, contact parents or school medical personnel to recommend the student receive a thorough vision examination.

■ **HEARING PROBLEMS** Hearing impairments are often correctable with a hearing aid, but only if the problem is detected first. Moreover, some hearing impairments are not fully or even partially correctable, even through a hearing aid. Expert teachers are always on the lookout for children who indicate, in one way or another, that they are having hearing difficulties. Examples of ways children might indicate such difficulties are the following behaviors:

- Asking the teacher to repeat questions or statements
- Asking frequent questions about orally presented material and especially questions that were clearly answered
- Straining or frequently cocking their heads so as to improve their hearing
- Asking the teacher to speak louder

Because children are often unaware of or hide hearing impairments, consider such impairments before you decide they might have a psychological problem.

There are several ways to help children with hearing difficulties in the classroom. For example, you can seat a student with a hearing problem in the front of the room or, if one ear hears better than the other, on the side of the "good ear." Face students when speaking, and speak at their eye level. If necessary, help students with their hearing aids. For example, Luke's teacher, Mr. Shabazz, takes care to speak loudly, clearly, and slowly in class. Mr. Shabazz has discovered that such speech not only aids Luke, who has a hearing impairment, but also benefits the other students.

THINKING PRACTICALLY

Why are children with visual and hearing impairments at risk of incorrect diagnoses for learning disabilities? Which steps can be taken to prevent such false diagnoses?

SUGGESTION: Children with these impairments can be low achievers whose behavior resembles that of children with learning disabilities or other psychological problems. Visual and hearing tests are essential to preventing misdiagnosis.

COMMUNICATION DISORDERS

Communication disorders are problems with speech in particular, or with language in general. Teachers are likely to encounter some common communication disorders, including stuttering, articulation disorders, and voicing problems.

■ **STUTTERING** Stuttering is repetitions, prolongations, or hesitations in articulation that disrupt the flow of speech (Guitar, 2006; Yairi, 2006). It typically appears around the age of 3 or 4 and can cause the child considerable embarrassment. Stuttering occurs in approximately 1 percent of students, and it is four times more common in males than in females (Papalia &

Wendkos-Olds, 1989). No one knows its exact cause. In roughly half of all cases, stuttering spontaneously disappears during early adolescence (Wiig, 1982). Even so, speech therapy is generally recommended as soon as possible to alleviate the problem as much as possible. Teachers of children who stutter must be patient. Whenever possible, they should allow the child to finish his or her spoken thoughts without interruption.

Children with communication disorders such as stuttering may have trouble being fully accepted by their peers (Guralnick, Connor, Hammond, Gottman, & Kinnish, 1996). For example, Emil's tendency to stutter has led him to be an object of ridicule for some children in his class. To keep classmates from teasing students who stutter, expert teachers set clear rules, or lead class discussions on student differences and respectful treatment.

■ **ARTICULATION DISORDERS** Articulation disorders involve substituting one sound for another, distorting sounds, adding sounds, or subtracting sounds. Most of these disorders disappear with age. Indeed, children are not typically able to pronounce fully all the sounds necessary for a normal conversation in English until they are 6 to 8 years old. Certain sounds, such as *l, r, sh,* and *th,* are particularly difficult. Children who grow up not speaking English are at a special disadvantage, because the sounds of their language will be different from those in English.

To help children overcome articulation disorders, provide correct examples of articulation for these students. Encourage them to try to pronounce sounds correctly, but remember that even those who never fully learn English articulation can do extremely well in society. Adults who learn English as a second language are likely never to master the exact articulation of English. Instead, they will likely carry with them an accent that identifies them as native speakers of another language. Nonetheless, such adults can adapt successfully to the demands of life in the United States.

THINKING PRACTICALLY

Speaking with poor articulation or in a monotone is not a problem limited to students. What can a teacher do to ensure that his or her speaking voice is both understandable to and engaging of students?

SUGGESTION: The teacher can tape his or her voice when teaching and then analyze it and invite others to do the same.

■ **VOICING PROBLEMS** Voicing problems include symptoms such as hoarseness, inappropriate pitch, loudness, or intonation (as when someone speaks in a monotone) (Wiig, 1982). Often, children merely need to be made aware of such problems. With a little help from the teacher, they can correct these problems.

PERCEPTUAL DEFICITS

Severe deficits in visual perception, referred to collectively as *agnosias,* typically occur as a result of brain damage. Although people with *visual-object agnosia* can sense all parts of the visual field, the objects they see do not mean anything to them. For example, one agnosic patient, upon seeing a pair of eyeglasses, noted first that there was a circle, then that there was another circle, then that there was a crossbar. He finally guessed that he was looking at a bicycle, which does, indeed, comprise two circles and a crossbar (Luria, 1973).

In *prosopagnosia,* people have a severe deficit in their ability to recognize human faces, yet may be able to recognize other kinds of faces, such as those of farm animals. This disorder is a hot topic of research in perception (Barton, 2003; Downing, 2007; Duchaine & Nakayama, 2006; Farah, Levinson, & Klein, 1995; Farah, Wilson, Drain, & Tanaka, 1995; Haxby, Ungerleider, Horwitz, Maisog, Rappaport, & Grady, 1996; Righart & de Gelder, 2007; Schiltz, Sorger, Caldara, Ahmed, Mayer, Goebel, & Rossion, 2005).

LEARNING AND MEMORY DEFICITS

Amnesia is loss of explicit memory. Amnesia victims perform extremely poorly on many tasks involving *explicit memory,* in which they are aware they are having to recall something (e.g., recall the authors of this textbook). By contrast, they show normal or almost-normal performance on word-completion tasks involving *implicit memory* (Baddeley, 1999; Goshen-Gottstein, Moscovitch, & Melo, 2000), in which they are not aware they are being asked to recall. When asked whether they have previously seen the word they just completed, however, they are unlikely to remember the specific experience of having seen the word. These data suggest that the effects of amnesia target explicit, rather than implicit, memory.

Amnesia victims also show paradoxical performance in tasks that involve *procedural memory* of how to do things, such as ride a bicycle, versus those that involve *declarative memory*, or memory for facts. For example, amnesia victims may perform extremely poorly on traditional memory tasks requiring recall or recognition memory of declarative (factual) knowledge. By contrast, they may demonstrate improvement in performance due to learning—remembered practice—when engaged in tasks that require procedural memory. Examples of such tasks include solving puzzles, learning to read mirror writing, or mastering motor skills (Baddeley, 1999).

One of the most famous cases of the severe memory loss known as amnesia is the case of H. M., reported by William Scoville and Brenda Milner (1957; Milner, Corkin, & Teuber, 1968; see also MacKay, 2006; O'Kane, Kessinger, & Corkin, 2004; Salat et al., 2006). Following an experimental surgical treatment for uncontrollable epilepsy, H. M. suffered severe **anterograde amnesia**—the inability to explicitly recall events that occurred *after* whatever trauma caused the memory loss. However, H. M. had full recollection of events that had occurred before his operation. Although his postsurgical intelligence test score was 112, which is above average, his score on the memory test was 67, which is far below average. Moreover, shortly after taking a test from the memory scale, he could not remember that he had taken it. Had he been given the test again, it would have been as though he were taking it for the first time. H. M. once remarked on his situation: "Every day is alone in itself, whatever enjoyment I've had, and whatever sorrow I've had" (Scoville & Milner, 1957, p. 217). H. M. all but lost his ability to form new explicit memories, so he lived suspended in an eternal present in which he was unable to create any explicit memories of the time following his operation.

Another type of memory loss is **retrograde amnesia,** the inability to explicitly recall events that occurred *before* the trauma that caused the memory loss. W. Ritchie Russell and P. W. Nathan (1946) reported a case of severe retrograde amnesia following a physical trauma. A 22-year-old greens-keeper suffered serious memory loss following a motorcycle accident. By 10 weeks after the accident, however, he had recovered his explicit memory for most events, starting with the events in the most distant past and gradually progressing up to more recent events. Eventually, he was able explicitly to recall everything that had happened up to a few minutes prior to the accident. As is often the case, the events that occurred immediately before the trauma were never recalled. Retrograde amnesia may also be the result of extreme emotional trauma or stress (Diamond, Park, & Woodson, 2004; Strange, Hurlemann, & Dolan, 2003).

Yet another form of amnesia is one that all of us experience: **infantile amnesia,** the inability to recall events that happened during early development of the brain. Generally, we can remember little or nothing that has happened to us before the age of approximately 5 years, and it is extremely rare for someone to recall any memories before the age of 3 years (Hayne, 2004). Reports of childhood memories usually focus on significant events, such as the birth of a sibling, the death of a parent, or other trauma (see Fivush & Hamond, 1991; Peterson, Grant, & Boland, 2005). Presumably, these emotional memories last because they make a very strong impression, although they are not always accurate (Schacter, 1996). Infantile amnesia is unlike the other forms of amnesia in that everyone experiences it.

ARE THERE DISTINCT DEFICITS DUE TO HEMISPHERIC SPECIALIZATION?

The brain has two hemispheres, left and right. Some investigators have suggested that individuals may show unusual performance because of patterns of hemispheric specialization. The individual most responsible for modern theory and research on hemispheric specialization is Nobel Prize–winning American psychologist Roger Sperry. Sperry (1964) argued that each hemisphere behaves in many respects like a separate brain. In a classic experiment that supports this contention, Sperry and his colleagues (Sperry, 1964) severed a cat's corpus callosum. They then showed that information presented visually to one cerebral hemisphere of the cat was not recognizable to the other hemisphere. Sometimes, Sperry's research has been misinterpreted to imply that some people are "left hemisphere people" and others "right hemisphere people." They are not!

Some of the most interesting information about how the human brain works, and especially about the respective roles of the hemispheres, has emerged from studies of humans with epilepsy. Surgeons have severed the corpus callosum to prevent epileptic seizures from spreading from one hemisphere to the other. The operation greatly lessens the severity of the seizures, but it also results in a loss of communication between the two hemispheres. It is as if the person has two separate specialized brains that process different information and perform separate functions (see Turk, Heatherton, Kelley, Funnell, Gazzaniga, & Macrae, 2002).

People who have undergone such operations are termed *split-brain* patients. Although they behave normally in many respects, in a few ways their behavior is bizarre. Instances have been reported of a person's left hand struggling against the right hand to accomplish a task such as putting on pants. One patient, angry at his wife, reached to strike her with his left hand while his right hand tried to protect her by stopping the left (Gazzaniga, 1970). Split-brain patients almost literally have two separate minds of their own.

Split-brain research reveals fascinating possibilities regarding the ways we think. Many investigators have argued that language is completely localized in the left hemisphere, and that *visuospatial ability*--a set of skills involving aspects of visual and spatial orientation and perception—is localized in the right hemisphere (Farah, 1988a, 1988b; Gazzaniga, 1985; Zaidel, 1983). For example, the ability to understand this sentence would be localized in the left hemisphere, but the ability to imagine what a car would look like if it were rotated 180 degrees would be localized in the right hemisphere. Jerre Levy (one of Sperry's students) and colleagues (Levy, Trevarthen, & Sperry, 1972) probed the link between the cerebral hemispheres and visuospatial versus language-oriented tasks, using participants who had undergone split-brain surgery.

Are the two sides of the brain really so distinct in function? Additional split-brain research supports the view that visuospatial processing occurs primarily in the right hemisphere (Gazzaniga, 1985; Gazzaniga & LeDoux, 1978) and language processing primarily in the left hemisphere. Some researchers, however, hold that the right hemisphere may have some role in language processing. For instance, Michael Gazzaniga (1985; Gazzaniga, Ivry, & Mangun, 1998) has argued that the brain—especially the right hemisphere—is organized into relatively independent functioning units that work in parallel. According to Gazzaniga, the many discrete units of the mind operate relatively independently of the others, often outside of conscious awareness. While the various independent and often subconscious operations are taking place, the left hemisphere tries to interpret them. Even when the left hemisphere perceives that the individual is behaving in a way that does not intrinsically make any particular sense, it still finds a way to assign some meaning to that behavior. For example, a person who senselessly attacks someone who is helpless may justify his or her behavior as giving the person what he or she deserves.

Some biopsychological researchers have tried to determine whether the two hemispheres think differently. Levy (1974) found some evidence that the left hemisphere tends to process information *analytically* (piece by piece, usually in a sequence), whereas the right hemisphere works *holistically* (as a whole, all at once). In another study, Schiffer, Zaidel, Bogen, and Chasan-Taber (1998) found that the right hemisphere of a split-brain patient appeared to be more disturbed than the left hemisphere by childhood memories of being bullied. At present, the precise distinctions between the right and left hemispheres have not been firmly established. As always, alternative scientific interpretations of the same data make science both frustrating and exciting.

Outrageous claims are sometimes made regarding hemispheric specialization. For example, you might hear someone referred to as a "right-brain" individual or a "left-brain" individual, often in reference to whether the person is more holistic ("right-brain") or analytic ("left-brain") in his or her approach to problems. Such expressions are purely metaphorical; they do not represent any biological reality. Except for people with extremely serious brain damage, everyone uses both hemispheres and the interaction between them in accomplishing most everyday tasks.

Cross-cultural research offers yet another way of looking at how visuospatial and sound-based language symbols are localized in the brain. In school, Japanese children study two forms of written language. The first, called *kanji*, is based on Chinese ideographs and conveys

an entire idea within each symbol. It is thus primarily pictorial. The second, called *kana,* is based on phonetic syllables and can be used for writing foreign words such as scientific terms. In the 1970s, Japanese researchers started wondering whether the pictorial and phonetic forms might be processed differently in the two hemispheres of the brain. Some concluded that the phonetic-based *kana* are processed entirely in the left hemisphere, but the picture-based *kanji* are processed in both left and right hemispheres (Shibazaki, 1983; Shimada & Otsuka, 1981; Sibitani, 1980; Tsunoda, 1979). It seems that to explore and understand the diverse abilities and functions of the human brain, researchers must study the rich diversity of the human community.

As we stated at the beginning of this chapter, all students are exceptional. Expert teachers become knowledgeable about the exceptionalities they are likely to encounter in their students and use this information to find ways to help each of their students achieve his or her potential.

SUMMING IT UP

TEACHING EXCEPTIONAL CHILDREN

- Exceptional children need special services if they are to profit maximally from the educational experience provided by schools. Special education refers to any program that provides special services for at-risk children.
- Public laws require children with special needs access to the least restrictive placement in an educational setting that is as normal as possible. Efforts to provide the least restrictive placement have included mainstreaming, or gradually placing special-needs children into regular classes when they are able to meet mainstream requirements, and full inclusion, or the placement of all children, including those with severe disabilities, in regular classes. In accordance with federal laws, individualized educational programs (IEPs) must be created and followed for each student with special needs.

EXTREMES OF INTELLECTUAL FUNCTIONING: GIFTEDNESS

- Gifted children are those with exceptionally strong abilities or talents. Definitions of giftedness must take into account the context in which the child is being considered.
- A high IQ in itself is not necessary or sufficient for identifying a child as gifted. The Marland Report distinguished six broad areas of ability that can be used to identify gifted children. The three-ring model of giftedness suggests that giftedness occurs at the intersection of ability, creativity, and task commitment.
- A variety of educational alternatives, including pull-out programs, acceleration, curriculum compacting, and enrichment, as well as combinations of these approaches, such as a revolving-door model, have been used to teach gifted students. In addition, teachers should try to encourage and challenge gifted students regularly.

EXTREMES OF INTELLECTUAL FUNCTIONING: INTELLECTUAL DISABILITY

- Teachers and other professionals must consider both academic and practical-competence aspects of performance before identifying a child as having intellectual disability. Alternative conceptions of intellectual disability include a developmental view and views that people with intellectual disability are qualitatively different from people without it.
- Teachers can help students with intellectual disability by teaching cognitive strategies directly, dividing lessons into steps, focusing on concrete and practical aspects of learning, and providing encouragement and support for self-esteem.

CHALLENGES TO LEARNING

- Some children have specific learning disabilities. The most widely studied are reading disabilities, which may have multiple causes and manifestations. Although students with learning disabilities do not usually have intellectual disability, they can, like students with intellectual disability, often be helped by direct teaching of cognitive strategies.
- Concern has been expressed about the growing number of children diagnosed with attention-deficit/hyperactivity disorder (ADHD), which is characterized by difficulties in paying attention, hyperactivity, and impulsive behavior. Treatment with stimulants, often combined with therapy, is common, and is yet another cause for concern. Teachers can help students with ADHD by structuring their classrooms and activities, and developing techniques to assist in focusing attention.
- Emotional and behavioral disorders are affecting a growing number of children. Such disorders are marked either by internalizing behavior, such as shyness and anxiety, or by externalizing behavior, including

defiance and aggression. Pervasive developmental disorders, including autistic disorder, are rare but have severe symptoms.

- Teachers are likely to encounter students with a variety of health disorders. Seizure disorders (also called epilepsy) and cerebral palsy are two of the more severe and most misunderstood of these health conditions. Teachers should learn all they can about any health disorders affecting their students and seek out proper training in case of emergencies.
- Teachers also need to accommodate students with sensory impairments. They should especially be on the lookout for children with auditory and visual impairments. Such problems, when undiagnosed, can lead to poor performance in school that might be readily correctable.
- Teachers can help students with common communication disorders such as stuttering, problems of articulation, and problems of voicing.

KEY TERMS AND DEFINITIONS

- **Amnesia** Loss of explicit memory. Page 188
- **Anterograde amnesia** The inability to explicitly recall events that occurred after whatever trauma caused the memory loss. Page 189
- **At-risk children** Exceptional children who are in danger of failing to gain the skills needed to succeed in school and in life in general. Page 159
- **Attention-deficit/hyperactivity disorder (ADHD)** Disorder in which children have trouble paying attention, often seem to act without thinking first, and show what is considered excess physical activity. Page 181
- **Autistic disorder (autism, Kanner's syndrome)** A form of pervasive developmental disorder involving severe social and language difficulties. Page 184
- **Cerebral palsy** Motor impairment caused by damage to the brain. Page 186
- **Communication disorders** Problems in language in general, or in speech, including stuttering, articulation disorders, and voicing problems. Page 203
- **Conduct disorder** Type of behavioral disorder in which children display a pattern of disruptive, aggressive behavior that often violates the rights of others. Page 183
- **Emotional and behavioral disorders** Group of disorders that cannot be explained by intellect, sensory, or health factors. Affected individuals may display either internalizing symptoms, such as shyness and anxiety, or externalizing symptoms, including disobedience and aggression. Page 182
- **Exceptional child** Child who is unusual in one or more ways, and whose unusual characteristics create special needs with respect to identification, instruction, or assessment. Page 158
- **Full inclusion** Placement of all children, even those with severe disabilities, in regular classes. Page 161
- **Gifted children** Children with exceptionally strong intellectual abilities or talents. Page 165
- **Individualized educational program (IEP)** Team-written educational plan updated annually to help a student with special needs attain certain specific goals. Page 161
- **Infantile amnesia** The inability to recall events that happened during early development of the brain. Page 189
- **Intellectual disability** Overall low levels of mental competence, usually viewed as including low IQ and low adaptive competence. Page 170
- **Learning disabilities (LD)** Instances in which individuals perform more poorly in subject matter areas than would be expected, given average intelligence, or cannot master specific skills important in school success. Page 175
- **Least restrictive placement** Legal requirement that every child must be taught in an educational setting that is as normal as possible. Page 161
- **Mainstreaming** Placing special needs children into regular classes when they are able to meet the requirements of those classes. Page 161
- **Marland Report** Government document issued in 1972 that distinguished six broad areas of ability that should be used to identify gifted children. Page 166
- **No Child Left Behind Act** Act containing stipulations to ensure that schools teach all children to perform at minimally acceptable, documentable levels, according to federally defined standards. Page 160
- **Public Law 94-142** Education for All Handicapped Children Act; a federal law passed in 1975 that requires states to provide a free, appropriate public education for every child between the ages of 3 and 21, regardless of how or how seriously the child is handicapped. Page 159
- **Public Law 99-457** Federal law passed in 1986 that extended the age range covered by PL 94-142. Page 159
- **Public Law 101-476 Individuals with Disabilities Education Act (IDEA)**; a federal law enacted in 1990 that expanded the requirements of Public Law 94-142 to include transition planning for adolescents with disabilities. Page 159
- **Reading disability** Most commonly recognized kind of learning disability, characterized by reading performance that is substantially worse than would be expected from a child's overall level of measured intelligence. Page 175
- **Retrograde amnesia** The inability to explicitly recall events that occurred before the trauma that caused the memory loss. Page 189
- **Seizure disorders** Collectively referred to as **epilepsy**; a condition in which abnormal discharges of electrical energy in parts of the brain cause seizures, ranging from convulsive to barely noticeable. Page 185
- **Sensory impairments** Difficulties in intake of information through the sensory systems of the body, primarily visual and auditory. Page 186
- **Special education** Any program that provides distinctive services for at-risk children. Page 159
- **Visual impairment** Uncorrectable difficulties in seeing. Page 186

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

1. A student in your kindergarten class is already reading at the third-grade level. How would you go about determining whether this student should be included in your school's gifted and talented program? How will you keep the student challenged in kindergarten?
2. You have just caught one of your fourth-grade students brandishing a heavy stick on the playground. This student also frequently gets into fights and disrupts lessons in a variety of ingenious ways. What steps should you take to determine whether the student has a conduct disorder? How will you help the student control his or her behavior?
3. One of your second graders has been out of school with frequent ear infections. You have noticed the student, although normally quick and accurate with seatwork assignments, often has not started the assignment until you come around to check progress. The child also seems to be getting things wrong more frequently, almost as if he or she is not understanding the directions. What could be wrong? What can you do to help the student?
4. You have just learned that a student with mild intellectual disability will be joining your fifth-grade class. How will you prepare your other students to accept this student?
5. How would you help a student with a hearing disability with the phonics work in second-grade reading lessons?

IN MIDDLE SCHOOL

1. How would you adapt a lesson on the U.S. government so it is meaningful and appropriate for a student with mild intellectual disability in your social studies class?
2. What can you do to help a gifted seventh-grade student who is working on college-level math courses more advanced than any you ever took yourself?
3. Which alternatives to a long term-paper project could you give to allow a student with a reading disability to demonstrate his or her mastery of the material taught in your English class?
4. One of your sixth-grade Spanish-class students is so timid he cannot bring himself to speak during pronunciation practices. As you review the student's records, you see that previous teachers have remarked on the student's shyness and withdrawal from social contact. You suspect the student may have an internalizing emotional disorder. What is your next step toward helping this student?
5. How could you adapt laboratory assignments so they could be performed by a seventh-grade science student who uses a wheelchair and has difficulty moving her hands?

IN HIGH SCHOOL

1. What would you do to help a student with ADHD, who is having problems sitting through your English literature class, be less disruptive to classmates?
2. Which steps might you take to make sure a student with cerebral palsy could perform, or at least participate in, all the experiments you require for students in your advanced chemistry class?
3. As the math teacher for a student with mild intellectual disability, you are part of the group working with the student's parents to prepare a transition-to-work plan. Which math concepts do you consider vital for this student to learn, and how will you teach them?
4. What are some ways you could enrich your normal American government curriculum for a gifted student enrolled in the class?
5. One of your junior-level literature students has a reading disability and has asked to substitute books on audiotape for the required reading assignments. Should you allow this accommodation? Why or why not?

Group Differences 6

SOCIOECONOMIC STATUS, ETHNICITY, GENDER, AND LANGUAGE

Why Understanding Group Differences Is Important to Teachers

Defining the Terms Used to Discuss Group Differences

Socioeconomic Diversity

SES and School Achievement

SES, Family Size, and Students' Development

SES, Parenting Style, and Educational Performance

SES, Self-Esteem, and Achievement

SES Does Not Predetermine Achievement

Ethnic Diversity

Group Differences in Test Scores

The Role of Mentoring in School Performance

Gender Diversity

What Teachers Need to Know About Sex Differences

The Evidence for Sex Differences in Cognitive Performance

Are Female–Male Differences Biological, Cultural, or Both?

Language Diversity

Teaching Non-native Speakers of English

SES and Language Use

Multicultural Education

The Rationale for Multicultural Education

Compatibility of Cultural and School Values

Avoiding Group Stereotypes

Multicultural Applications in the Classroom

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this chapter:

- What are today's classrooms like compared to the classrooms of the past, and how are tomorrow's classrooms likely to compare with today's? What are the implications of these demographic trends for a developing teacher?
- How do differences in social class affect student performance and teacher responsibilities? How can teachers meet the needs of students from differing social classes when these students must be taught in the same groups?
- Why are ethnic and racial differences important for teachers to understand? How can we understand the challenges faced by students of different racial and ethnic groups?
- How do differences between the sexes affect classroom performance, student achievement, and learning patterns?
- How can teachers reach students who have a language barrier and help these students learn various subjects, even as the students are acquiring necessary language skills?
- How can teachers encourage students to overcome their reluctance, work together, and share projects and responsibilities with other students from differing backgrounds?

Charlene Johnson had just moved to an urban area for the first time in her teaching career, and her class reminded her of a United Nations poster. Where Charlene used to teach, there were poor kids and well-off kids, but that was about it for diversity—everyone was white and from the same small town. But now it was a new story: Charlene's class of eleventh graders included African Americans, Asian Americans, Latinos, other Hispanics, and Caucasians; rich kids, poor kids, and the whole range in between; Orthodox Jews, Catholics, Muslims, Buddhists, and Protestants. Charlene had never had experience with so many different types of people, but she knew enough to ask the right questions: "What can I do when they start arguing among themselves and making jokes at one another's expense?" "How can I keep the peace and maintain high standards, but still show respect for their differences?" "How can I have fair and equal expectations of such dissimilar students?"

Within a few days, Charlene had learned something about how racial and ethnic differences in her classroom were important to consider in teaching and managing students. Students from similar backgrounds always sat together at lunch and during activities, and they would sometimes speak in their home languages, interacting only rarely with students from other backgrounds. Students from different backgrounds also had varying styles of interaction with Charlene—she had to be aware of the expectations of the various groups of students to keep lines of communication open and to make sure she didn't offend anyone. Moreover, students of different backgrounds seemed to have different preferences for writing papers or doing projects or taking tests. Charlene noted that academic success was not equally important to students from different groups—or, if it was, the students did not show their dedication in comparable ways.

Charlene wanted to be an effective teacher and reach all of her students. Her goal, then, was to learn to understand and teach all her students even though she shared so little background with so many of them.

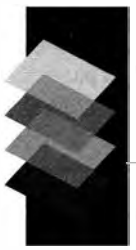
Charlene's situation is a common one today. The composition of classrooms is more heterogeneous now than when you began your schooling, and this trend is accelerating. Regardless of our own experiences and degree of exposure to people from different cultural, racial, and ethnic groups, each of us is more familiar with the values and norms of some cultures than with the values and norms of other cultures. To be an expert teacher today, you must know what diversity means and understand its implications in your daily teaching. You must know how to solve the types of problems facing Charlene Johnson. This chapter will provide you with an overview of group differences so you can acquire some of the skills you will need to reach every one of your students and teach them effectively. Before beginning this chapter, consider some of the findings of the most recent census, which illustrate the rapidly changing nature of our society related to education:

- According to the National Center for Education Statistics[JEH1] (2008), an estimated 49.6 million students were enrolled in elementary, middle, and high schools in the United States in the 2007–2008 school year.
- In 2007–2008, 18 million students were enrolled for full-time or part-time study in either two-year or four-year colleges.
- In 2004, 83 percent of the 3- to 5-year-old population was enrolled in early childhood education.
- In 2004, more than one in four people aged 25 and older in the South and Southwest did not graduate from high school (Laird, Kienzl, Debell, & Chapman, 2007).
- Thirty years ago, girls in the United States were more likely to drop out of high school than were boys. This trend reversed in the late 1970s, and today boys are more likely to drop out of high school than their female classmates.
- Over the past two decades, the median age of primary and secondary school teachers increased from 36 to 43. With a large number of teachers approaching retirement age, it is projected that 2 million new teachers will be needed in the next decade.
- The educational attainment of U.S. native- and foreign-born people reveals a dichotomy in the immigrant community: One group within this community is highly

skilled and college educated, and can expect to compete with native-born persons for well-paying jobs; the other group consists largely of less educated migrant workers.

- Mortality rates for Americans ages 25 to 64 who have attended college are less than half the mortality rates for those who stopped education after completing high school.
- According to the Census 2000 Supplementary Survey, in 2000 there were 19.5 million people in the United States ages 5 and older who did not speak English very well.
- Because of their relatively high migration and fertility rates, the U.S. Hispanic population grew 58 percent from 1990 to 2000, and it outnumbered the African American population beginning in 2003. By 2025, Hispanics will account for 18 percent of the U.S. population, while only 13 percent of the population will be African American. Over the same period, the percentage of the U.S. population classified as white will decline by 10 percentage points, to 62 percent. If current trends continue, almost half of the U.S. population will be non-white by 2050. By 2025, minority groups are expected to account for more than 50 percent of the population in four states (Hawaii, California, New Mexico, Texas) and the District of Columbia. During the 1990s, the combined population of African Americans, Native Americans, Asians, Pacific Islanders, and Hispanics/Latinos grew at 13 times the rate of the non-Hispanic white population.
- Poverty is a problem that cuts across racial and ethnic boundaries. Almost half of all U.S. families in poverty are white, a little more than a quarter are African American, slightly less than a quarter are Hispanic American, and the remainder are Asian American or from other groups.

It is clear that teachers today have a lot more to prepare for than their counterparts did 50 years ago. Knowing one's subject area is not enough—a knowledge of culture, ethnicity, and group differences is essential. This chapter will help prepare you to teach effectively in the changing classrooms of today.



Why Understanding Group Differences Is Important to Teachers

Some teachers believe that all they have to do is teach well and their students will learn, regardless of the attributes of each specific student. These teachers may have been taught effective teaching techniques, and they may think a package of good teaching tools is all they need to succeed. Expert teachers, however, know that students differ—and they appreciate how some of these differences can affect how students learn. Each student has an identity that is a product of personal abilities and experiences, gender, social class, nationality, race, ethnic group, religion, and geographic region. Of course, within any racial, cultural, ethnic, or religious group, individuals vary widely on all sorts of characteristics. Nevertheless, certain trends characterize the members of different groups, and these trends influence how much and how well students learn. Expert teachers appreciate group differences and know how to adjust their teaching styles to reach students of various groups. Charlene Johnson is striving for expertise.

For example, the home environments and cultural experiences of some Asian American students teach these students not to speak up quickly in groups, but rather to patiently wait their turn. Interrupting is considered rude in their culture (Lee & Zane, 1998, 2007; see also Lam & Zane, 2004, and Zane & Song, 2007). In contrast, many urban middle-class children from other cultures in the United States grow up in an environment that encourages and rewards speaking up quickly and often loudly. In this environment, interrupting with enthusiasm is a sign that the listener is actively involved in the conversation. The forwardness of these children might be disturbing to an Asian American child of the s
interaction style of some Asian American children might appear to signal detachment or lack of interest to children from other cultures. Indeed, teachers of Asian American children report that

Index Open

Laima Druskis/PH College

In the traditional Chinese classroom at the left, uniformed students sit quietly as they do a reading exercise. In the typical U.S. classroom at the right, students enthusiastically raise their hands and often speak out all at the same time.

they often must provide clearer cues and opportunities to Asian American children (compared with other children) to encourage them to speak out in class.

Most of this textbook aims to provide you with the background, resources, and direct instructional techniques you need to build a generally effective teaching style. To teach, and reach, every student, you must understand the complex package of values, beliefs, cultural norms, expectations, and behaviors that each individual represents. This chapter, which focuses on group-related differences among students, prepares you to respond optimally to group-oriented differences that affect student learning and performance.

DEFINING THE TERMS USED TO DISCUSS GROUP DIFFERENCES

At the outset, let us review some relevant terms and their definitions.* **Culture** is the socially communicated behaviors, beliefs, values, knowledge, and other traits that characterize a particular time period or a particular class, community, or population of people. Cultures can differ within as well as between nations, and even can differ within communities.

THINKING PRACTICALLY

What might happen to a typical U.S. student if he were transported to a typical classroom in a very different culture—say, for example, Japan or India?

SUGGESTION: A U.S. student might speak out too aggressively and too often in an Asian classroom, thus seeming undisciplined. He might behave in ways perceived as rude or inappropriate by teachers in other countries, although his behavior would be seen as normal in the United States.

Another concept commonly talked about is *race*, but race is a culturally constructed concept, not a scientific one. When we discuss race in this book, we use the term in the way it is most commonly used in the United States today, in the popular media, and by political leaders.

Ethnicity is the distinct national, religious, linguistic, or cultural heritage shared by a sizable group of people. The term **minority group** originally was used to refer to a group that was smaller than the group representing the dominant culture; now, however, the term often is used to refer to people from traditionally disadvantaged backgrounds. **Discrimination** is treatment or consideration—usually negative—based on perceived class or category rather than individual merit.

What will the composition of your classrooms be? How many ethnic and cultural groups are you likely to encounter? Consider the facts about the changing composition of the U.S. population and, consequently, of the children who will populate your classrooms: By the year 2040, a majority of U.S. school students—51 percent—will be non-Caucasian. By comparison, in 1997, about 33 percent of U.S. students were non-Caucasian (D.J. Hernandez, 1997). Thus the students now described as "minorities" will soon account for the majority when aggregated and compared to the proportion of Caucasian students. In other words, in roughly 40 years, the combined proportion of African American, Asian American, Latino and Hispanic American, and Native American students will outnumber Caucasian students. It is important to realize there is great diversity within each of these groups.

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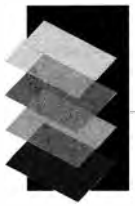

Socioeconomic Diversity

Socioeconomic status (SES) is usually defined by psychologists as a measure of a person's social class level based on income and educational level. Social class means different things to different people; SES is a more scientific term with a specific definition. It is important to remember that SES is not a measure of a person's inherent worth, but rather a reflection of how the dominant culture tends to view the person. The Hollingshead Index (Hollingshead, 1957, 1975; Hollingshead & Redlich, 1958) was historically used by social scientists to give a score for a person's combined level of income and education. There is no single, set definition of socioeconomic status, however, and some have raised concerns about making too-simple conclusions based on numbers from an index (Duncan & Magnuson, 2001). Sociologists believe that in addition to how much money a person makes, another important factor in determining social class is the prestige of the person's job (Davis & Smith, 1994). In other words, two people who earn the same amount of money could have different socioeconomic statuses if their occupations differ in prestige.

Hauser and Warren (1997; see also Warren, Hauser, & Sheridan, 2002) have developed an extensive SES index for various occupations; these authors argue that the best measure of occupational SES is provided by calculating what percentage of the people in a given occupation have completed at least one year of college. We all have our own ideas about which occupations are more prestigious than others, and these ideas can be idiosyncratic. For example, many teenagers believe that rock stars have highly prestigious jobs, while their parents believe the opposite. The Nakao–Treas Prestige Scores (Hauser & Warren, 1997) provide one formal index of the prestige of various occupations (see Table 6.1 for an excerpt); Hauser and Warren provide a more complex table of occupational ratings that is beyond the scope of this text. When researchers measure people's SES, they often try to factor it into their conclusions, although this process can be difficult in practice (Jeynes, 2002).

Most people believe that income and job prestige go hand-in-hand. Sometimes they do have a correlation—with physicians and lawyers, for example—but other times they do not.

THINKING ANALYTICALLY

Which factors related to the way children of different groups are raised might account for group differences among children?

SUGGESTION: The nature and extent of discipline used by parents—whether parents are very controlling versus very permissive, or highly critical versus encouraging and supportive—can contribute to group differences. Attitudes toward education—whether it is a primary focus of life or secondary to family life and family activities—can also be important. Exposure to books and higher education in the home might be a factor as well.

TABLE 6.1 Samples of Occupations and Their Prestige Ratings

Air traffic controller	64.76	Hairdresser	36.08	Sales worker, apparel	30.22
Architect	73.15	Insurance salesperson	44.85	Secretary	46.08
Author	63.05	Janitor	22.33	Tailor	42.48
Auto mechanic	39.64	Lawyer	74.77	Teacher, biological science	73.51
Baker	34.86	Legal assistant	56.53	Teacher, chemistry	73.51
Bank teller	43.28	Legislator	60.92	Teacher, elementary	64.08
Bus driver	32.07	Librarian	54.42	Teacher, physics	73.51
Cashier	29.45	News vendor	19.38	Teacher, postsecondary	73.51
Chief executive officer	70.45	Nuclear engineer	63.30	Teacher, pre-kindergarten and kindergarten	54.93
Child-care worker	29.25	Order clerk	31.03	Teacher, psychology	73.51
Computer programmer	60.51	Painter, sculptor	52.38	Teacher, secondary	66.37
Construction worker	35.67	Physician	86.05	Teacher, special education	65.06
Dancer	53.49	Police	59.99	Veterinarian	62.28
Dentist	71.79	Psychologist	69.39	Waiter/waitress	28.08
Fire fighter	52.87	Real estate salesperson	48.82		
		Registered nurse	66.48		

Source: Adapted from the Hauser-Warren Socioeconomic Index, 1997, Portraying 1989 Nakao–Treas Prestige Measures.

THINKING CREATIVELY

How could you develop a scientifically prestige level of different jobs?

SUGGESTION: One method might involve asking large and diverse groups of people to rank the prestige of different jobs on a 1-to-100 scale; another method is to rank jobs on the basis of the average income earned by people employed in these jobs.

Consider a professional gambler who regularly cleans up at the blackjack table. This person might have a high income, but would still have a job relatively low in prestige. The converse is also true: University professors are customarily thought to have high-prestige jobs, but their income is not extremely high (as the authors of this text can attest). And, of course, there are people whose income and job prestige level are both low, such as fast-food servers. A of true measure of the

Expert teachers know that, just as a book should not be judged by its cover, so a student's SES should not be judged simply by the student's clothing and demeanor. Anyone who has been in a classroom lately knows that many students choose to dress in deliberately torn, baggy, and dirty clothes, all in the name of style, and much to their parents' dismay. The moral for the expert teacher is that determining a student's SES requires far more meaningful information than can be gathered by a glance.

SES AND SCHOOL ACHIEVEMENT

Why are the concepts of socioeconomic status and social class important to you as a teacher? They're especially important because your goal is to teach every student equally, regardless of social class. Just as Charlene Johnson learned, meaningful differences in student achievement are related to SES. The key word here is "related": An essential point is that SES does not predetermine achievement. Some students from low-SES backgrounds do exceptionally well in school, whereas some very affluent students who have been provided with numerous advantages do quite poorly, as many private-school teachers know. To teach effectively and to understand your students' needs, you must first understand the role social class plays in their educational experiences and performance. At the same time, you must remember that population trends do not tell the whole story about any individual student.

■ **PARENTS' INCOME AND CHILDREN'S SCHOLASTIC ASSESSMENT TEST SCORES** The student from a low socioeconomic level presents an educational challenge. Consider the relationship between parents' income and their children's Scholastic Assessment Test (SAT) scores (see Table 6.2). The average SAT verbal, math, and writing combined score for children of parents earning a combined income over $100,000 a year is 1637 (out of 2400 possible points). The average combined score for children of parents earning between $40,000 and $50,000 a year is 1462; the score for children of parents earning under $10,000 a year is 1301 (note that a similar trend exists for PSAT scores; this test is taken by all eleventh graders in the country. [Williams & Ceci, 1997]).

TABLE 6.2 Relationship Between SAT Scores and Family Income, 2005–2007

Income Level	% of Test Takers 2005	% of Test Takers 2006	% of Test Takers 2007	Mean Total SAT Score
Less Than $10,000	5	4	4	1301
$10,000-$20,000	8	7	8	1371
$20,000-$30,000	9	8	6	1363
$30,000-$40,000	10	10	9	1427
$40,000-$50,000	9	8	8	1462
$50,000-$60,000	9	9	8	1487
$60,000-$70,000	8	8	8	1508
$70,000-$80,000	8	9	9	1522
$80,000-$100,000	13	13	14	1559
More than $100,000	21	24	26	1637

Source: College Entrance Examination Board, 2008.

SAT test scores are used to screen students for college admission, so they are important because they determine access to higher education. Students with lower SAT scores may not get equal access; consequently, they may earn less at their jobs because they lack the education to get better jobs. Education in and of itself results in higher earnings independently of a person's level of intelligence (see Figure 6.1). Ultimately, when these low scorers become adults and have their own children, who are then raised in lower-income households, these children tend also to score low on the SAT. A cycle is created in which low SES is associated with low SAT and other standardized test scores, which in turn are associated with low SES, from one generation to the next. Of course, some individuals escape this cycle, often as a result of having good mentors—who quite often are *teachers*.

A variety of reasons for the relationship between SAT scores and SES have been suggested. For instance, lower-income families often do not have access to the best schools and lack the funds for tutoring, out-of-school lessons, and summer camps. Also, lower-income families may not possess as many computers, books, and other learning tools and games. As a consequence, lower-income children may lack certain experiences that would help prepare them for standardized tests such as the SAT. The relationship between the SAT and SES is mirrored in every standardized test taken during the earlier grades as well, beginning in kindergarten (Denton & West, 2002; Rathburn, West, & Walston, 2005).

■ **WHAT DETERMINES CHILDREN'S SES?** Children's SES is partly determined by general societal trends in marriage, divorce, and single parenthood. Consider Figure 6.2, which shows the trend toward an increasing number of children being raised by one unmarried parent. In 1970, roughly 10 percent of children younger than 6 years of age were being raised by one unmarried parent (who was almost always divorced). By 1994, this number had risen to roughly 28 percent of children younger than 6, and these children were more likely than not being raised by a parent who was never married. By 1998, 27 percent of children younger than age 18 were living with a single parent, most often a mother, and 4 percent lived with neither parent.

The implications for these children's educational attainment, and the resulting effects on their SES, are clear. Figure 6.3 shows the percentage of children who graduate from high

FIGURE 6.1 Wages by Levels of Schooling and Cognitive Ability

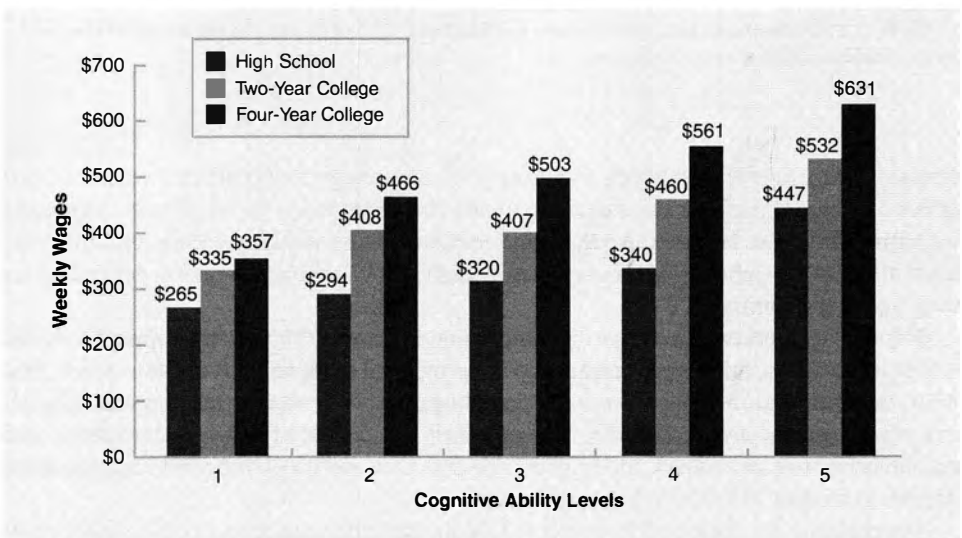

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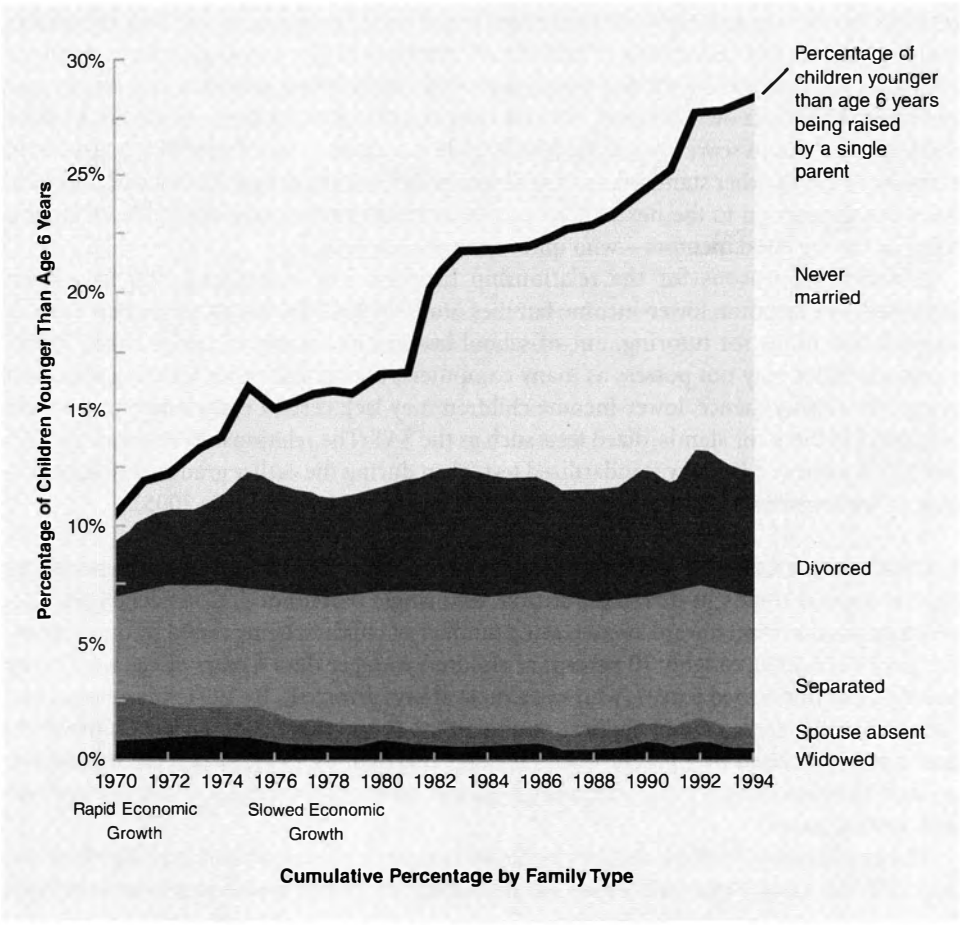
FIGURE 6.2 Increase in Number of Children Being Raised by One Unmarried Parent



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school as a function of whether they grew up with a never-married mother, a never-married father, a divorced parent, or two married parents. The figure shows the percentages separately for Latino and other Hispanic, African American, and white children. Clearly, children perform differently in school—and have different high school graduation rates—depending on their home environments.

THINKING PRACTICALLY

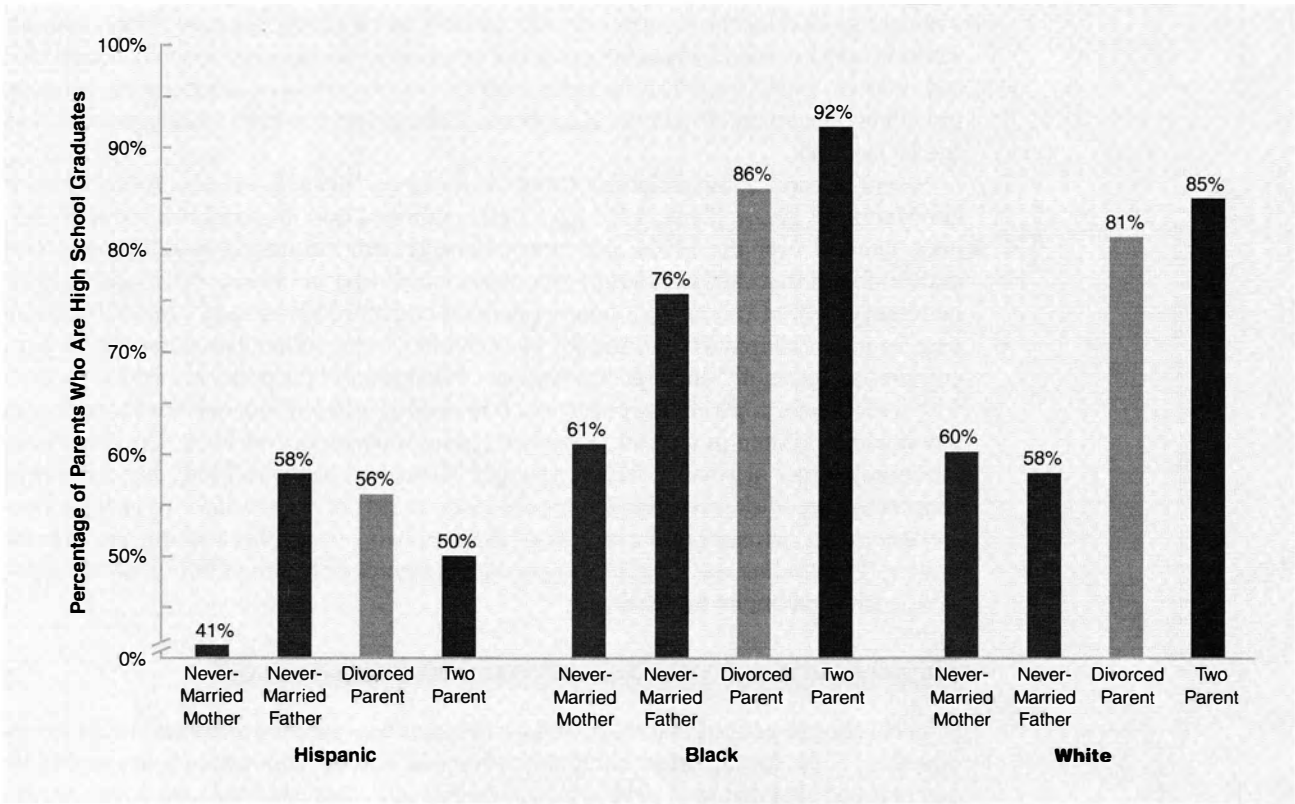
How might an expert teacher help low-SES students score higher on the SAT?

SUGGESTION: Recommend extra preparation time, either in formal prep classes or by use of a preparation book to complete sample tests and exercises. Encourage students and bolster their belief that they have the ability to succeed on the test.

Although teachers cannot change the composition of a student's home environment, they can help students whose home environments do not provide all of the support and interaction they need. Extra help from a caring teacher can close the gap between what a student *can* accomplish and what a student *does* accomplish. This extra help can consist of daily words of praise and encouragement, extra feedback, meetings outside class time, and telephone calls to enlist parental support in meeting children's educational goals.

The challenge for the expert teacher is to help the individual students he or she instructs to break the cycle of low SES leading to low education leading to low earnings leading to low SES. This textbook is filled with ideas about better teaching techniques that can help students achieve to their optimal levels. If you use in your daily teaching what you have learned in this book (particularly the ideas in the Implications for Teaching sections), you can help your low-SES students escape the cycle of poverty and low achievement.

FIGURE 6.3 Education Attained and Current Family Situation of Parents of Young Children



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SES, FAMILY SIZE, AND STUDENTS' DEVELOPMENT

Obviously, children grow up differently depending on the income and educational level of their parents and the prestige of their parents' jobs. For one thing, more income in the household may mean more resources: more books, better toys, enriched preschool programs, family trips and vacations, private music or athletic lessons, and so on. The resulting broader experiences provide developing children with opportunities for informal and formal learning outside the immediate school environment (Williams, 1998). When these children enter school, they often already know how to read and have a jump on their peers from less resource-rich environments.

But total household income does not tell the whole story. When we look at a family's SES and draw conclusions about the children's likelihood of succeeding in school, we must remember to think critically about another key variable: family size. On average, today's families are smaller; there has been a general downward trend in number of children born per family for nonwelfare families. Today's families have fewer children, and fewer children overall means that each child has fewer siblings with whom she or he needs to share resources. Thus greater financial resources are available per child. As a consequence, nonwelfare family income per child has tended to increase (Ceci, 1996a, 1996b; Grissmer et al., 1994). This trend toward families having more dollars per child is noteworthy, because even children who come from poor families will do better in school if they have fewer siblings and consequently have access to greater financial resources.

THINKING ANALYTICALLY

How many factors can you identify that might explain why having fewer children per family might influence how children grow up and how they do in school?

SUGGESTION: Fewer children may mean that more resources are available for each child: more parental attention, more time spent interacting with adults, and more money available for summer camp, enrichment experiences, music and art lessons, travel, vacation, and other opportunities.

Regardless of general population trends, expert teachers who learn that a student is from a large family, especially one from a lower SES level, are vigilant about recognizing cues that a student needs extra encouragement and support. These students may have parents who are working long hours and whose attention and other resources are stretched thin among several children. Expert teachers help students compensate for resources lacking in the home by providing extra attention, additional academic challenges such as extra reading practice, and special feedback.

Recent research about children's economic resources (Blank & Schoeni, 2002, 2003; see also Hanming, Keane, Blank, & Grogger, 2004) examined how the economic status of children changed over the 1990s, and how welfare reform influenced these changes. The authors found that children's family income increased over the 1990s, with slightly higher increases observed among poor families than among more advantaged families. This was true for poor children overall, and for poor children living in families without both parents present (generally single-parent families). What role did the policy changes associated with welfare reform play in the positive shift in children's family income? For example, did low-income children in states that enacted strong work incentives for welfare recipients experience larger or smaller income changes? Blank and Schoeni found that states that adopted strong work incentives in the mid-1990s as part of their welfare-reform package created greater increases in the income of children living in families without two parents present. This finding was unrelated to the overall economic health of individual states, as measured by unemployment rates.

SES, PARENTING STYLE, AND EDUCATIONAL PERFORMANCE

A specific line of educational research has examined how parental attitudes and practices regarding child rearing affect children's success in school. This research has looked at parental attitudes that tend to be associated with social class level and with ethnic group. The purpose has been to determine whether systematic ways of parenting characterize different groups, and to learn whether, in turn, differences in children's school achievement can be traced in a systematic way on their parents' child-rearing attitudes and styles. This line of research has meaning for you as a developing teacher. To become an expert teacher, you need to recognize your own style of interacting with students, as well as the costs and benefits of this style for student achievement. You may even wish to modify your style to make it more effective in bringing about optimal student achievement.

Expert teachers are often aware from students' classroom behavior of the different types of parenting that students receive at home. Some parents' styles are more conducive to creating a curious, open-minded child who benefits from school; other parents may discourage question asking and information seeking and may discipline children so harshly that the children respond by sitting still and keeping their mouths shut. Sensitivity to these potential home experiences helps teachers both interact positively with students and counteract negative influences in the home.

■ **PARENTING STYLES** What do we know about the parenting styles of middle- and lower-SES parents today (Bronfenbrenner, 1985; Bronfenbrenner & Ceci, 1994; see also Hoffman & Youngblade, 1998, and Hughes & Perry-Jenkins, 1996)? Today's middle-SES mothers tend to be more responsive to and less directive of their children than are lower-SES mothers. This pattern was reversed in the 1940s—back then, middle-SES mothers were more rigid and controlling and lower-SES mothers were more permissive. Bronfenbrenner (1985) concluded that the literature on child rearing that first became popular in the 1960s and 1970s, such as Benjamin Spock's parenting guides and the work of T. Berry Brazelton, changed the way middle-SES mothers interact with their children, by making them more responsive and encouraging them to let their children lead the way rather than by suggesting they try to control their children.

Although a student's SES is not always a reliable indicator of the parental style in the student's home, parents of a given social class and culture do exhibit tendencies to treat children in certain ways. Expert teachers are attentive to these trends and their significance for the students' learning, development, and behavior in school.

As discussed in Chapter 3, Diana Baumrind has developed a taxonomy to help researchers understand, describe, and study different parenting practices (see, for example, her early work: Baumrind, 1967). Baumrind (1991) views parental behavior as fitting within three general types or patterns:

- Parents with an *authoritarian* style try to shape and control their children's behaviors, which they evaluate against a set of rigid standards. Authoritarian parents emphasize obedience, respect for authority, hard work, and traditional values, and they discourage real communication in favor of the "listen and obey" mode. Baumrind (1971, 1973) saw authoritarian parents as being high in demandingness and low on responsiveness toward their children.
- Parents with a *permissive* style give their children considerable freedom. Permissive parents have a tolerant and accepting attitude toward their children, rarely punish them, and make few demands and place few restrictions on them.
- Parents with an *authoritative* style set clear standards and expect their children to meet them, treat their children maturely, and use discipline where appropriate to ensure that rules are followed. These parents encourage their children to develop independence and individuality, and consequently they practice open communication in which children's points of view and opinions are considered. In other words, children's rights as independent human beings are honored within the authoritative family system (see also Darling & Steinberg, 1993; Dornbusch, Ritter, Leiderman, & Roberts, 1987; Fletcher, Steinberg, & Sellers, 1999).

Teachers' styles in the classroom can also be described within the authoritarian–permissive–authoritative framework. Not surprisingly, the beliefs students have about authority are also an important factor in how students behave (Darling, Cumsille, & Loreto, 2007).

THINKING PRACTICALLY

Which style best describes your teaching approach (or the way you would naturally teach)? What could you do to modify your style to make it as effective as possible?

SUGGESTION: Are you basically a nondemanding and permissive person, or a demanding and critical one? If you meet either of these criteria, you can make a conscious choice to improve by behaving in a less extreme manner. Being open to student and peer feedback will help.

■ PARENTING STYLES AND CHILDREN'S COGNITIVE PERFORMANCE Baumrind conducted many studies exploring the interrelationship of parental style and children's cognitive and social competence. She began by studying preschool children to learn what effects parental style had on the children's intelligence and personality. Later, Baumrind and other researchers expanded their investigations to include middle and high school–age children, children of different races and ethnic groups, and children of different socioeconomic backgrounds. In general, Baumrind (1989, 1991) found that parents who display an authoritative style of discipline and child rearing tend to raise children who are more cognitively competent. The lesson for the expert teacher is that an authoritative style is generally more effective in the classroom and leads to better learning outcomes.

MOTHER–CHILD RELATIONSHIP, IQ, AND LANGUAGE DEVELOPMENT. Other researchers have investigated the mother–child relationship as a predictor of later IQ and language development in the child (Bee et al., 1982; Kelly et al., 1996; Landry, Smith, Swank, & Miller-Loncar, 2000; see also Hart & Risley, 1992, 1995). For example, Helen Bee and her associates evaluated the effects of two different sets of factors on IQ and language development. One set of factors included infant physical status shortly after birth, early childhood performance, and family ecology (e.g., level of stress, social support, and maternal education). The other set included various measures of mother–infant interaction. The authors found that the quality of mother–infant interaction was one of the best predictors at every age tested. In fact, it was as good as actual child performance in predicting IQ and language development. This finding suggests that the quality of mother–infant interaction is as important as a child's own behavior and skills at an early age in predicting the child's later cognitive ability. Like mother–child interactions, teacher–student interactions can also be a significant force in the life of a developing child.

PARENTING STYLE AND COGNITIVE PERFORMANCE. Another study found that the emotional quality of the mother–child relationship when the child was 4 years old was associated with cognitive ability at age 4, IQ at age 6, and school achievement at age 12 (Estrada, Arsenio, Hess, & Halloway, 1987). The associations remained significant even after the effects of mother's IQ, SES, and children's mental ability at age 4 were taken into

THINKING CREATIVELY

How might you help a student whose parents have an authoritarian style to deal with her parents effectively and to develop positive relationships with adult mentors outside of the family?

SUGGESTION: Explain to her that her parents probably believe they are doing their best for her. Suggest that she obey her parents and behave respectfully toward them while pointing out to her parents that she needs their support to do her best. Encourage her to seek out adults who are supportive and nurturing—perhaps meeting them through hobbies, religious organizations, after-school activities, or sports.

account. The authors suggested that emotional relationships influence cognitive development through the parent's willingness to help children solve problems, through the development of children's social competence, and through the encouragement of children's exploratory tendencies.

One large study examined the relation of parenting style to adolescent school performance in a sample of 7836 high school students (Dornbusch et al., 1987). This study showed that both authoritarian and permissive styles were associated with lower grades, whereas authoritative parenting was associated with higher grades. The strongest effect on grades was in the negative direction for authoritarian parenting. Children of families with a purely authoritative style had the highest average grades, whereas children of families with mixed or inconsistent styles had the lowest grades. Again, expert teachers recognize the value of an authoritative style in helping students achieve in school.

A similar study that investigated parenting practices and adolescent achievement focused on the impact of authoritative parenting, parental involvement in schooling, and parental encouragement to succeed on adolescent school achievement (Steinberg, Lamborn, Dornbusch, & Darling, 1992). The sample was ethnically and socioeconomically heterogeneous, involving 6400 U.S. high school students. The authors found that authoritative parenting led to better school performance and stronger school engagement. They also found that parental involvement with schooling was a positive force in adolescents' lives when the parents had an authoritative style, but had less postive effects when the parents had other styles. It is not surprising that school involvement by demanding, rigid, critical parents does not have the positive impact of school involvement by parents who accept their children's interests and goals and assist them in achieving these goals!

HOW PARENTAL BEHAVIOR AFFECTS A CHILD'S DEVELOPMENT. What about the processes through which parental behavior affects a child's development? Researchers watched 32 middle-class mothers preparing their 6- to 9-year-old children for a memory test. They found that the mothers helped the children to transfer relevant concepts from more familiar settings to the less familiar laboratory task, thereby assisting the children in mastering the task and in developing methods for completing similar future tasks (Rogoff, Ellis, & Gardner, 1984). These mothers acted like good teachers by helping their children borrow knowledge from one domain and apply it to another domain—something expert teachers do every day.

CONCLUSIONS. The main conclusion of these studies is that parental style tends to vary with SES, and that parental style also predicts school achievement of children. As a teacher, you may find that many children from lower-SES families have been exposed to parental styles that are more authoritarian and directive (Bronfenbrenner, 1985). The consequences for these children's school performance may not be desirable. By comparison, children from higher-SES families may have been exposed to parental styles that are more authoritative and, therefore, more beneficial for school performance (Bronfenbrenner, 1985).

Expert teachers know how to counteract some of the negative aspects of authoritarian parenting styles by allowing children to enjoy more independence in the classroom. This tactic helps children learn how to direct themselves instead of doing only exactly what they are told to do. For example, students who are tightly controlled at home and criticized by harsh or overly demanding parents can be given flexibility and freedom in choosing paper topics, reading materials, and activities. Teachers can make an extra effort not to react negatively to these students' mistakes, and to praise positive efforts so as to build students' self-worth.

THINKING PRACTICALLY

Name three reasons why helping students to think more of themselves might not necessarily help the students to do better in school.

SUGGESTION: High self-esteem might make a student feel that he does not need to work and study hard to do well, because he is naturally brilliant. Students who think a lot of themselves might spend their time on activities other than studying. Students with high self-esteem might nevertheless lack basic study skills and knowledge of the material.

SES, SELF-ESTEEM, AND ACHIEVEMENT

Many teachers believe that low-SES students also have low self-esteem These teachers may think that if they can just help these students to think more of themselves and their abilities, their achievement will improve. Charlene Johnson thought often about how she might make her lowest-SES students feel better about themselves, in hopes that this change would help them do better in school.

One study found a very small relationship between SES and self-esteem in young children, though the strength of this relationship increased as children moved into young adulthood (Twenge & Campbell, 2002). Students' self-esteem related to how well they do in school, however, turns out to be a better predictor of school performance than the general self-esteem of these students (Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995). Although it is clearly worthwhile to help students develop positive self-images, surveys of low-achieving students have revealed that the self-esteem levels of these students are comparable to those of high-achieving students (Rosenberg, Schooler, & Schoenbach, 1989). These results may vary with students' age. For example, one study found that in the seventh grade, the self-esteem of successful versus unsuccessful students differed, but that these differences disappeared by the ninth grade (Alves, Peixoto, Gouveia, Amaral, & Pedro, 2002).

As these findings suggest, a teacher cannot cure low achievement simply by raising students' self-esteem. Sometimes the highest-achieving students have more self-doubts and lower self-esteem—they do not see themselves as being as good as they are (Kolligian & Sternberg, 1987, 1991; Sternberg & Kolligian, 1990). Conversely, high school dropouts' self-esteem is just as high as that of high school graduates! Thus the data show that boosting students' self-esteem is not a quick-fix route for enhancing achievement. Helping raise students' self-esteem may be a worthwhile goal, but real gains in achievement must be targeted, not merely gains in self-esteem.

Paul Howell/Getty Images, Inc.–Liaison

African American Mae Jemison, though from a modest family background, not only became a physician, but also went on to be the first African American female astronaut. She was determined from childhood to explore space. She presently dedicates much of her time to encouraging women and minorities throughout the world to enter scientific fields.

SES DOES NOT PREDETERMINE ACHIEVEMENT

As we said at the beginning of our discussion of SES and achievement, within any single SES group, achievement is extremely variable. Many trends are associated with SES, and these trends have surfaced in study after study. It is clear, however, that each SES group includes both achievement stars and stragglers. When you look at any individual student's performance, you will find that often you could not have predicted it from the student's apparent SES level. Some lower-SES children come from homes in which education is stressed and achievement in school is prized, and these children can rank first in their classes. Also, higher-SES children who do not study or apply themselves and whose parents are completely uninvolved in their educational success can be among your worst performers.

This understanding leads to the important message of this section: Never assume because students are from poor families that they are incapable of doing well. Students' SES is not their destiny. For any given person, it is what the person does, and not what the population as a whole tends to do, that matters. A large proportion of revolutionary ideas, medical discoveries, inventions, and other accomplishments that represent the best of our society's attainments have come from people from relatively modest or even poor backgrounds.

*i*MPLICATIONS FOR TEACHING

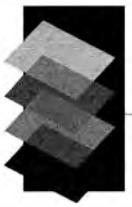
- **Never judge a student's SES on the basis of superficial attributes such as clothing. Instead, work to develop a deeper understanding of each student's background.** Especially in today's society, affluent children may dress in torn clothes, and children living in poverty may dress neatly. Old standards for judging social class are no longer appropriate.
- **Recognize that lower-SES students must overcome greater obstacles to achieve as well as middle- and upper-SES students, and provide these lower-SES students with extra support and encouragement.** Teachers can help make up for the lack of advantages in the home by providing extra materials and direction regarding low-cost methods of enrichment (such as after-school programs).

THINKING CREATIVELY

Why might people from humble backgrounds tend to develop unusual inventions or make discoveries? How might a poor background be helpful to an inventor?

SUGGESTION: Growing up and living without money may force a person to be creative by making or building things instead of buying them. Lacking money can make someone more resourceful and force the person to find alternative routes to goals. Poor people often come from backgrounds filled with numerous challenges that spurred them to become creative.

- **Recognize that students from single-parent homes often have a parent who must work long hours and who cannot provide necessary support; provide extra scaffolding for these students.** When you assign work that a student needs a parent's help to complete, remember that you may unintentionally be disadvantaging some students, and offer alternatives to these students.
- **Work to develop an authoritative style to optimize interactions with students, especially students whose parents have authoritarian or permissive styles.** Offer these students project choices; encourage them and praise their work
- **Discourage a focus simply on "feeling good about ourselves"; instead, help students believe in their ability to accomplish meaningful tasks.** Stress accomplishments that reflect effort instead of self-esteem for its own sake.
- **Remember that SES is not destiny.** Great accomplishments have been achieved by people from low-SES backgrounds. Use examples of these people in your teaching to provide effective role models for students from lower-SES backgrounds.



Ethnic Diversity

Unless you plan to teach in a remote rural region, you will likely be confronted by a diverse array of student backgrounds in your classrooms. Like Charlene Johnson, you may be amazed by the ethnic variety you encounter on your first day of class. You will be expected to teach students of different cultural and ethnic groups right from the start. To teach these students effectively, you must understand the significance of group differences to school achievement. Remember, though, that trends in achievement patterns for different cultural and ethnic groups are just that—trends; they are not labels that fit every individual. This said, there do appear to be significant and reliable differences among ethnic and other groups in academic performance and test scores. But what do these differences mean? And what causes these differences?

As mentioned earlier, SES is associated with many variables that affect the lives of school-aged children, such as educational games that parents can purchase, the amount of time they can devote to their child's homework, and the types of enrichment activities they can afford. Socioeconomic status also is related to cultural and ethnic background—and it is difficult, if not impossible, to define exactly the effects on school achievement of being of a certain ethnic group and socioeconomic level. For example, proportionately more African American, Latino, and other Hispanic children live in poverty than do white children. Consequently, it is difficult to know if the lower scholastic achievement of African American and Latino children is due to the economic conditions experienced by the children in the two groups, or whether it is attributable to some other reasons. Although a few scientists believe that intrinsic differences in ability are related to ethnic group (e.g., Gordon, 1985; Gottfredson & Koper, 1997; Herrnstein & Murray, 1994; Jensen, 1997, 2000; Lynn, 1997, 1998, 2002, 2006, 2007; Mau & Lynn, 1999; Rushton, 1997a, 1997b, 1997c), most scientists believe the observed differences are more reflective of the lowered performance associated with living in conditions of greater economic need and scarcity of other resources (e.g., Ceci, 1996a, 1996b; Flynn & Dickens, 2006; Gardner, 1995; Neisser, 1998; Neisser et al., 1996; Sowell, Bergwall, Zeigler, & Cartwright, 1990; Steele, 1997a, 1997b, 1998; Steele & Aronson, 2000; Sternberg, 1995; Williams & Ceci, 1997).

THINKING ANALYTICALLY

Why is the education level of parents important to a child's school performance?

SUGGESTION: Better-educated parents tend to encourage education in their children, discuss topics relevant to education, have better vocabularies and education-related values, have higher incomes and access to better schools, and have the ability to afford camps and special tutors.

For example, Duncan and Magnuson (2005) demonstrated that most of the achievement gap among fourth-grade African American and white students can be explained by taking into account family SES and maternal test scores. In fact, the gap between African American and white students is reduced from slightly more than one standard deviation to about one-third of one standard deviation when adjusted for these factors. Similarly, Fryer and Levitt (2004), using data from the U.S. Department of Education, reported that a group of SES-related factors such as family income, number of books in the home, low birth weight, and

age of the mother at her child's birth, accounted for three-fourths of the math and reading gaps between African American and white students. Figure 6.4 shows the different levels of educational attainment (i.e., how much school a person has completed) for members of different ethnic groups, ranging from a high school degree to some college to a 4-year college degree or more. Clearly, access to schooling, especially college level and beyond, reflects economic opportunities and advantages in students' homes and communities, and these economic advantages differ widely among ethnic groups.

THINKING ANALYTICALLY

How might living at or near the poverty level affect a child's scholastic performance?

SUGGESTION: The child might lack a secure place to live, might not get adequate rest and nutrition, might not receive adequate parenting, and might lack clothing, books, and other resources such as medical care. All of these factors can affect performance in school.

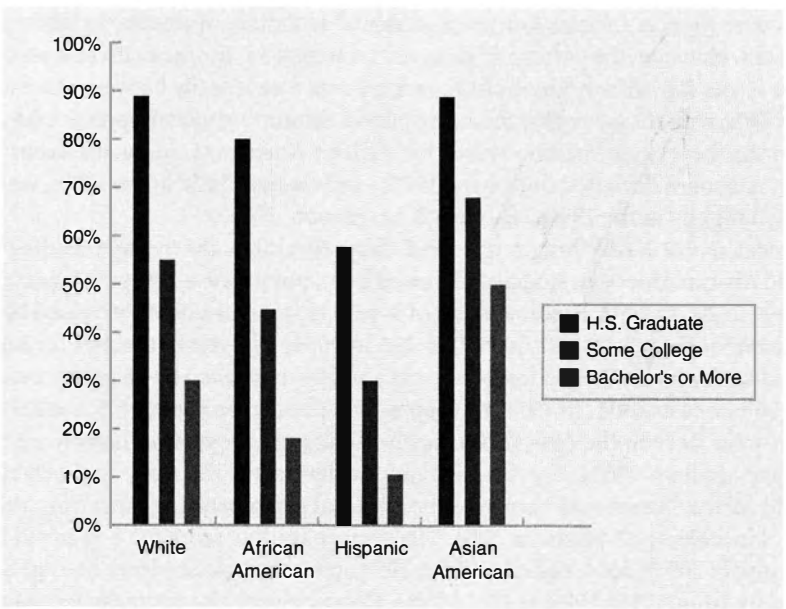
GROUP DIFFERENCES IN TEST SCORES

Let us examine some of the group differences in test scores and school performance by viewing these differences within a broad perspective that shows what has happened to these group differences in performance over the past 35 years or so. By tying our discussion of group differences to their changes over a relatively short period of time, you will see that these differences reflect numerous environmental factors. An argument that the performance gaps between the groups are intrinsic, biological, or genetic would not allow for dramatic changes in the patterns of differences over comparatively short periods (for example, 35 years), because genetic changes in groups take considerably longer to occur.

■ **GAP SIZES** Without exception, studies of the achievement test scores of young white, African American, and Hispanic children have identified substantial gaps among these groups. The size of the gaps depends on the subject matter, the test used, and the age group being assessed. Using national data from the children of the National Longitudinal Survey (CNLSY), Phillips and her colleagues estimated that 5- and 6-year-old African American children scored substantially below white children (more than one standard deviation below them, in fact) on a picture vocabulary test (PPVT).

Using the same test, Farkas and Beron (2004) described racial differences in terms of the average age at which African American and white children correctly identify 50 words. For whites, this happened when they reached 50 months of age—a full year earlier than for African Americans. Thus African American children were a year behind whites on this measure of receptive language before formal schooling began.

FIGURE 6.4 Educational Attainment in U.S. by Ethnic Group, 2003



Source: U.S. Census:

Brooks-Gunn, Klebanov, Smith, Duncan, and Lee (2003) estimated racial achievement gaps in a diverse sample of low-birth-weight African American and white children at age 5, also using the PPVT. These investigators found a substantial gap between the two racial groups measuring 1.3 standard deviations. Interestingly, the racial gap in the verbal component of the popular IQ test used by these researchers was smaller, but still approximately a full standard deviation. Because two different verbal IQ/vocabulary tests were administered to the same children simultaneously, and produced such different estimates of racial gaps, Duncan and Magnuson (2005) caution against placing too much weight on the results obtained using any single test.

■ **NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS** Beginning in the late 1960s, the Educational Testing Service (ETS) undertook an assessment of educational progress of 9-, 13-, and 17-year-olds' math, reading, writing, and science achievement. This large-scale project of the Department of Education, which continues today, is known as the National Assessment of Educational Progress (NAEP) The NAEP, also known as "the nation's report card," tracks student learning using nationally representative samples of 9-, 13-, and 17-year-olds (fourth, eighth, and twelfth graders, roughly).

To see how the NAEP works, consider its scoring system for reading. Scores are divided into five levels, shown here starting from the most rudimentary level:

- Scores below 150: "can carry out simple, discrete reading tasks"
- 150–199: "can comprehend specific or sequentially related information"
- 200–249: "can search for specific information, interrelate ideas, and make generalizations"
- 250–299: "can find, summarize, and explain relatively complicated information"
- 300–500: "can synthesize and learn from specialized reading materials"

THINKING ANALYTICALLY

Why are the scholastic educational gains of minorities important from the point of view of teachers and school administrators?

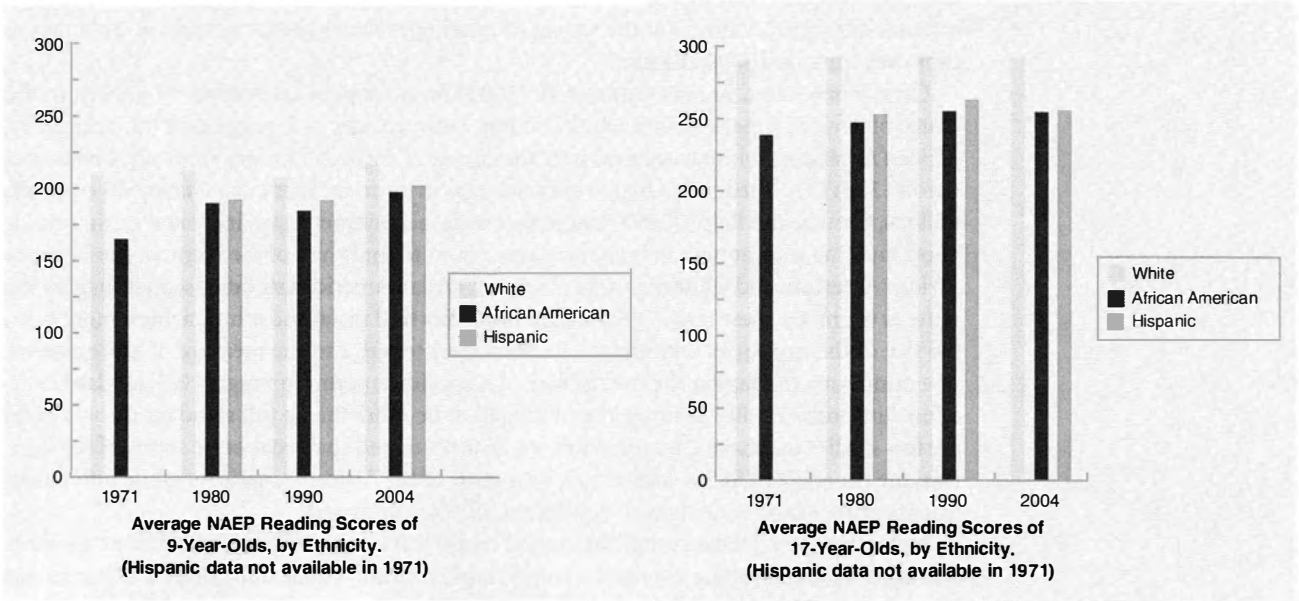
SUGGESTION: These gains show that our society can successfully increase the education level of minorities through various methods; also, these education gains mean minorities get better jobs, have higher incomes, and do better in school.

Because the earliest point of NAEP assessment is fourth grade, the data reflect the influences of both preschool and early elementary school environments. Encouragingly, the racial gap in math appears to have declined through the 1980s until it reached 0.71 standard deviation in 1988. Similar patterns are found for the NAEP reading test gap, which started at −0.97 in 1973 and fell to −0.74 in 1986. Less encouraging is the lack of progress made during the 1990s, when the gap may have widened (Duncan & Magnuson, 2005). By 1999, the respective gaps in reading and math, respectively, were −0.90 and −0.84 standard deviation. Most of the narrowing of the gaps for fourth-grade students can be attributed to larger increases over time in African American students' achievement relative to white students' achievement. However, the pattern of gains differs somewhat for the math and reading tests. Math test scores for African American fourth graders rose steadily between the early 1970s and late 1980s, with the gains over the entire period amounting to an impressive 0.6 standard deviation. In the case of reading scores for African Americans, the gains occurred early (nearly 0.5 standard deviation during the 1970s) and changed little in the 1980s, while scores actually fell slightly in the 1990s (Duncan & Magnuson, 2005).

The most recent NAEP long-term trend data reveal that the average reading score of 9-year-old African American students increased by 14 points (on a 500-point scale), up from 186 in 1999 to 200 in 2004. Reading scores of 9-year-old white students increased by 5 points over the same period, from 221 in 1999 to 226 in 2004. As a result, the African American–white reading achievement gap for 9-year-old students narrowed by 18 points over the five years, to 26 points in 2004 (in 1971, this gap was 44 points; see Figures 6.5 and 6.6), leading to a front-page story in the *New York Times* heralding the progress in narrowing the racial reading gap (Dillon, 2005). For mathematics achievement, the story is much the same: 9-year-old African Americans narrowed the 28-point gap separating them from their white classmates in 1999, to 23 points in 2004. The average reading score for 9-year-old Hispanic children rose to 205 in 2004, up from 193 in 1999; in math, these students' average score rose 17 points, up from 213 in 1999 to 230 in 2004. Consequently, the math gap between 9-year-old Hispanic and white students narrowed from 26 points to 18 points over the five-year period. The latest round of NAEP results also show weak gains among middle school students and no gains at all among high school students.

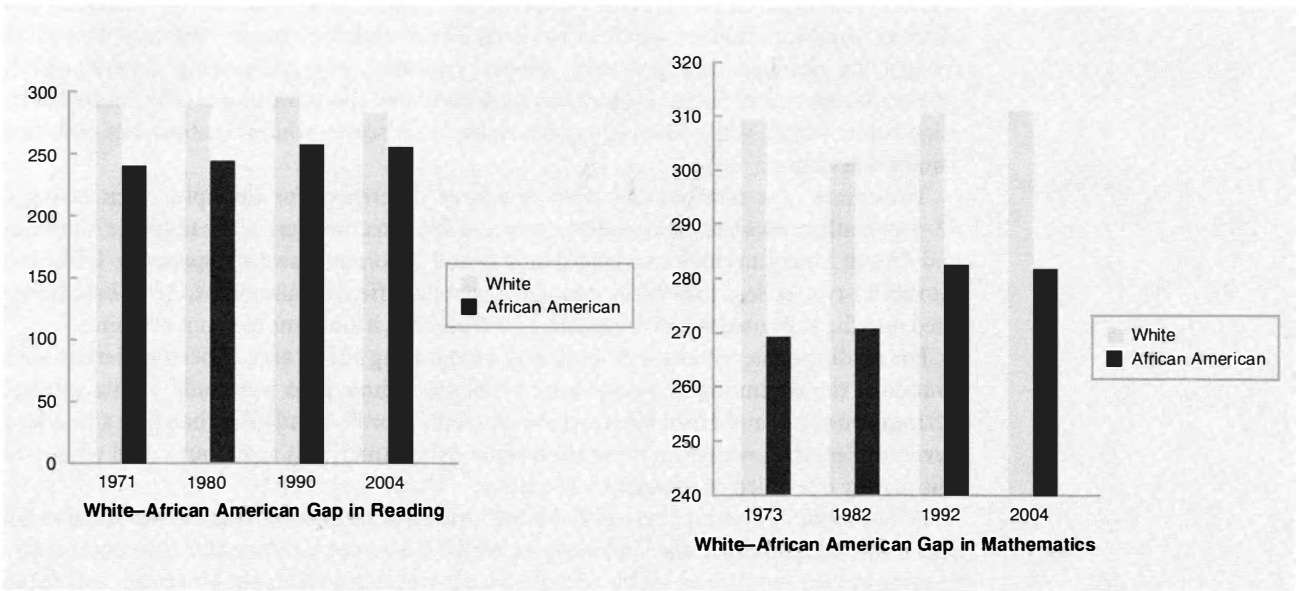
Taken together, the results from these analyses and many others like them point to racial and ethnic group differences that are already observable during the preschool period and persist throughout formal schooling, although it is also clear that changes in the environments of disadvantaged children can create substantial increases in these scores. (This outcome is not

FIGURE 6.5 **Average NAEP Reading Scores of 9- and 17-year-olds, by Ethnicity. Data Source: NAEP, U.S. Dept. of Education**



Source: Wendy M. Williams, used with permission.

FIGURE 6.6 **6.6a: Narrowing of White-African American Gap in Reading Between 1971 and 2004 (17-year-olds). Data Source: NAEP, U.S. Dept. of Education. 6.6b: Narrowing of White-African American Gap in Mathematics Between 1973 and 2004 (17-year-olds). Data Source: NAEP, U.S. Dept. of Education.**



Source: Wendy M. Williams, used with permission.

inevitable, however; see Sanbonmatsu, Kling, Duncan, & Brooks-Gunn, 2006; Leventhal, Xue, & Brooks-Gunn, 2006). But what about changes in these gaps over the years of schooling? Do they tend to get larger with each school year? On this point, there is some disagreement among researchers. It is virtually impossible to measure preschoolers' cognitive ability and achievement and to track them consistently across the school years. This difficulty arises because preschoolers are unable to perform the reading and verbalizing tasks associated with tests administered to school-aged students, and their varying abilities to focus on tasks produce considerable measurement error even in the assessments designed for their developmental stage. All these factors conspire against an unequivocal answer to the question of whether gaps increase during schooling. But the weight of existing evidence seems to point to widening of gaps over time, as discussed next.

On the one hand, Brooks-Gunn et al. (2003) found somewhat equivalent growth in the scores of African American and white children between ages 3–5, suggesting little change in African American–white score gaps over the course of early childhood. Similarly, Farkas and Beron (2004) reported little change in racial gaps prior to or after school entry. In contrast, Phillips, Crouse, and Ralph (1998) found that racial achievement gaps increased during childhood, and that gaps present in kindergarten account for only half of the eventual gap between African American and white high school seniors. (Asian American students scored roughly the same as whites on these tests.) Thus, while all studies find racial and ethnic achievement gaps, the size of the gap varies with the study, the cohort tested, and the measure of achievement. At a minimum, the gaps at the start of formal schooling amount to roughly 0.5 standard deviation, and some studies estimate the racial gap to be more than a full standard deviation. In the few studies that have attempted to control for race and socioeconomic status of the families, the net effect of SES is substantial, with most of the African American–white differences disappearing when students with equivalent SES are compared.

Notwithstanding the accomplishments of many past researchers, understanding how these and other factors combine to produce and expand racial and ethnic differences in achievement is something that currently remains at the level of "sloganeering" rather than careful science. For example, the pronounced gaps in nearly all cognitive measures prior to the onset of formal schooling necessitate an examination of preschool variables. In 1998, the U.S. Department of Education launched the kindergarten component of the Early Childhood Longitudinal Study (ECLS-K), the most comprehensive assessment of school readiness among the nation's kindergarteners. The data for this study come from test score results, drawn from a representative sample of more than 13,000 children enrolled in both public and private kindergartens. Using this information, Duncan and Magnuson (2007) revealed large gaps in school readiness between white and Asian American students on the one hand, and African American and Hispanic American students on the other hand. For math achievement—that is, skills such as recognizing numbers and geometric shapes, counting, and recognizing patterns—both African American and Hispanic American students scored about two-thirds of a standard deviation below whites, while Asian American students outscored whites by about one-fifth of a standard deviation.

Two-thirds of a standard deviation is a large difference. For example, when taking a 92-item mathematics test, white children averaged 25 correct answers, while Hispanic American and African American children averaged only 19 and 20 correct answers, respectively. Translated into an IQ-type scale, a two-thirds standard deviation difference amounts to 10 points. Translated into the scale used for an SAT math or verbal score, it amounts to about 65 points.

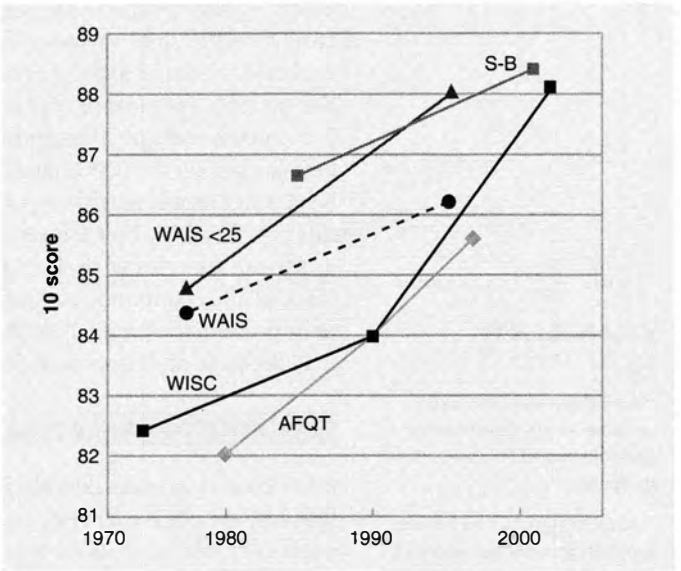
For reading achievement—skills such as recognizing letters and associating letters with sounds at the beginning of words—the racial and ethnic gaps were only a little smaller. African American and Hispanic American students scored slightly less than half a standard deviation less than whites on these tests, while Asian Americans again outscored whites, in this case by one-third of a standard deviation.

What might be causing these differences? One obvious possibility is the historical racial and ethnic inequalities in the United States, which have created different socioeconomic circumstances for families in which white, African American, Hispanic American, and Asian American children are reared. These social and economic differences may, in turn, explain the racial and ethnic achievement gaps.

The ECLS-K also asked participating children's parents about their own schooling, occupations, and household incomes. Combining these elements into a single SES index and comparing scores across groups, African American kindergartners were found to score more than two-thirds of a standard deviation below whites. Hispanic American children had an even lower SES standing relative to whites. Also consistent with the test score patterns, Asian American children enjoyed SES levels that were one-seventh of a standard deviation higher than those of white children.

In view of the economic gains made by African American and Hispanic American students' families in recent decades, particularly during the 1970s and 1980s, one might expect that cognitive and intellectual scores would have improved as the SES conditions improved. This is essentially what new research by Dickens and Flynn has shown. Across a group of four popular IQ tests, Dickens and Flynn have demonstrated a narrowing of intelligence score differences between African Americans and whites, on average, of 4.5 points between the 1970s and 2000, as seen in Figure 6.7.

FIGURE 6.7 **African American Scores on Four Tests of Cognitive Ability (white average = 100)**



Source: From J. Flynn and W. Dickens, "Black Americans Reduce the Racial IQ Gap: Evidence from Standardization Samples," 2006, *Psychological Science 17*(10), p. 913. Copyright by Wiley-Blackwell. Reprinted with permission.

■ A SNAPSHOT OF THE NATION'S TWELFTH-GRADE STUDENTS AND THEIR LEVELS OF ACHIEVEMENT We have written about test score differences in young children—but how about taking a snapshot of the nation's twelfth graders? As noted earlier, the African American–white achievement gap remains at the end of high school. A recent mathematics assessment for twelfth graders occurred in 2000; for reading, twelfth graders were assessed in 2002.

On the composite scale for mathematics, white twelfth graders averaged 308 points in 2000, whereas the mean for African American students was 274 (NCES, 2001). The difference of 34 points is the equivalent of .68 standard deviation units. On reading achievement, the 2002 NAEP results show twelfth-grade whites scoring an average of 292, while African American students average 267 points (NCES, 2003). Thus, at the end of secondary schooling, the overall African American–white achievement gap is (approximately) two-thirds or more of what it was at the start of kindergarten.

These differences, of course, have substantial real-world significance. A gap of a full standard deviation means that African American students lag behind white students in a range of categories. For example:

- Randomly selecting African American and white scores from the combined sample of children will result in the white child exceeding the African American child 76 percent of the time.
- Eighty-four percent of white children will perform better than the average African American child, whereas only 16% of African American children will exceed the performance of the average white child.
- If a class that is 50:50 African American and white is divided into high- and low-ability groups, white students will constitute approximately 70 percent of the higher-ability group.
- If only the top 5 percent of students in such a class are eligible for gifted/talented programs, the class will include 13 times as many whites as African Americans.

These are all predictions that are derived from a normal distribution of scores. As Lubienski (2002) points out, when group differences are examined across grade levels, the average African American student is graduating from high school with a math proficiency score significantly lower than that of the average white eighth grader (274 versus 286, respectively).

In sum, the significant racial and ethnic gaps that are present prior to the onset of schooling appear to be sustained over the course of schooling, such that preschool gaps seem to be nearly as large by the end of high school. Considering factors such as maternal education, family wealth, child variables, family reading practices, and so on reduces (in other words, explains) the racial gaps by as much as two-thirds on some (but not all) aptitude measures. For example, for reasons that are not clear, these factors do not reduce the racial gap on the best-known measure of receptive vocabulary (PPVT), whereas they do reduce the gap on the best-known IQ tests (Brooks-Gunn et al., 2003). Also, recent research shows that there has been a significant narrowing of the IQ gap separating whites and African Americans, with this gap shrinking by 4.5 points in the final decades of the twentieth century. This increase in African Americans' performance illustrates an important point: Gaps are not inevitable. If social and economic conditions experienced by currently disadvantaged groups continue to improve in the future, then there is reason to hope that racial and ethnic achievement gaps may decrease or disappear as well.

THINKING PRACTICALLY

Name three ways you can become an effective mentor and role model for your students.

SUGGESTION: Offer advice, support, and encouragement; discuss the obstacles you encountered and how you overcame them; listen to students and provide direction during troubled times.

THE ROLE OF MENTORING IN SCHOOL PERFORMANCE

All of these data make clear the importance of education in breaking the cycle of poverty and low academic achievement, especially for African Americans and Latinos and other Hispanics who are more likely to suffer the consequences of poverty. Parents' education level is critical; as we said earlier, it is a good predictor of children's school performance. But what can you, as a child's teacher, do about this problem? You cannot change the amount of education a child's parents have. However, you can practice mentoring, which will make a significant difference in the lives of your students.

Zena Blau (1981) conducted extensive research on the importance to a young and impressionable minority child of having one educated adult in her or his life. More than one educated and inspiring adult is better still, but one is enough to make a real difference. One educated adult in a developing child's life means the child has a mentor and role model who represents the doors that education can open. Blau found that the African American inner-city children who have better life outcomes have at least one adult in their lives with an educational orientation. This adult could be a parent, other relative, friend, teacher, and so on. Knowing one person with an educational focus is essential to the child's outcome. You as a teacher can be this adult—and you can make a real difference to a developing child. By serving as a mentor and role model, you will help break the cycle of poverty, low school performance, and low education that has held back many youngsters of less advantaged groups.

To accomplish this goal, make it clear to your students that education and hard work matter to you, stress their values in your own life, and show students how they can benefit as a result of educational success. You can use a variety of techniques to meet these goals—for example, analysis of real-life problems and issues education helped to solve, and discussions about famous individuals whose lives were changed by an educational focus. More importantly, you can generally be available and willing to listen to students' opinions and to provide advice.

*i*MPLICATIONS FOR TEACHING

- **Do not assume that lower scores necessarily reflect lower levels of innate ability.** Lower test scores of students from certain racial and ethnic groups are likely the result of restricted resources. With improved resources, differences in scores among groups narrow considerably.
- **Recognize that the parents of today's students—particularly minority parents—are dramatically more educated today than they were a generation or two ago.** Do not stereotype minority parents unfairly.

- **Stress to all students, but particularly those from traditionally disadvantaged groups, the lifetime value and rewards associated with completing high school and attending college.** Teachers can be effective vehicles of the message that education is the ultimate answer to many problems experienced by people of lower SES.
- **Never underestimate what one dedicated teacher can mean at a critical time in a student's life.** One teacher or other educated adult mentor can make an enormous difference in the life of a developing student.

Scott Cunningham/Merrill

Research has shown the enormous importance of mentoring. Mentors and role models make clear the doors education can open. Expert teachers, too, can make a real difference to a developing child.

Gender Diversity

Women and men are different, both in obvious and not-so-obvious ways. Boys and girls are also different, and regardless of the age of the students you teach, you will be confronted with sex and gender differences. Like all teachers, Charlene Johnson has had to deal with sex and gender differences in addition to SES and cultural differences. Unless you teach in a single-sex school, you will confront these differences, too. **Sex differences** are biologically controlled differences; **gender differences** are psychologically and socially controlled differences. Gender differences are related to how people express their biological sex in behavior. According to this definition, sex differences reflect biological factors, whereas gender differences reflect cultural factors in addition to biological ones.

Early in our writing of the first edition of this textbook, we attended a professional education conference where we met other textbook authors. Upon meeting the two of us (and not knowing of our book), one of these authors asked if the second author of this book (a woman) was the new secretary assigned to the first author of this book (a man)! Many readers of this text can undoubtedly offer similar accounts of their own experiences with sexual stereotyping, ranging from amusing instances such as that just described, to more blatant and distressing cases of discrimination in which someone was denied employment or other opportunities solely because of sex. **Gender bias** exists when a person possesses unjustified views of female versus male competencies; these views often favor one sex over the other. Many traditional notions about gender and sex roles are changing, and concepts of gender and people's beliefs and expectations about it are influenced by numerous trends in modern society.

THINKING ANALYTICALLY

Through which specific behaviors do you represent your gender to the world? What exactly do you do that defines you as male or female?

SUGGESTION: Think about how you behave in social situations, and how you dress—the jewelry and other accessories you wear, your hairstyle, and other aspects.

WHAT TEACHERS NEED TO KNOW ABOUT SEX DIFFERENCES

Given that a person's sex is almost always an immediately obvious trait, most people—teachers included—may process and act on this information without even realizing they are doing so. Examples are a teacher treating a 7-year-old girl differently from a 7-year-old boy when she returns an incomplete math test, a teacher calling more frequently on girls in literature courses and more frequently on boys in science courses, and a teacher encouraging boys to tough it out when they are scared and girls to withdraw from frightening situations. Because teachers have such a substantial influence on their developing students, and because their influence is exerted at a time when students are developing their gender identities, teachers should be especially aware of their own biases and beliefs about the sexes. In this section we explore what is known about sex and gender differences, and—equally important—what remains speculative or unconfirmed.

THINKING PRACTICALLY

Have you ever used a sexual stereotype to describe someone? Was your description fair and accurate?

SUGGESTION: Think of a time when you described someone (perhaps someone at school or in your family) as either stereotypically masculine or feminine—for example, "as strong as an ox" or "as pretty as a picture." Did your description capture what this individual is really like?

Obviously, expert teachers should understand what we know, and what we don't know, about sex differences. Armed with accurate knowledge, the expert teacher can ensure that all students are given the best possible chance to show what they have learned Are there sex differences in intellectual abilities, scholastic performance, and achievement? Whether such sex differences really exist and, if they do, what causes them, has been a hot topic in the social sciences for many years (Ceci & Williams, 2007). If as a society we are concerned with the low percentage of women who enter technical and highly scientific fields and seek to encourage more women to enter these fields, we should want to know whether women are biologically at a disadvantage for developing mathematical skills, for example (Benbow, Lubinski, Shea, & Eftekhari, 2000; Lubinski & Benbow, 2007). Early studies of sex differences, reviewed by Halpern (2000), were biased and based on samples of people who did not represent the population as a whole. More recently, better methods of research have been developed and more representative samples have been used to examine sex differences in abilities (Halpern, 2000, 2007; Halpern, Benbow, Geary, Gur, Hyde, & Gernsbacher, 2007; see also Garner & Engelhard, 1999; Hedges & Nowell, 1995; Marsh & Yeung, 1998).

THE EVIDENCE FOR SEX DIFFERENCES IN COGNITIVE PERFORMANCE

Are there any measurable, fundamental differences between males and females in their ability to perform cognitive tasks? Are there biological differences (i.e., differences in brain function, for example) that underlie male/female differences in intellectual task performance?

THINKING PRACTICALLY

How might teachers' values regarding sex differences influence their teaching, particularly those values and beliefs the teachers themselves do not realize they possess?

SUGGESTION: Teachers who believe girls are more cooperative and boys are more competitive might be quicker to criticize boys and praise girls. Teachers who believe girls are smarter in a subject might give girls higher grades on tests, homework, and overall.

THINKING ANALYTICALLY

Must differences between males and females have a biological root to exist?

SUGGESTION: No. If boys and girls are raised with different experiences and expectations, they can grow up to possess different abilities and characteristics.

■ **DIFFERENCES ARE SPECIFIC, NOT GENERAL** A substantial number of studies have found no overall difference in the performance of females and males on intelligence tests (Aluja- Fabregat, Colom, Abad, & Juan-Espinosa, 2000; Codorniu-Raga & Vigil-Colet, 2003; Flynn, 1998; Halpern, 1992, 2000; Strand, Deary, & Smith, 2006; see also Mackintosh, 1996). For example, a population study of 87,400 children born in Scotland in 1921 found that when they were 11 years old, their mean intelligence test score was 43.1 for males and 43.5 for females (Deary, Whalley, Lemmon, Crawford, & Starr, 1999).

However, certain differences emerge when we examine patterns of scores on different types of performances. On average, females score higher than males in many aspects of verbal ability, which includes reading, vocabulary, spelling, grammatical knowledge, and oral comprehension. Males are far more likely than females to have problems with verbal abilities—for example, stuttering. Toddler girls already show their average verbal superiority over boys by mastering talking and language earlier than do boys. These gender differences in verbal abilities tend to be small (Hyde, 1997; Hyde & Linn, 1988; Smedler & Torestad, 1996) but consistent, and you may be able to see them in your teaching.

On average, males are better than females in many visual–spatial tasks, including tasks such as rotating visual images mentally (Nordvik & Amponsah, 1998; Vederhus & Krekling, 1996). These differences in visual–spatial ability can be substantial. Regardless of practice and training, which improves performance of all children, sex differences usually persist (Ben-Chaim, Lappan, & Houang, 1986), although some recent work shows that training in computer games can make girls and boys score nearly equivalently (Feng, Spence, & Pratt, 2007). Experience with the task helps, but there may be an underlying biological component to males' overall superior performance on some visual–spatial tasks.

Males are also less influenced than females by context effects in perceptual tasks, differing in what is called field dependence/independence. Have you seen the cereal boxes and children's placemats with the "Find the 25 hidden faces" games? Boys perform better on these types of tasks, on average, than girls do.

Quantitative skills of the type measured on standardized tests are another area where males tend to outperform females, although the meaning and real-world significance of these differences has been called into question, given that girls outperform boys in high school math courses and grades (Spelke, 2005). Male advantages in quantitative abilities tend to be larger than the differences in verbal abilities. Males particularly outnumber females at the extreme end of high performance in math tests. For example, four times as many boys as girls scored above 700 on the math portion of the SAT in 2005, down from

a ratio of 13:1 in 1983 (Benbow & Stanley, 1980; Lubinski & Benbow, 1992, 2007). One controversial theory (Colom & Lynn, 2004) suggests that girls' brains mature faster, leading to girls performing better in adolescence and just beyond, while boys' brains mature more slowly, leading to boys overtaking girls in the later teenage years. Because males' better overall math performance relative to females' does not show up in math courses in school, but rather on standardized tests, some researchers have concluded that standardized tests represent a more threatening situation for girls that tends to lower their scores (Steele, 1997b), whereas girls outperform boys in daily life at school. We discuss this finding further in the section on the role of motivation.

■ **MALE PERFORMANCE IS MORE VARIABLE** What is interesting about the very large number of high-scoring males relative to females is that there is also a large group of very low-scoring males. The performance of males is simply more variable overall (Deary, Thorpe, Wilson, Starr, & Whalley, 2003; Feingold, 1992a, 1992b; Hyde, 1997; Lubinski & Benbow, 2007)—that is, males' scores are more widely distributed and more different from one another than are females' scores, which are more tightly clustered. Maccoby and Jacklin (1987) showed that males' scores were more widely distributed and more highly variable than women's scores for mathematical abilities and spatial abilities, but not for other abilities. Jensen (1985) reviewed the literature on sex differences in IQ and concluded that males' scores were more variable than females' scores. Feingold (1992a, 1992b) reviewed a large sample of summary statistics on tests and concluded that male scores were more variable than female scores for tests of quantitative and spatial ability but not for tests of verbal ability.

What these results suggest is that teachers may see more very high-achieving boys than girls—but that these teachers may also see many more low-achieving boys than girls. The girls' scores will simply be less variable, overall. Thus, in your work as a teacher, your star math performers in high school may mostly be boys—but your worst math performers may also be boys.

■ **ROLE OF MOTIVATION AND SOCIETAL SUPPORT** Despite these male/female differences, expert teachers know this list of sex differences in cognitive abilities is short relative to the large numbers of cognitive abilities for which no sex differences have been found. For example, most types of memory tests show no consistent sex differences. And when it comes to explaining why males do better on standardized math tests, we clearly have to consider the roles of societal values about math performance and support for math achievement. Ask yourself: Did your parents, teachers, culture, and our society as a whole encourage you to excel in math? What about a young child of the opposite sex—would the support systems have been the same as they were for you?

Lubinski and Benbow (1992, 2007) believe that female motivation to do well in math is less than male motivation, even for the highest-scoring females. They have investigated why even high-scoring women fail to choose careers in math and science: Indeed, men are six to eight times as likely to pursue such careers. Why is it that these women do not seek careers as scientists as often as do men who score comparably in math? Lubinski and Benbow believe there are no simple explanations for this gap. Perhaps females are turned off by careers in science in part because society as a whole does not support the entry of young females into the ranks of professional scientists. Encouraging your female students is another area in which you as an expert teacher can make a big difference in the life of these developing young women. By stressing that science and math achievement is something to strive for and be proud of—for example, by citing the achievements of famous women mathematicians, scientists, and engineers—you can help create a culture in which females pursue scientific careers. It would be interesting to know what the magnitude of male–female differences in math would be if girls and boys were given equal encouragement, rewards, and cultural and societal supports for their math achievements.

THINKING PRACTICALLY

How can a middle school teacher interact with the parents of a girl who is talented in math, but who does not receive encouragement from her parents to achieve in math, to persuade these parents to set higher standards for her?

SUGGESTION: The teacher might tell the parents about the girl's high scores relative to other students, to give them proof of her ability, and suggest to the parents that their attitude is holding their daughter back. The teacher might recommend an extra class or enrichment program for the girl, and explain to the parents why this is a good idea.

THINKING CREATIVELY

In what ways did our culture encourage or discourage your own math achievement?

SUGGESTION: Were you made to feel competent in math as a child? Were you expected to succeed or to fail? Think about what cultural messages you received about your math ability.

ARE FEMALE–MALE DIFFERENCES BIOLOGICAL, CULTURAL, OR BOTH?

Observed differences between males and females may come about as a result of biological, genetically based factors or as a result of differences in how female and male children are

raised in our culture (or both). One study asked people to rate the behavior of a baby in terms of how exploratory and active the baby was (Condry, 1984; Condry & Condry, 1976; Condry & Ross, 1985). Some people rated a baby dressed in a blue outfit and others rated a baby dressed in pink. The blue-suited baby was rated as more active and exploratory and as exhibiting typically male behaviors. The catch was that all people rated exactly the same baby! Clearly, cultural expectations of male versus female behavior influenced how people perceived the baby's behavior.

Teachers are as likely as anyone else to possess subtle gender-related expectations and biases. Understanding the basis of male–female differences helps the expert teacher to cope with differences in a positive manner.

■ **BIOLOGICAL DIFFERENCES** There is evidence that some sex differences may have a biological basis (Halpern, 1992, 2000; Halpern et al., 2007; Kimura, 2007). Prenatal sex hormones such as testosterone are known to affect the development of gender differences in the brain. High levels of male hormones during development of a female fetus, for example, have been shown to increase spatial abilities in females. Male fetuses that do not respond appropriately to male hormones during fetal development develop certain female psychological characteristics, such as higher levels of verbal than spatial ability. Some researchers believe that gender differences may in part be explained by differential brain lateralization in males and females. Testosterone affects the development of the right and left hemispheres of the brain, and males have more lateralization of their brains than females do (Hiscock, Inch, Hawryluk, Lyon, & Perachio, 1999; Hiscock, Perachio, & Inch, 2001; Kee, Gottfried, Bathurst, & Brown, 1987; Meinschaefer, Hausmann, & Guentuerkuen, 1999). Verbal skills are more left hemisphere related for males than for females. For females, verbal skills tend to involve the use of both hemispheres, and many spatial abilities originate in the right hemisphere.

Another biological influence on females' performance is the pattern of hormonal changes during the menstrual cycle (Hampson & Kimura, 1988; Kimura, 2000; Kimura & Hampson, 1994; McEwen, Alves, Bulloch, & Weiland, 1998). During menstruation, when female hormones are at their lowest levels all month, women do better on tasks on which males are usually superior, such as map problems, mazes, and visual–spatial problems. By contrast, when female hormones peak at midcycle, females do even better on tasks on which they are usually superior, such as verbal fluency (Hampson, 1990, 2002; Hampson & Kimura, 1988).

Another observable biological difference between females and males is that the corpus callosum, a part of the brain that connects the two brain hemispheres, is larger in females than in males. As a consequence, females' brain hemispheres may be better able than males' to communicate back and forth.

All in all, there are several potential biological bases for sex differences in cognitive performance (Duff & Hampson, 2001). Nevertheless, environmental and social factors that influence cognition are also important to consider, particularly because teachers can do nothing about biological differences but can have a substantial impact on the social environments of developing children (Spelke, 2005).

■ **CULTURAL DIFFERENCES** Cultural and social attitudes and stereotypes that shape how a girl grows into a woman and how a boy grows into a man are everywhere in our society. Put bluntly, little boys and girls are treated differently. They grow up exposed to different values, lessons, morals, encouragements, and expectations. Traditionally, in North American culture, females have been enculturated to have lowered expectations for scholastic performance and ultimate career success compared with males (Halpern, 1992, 2000, 2007; Stroh & Reilly, 1999). Men are shown occupying the positions of greatest income, prestige, and influence in magazines, newspapers, books, movies, television, and so on. As they grow up, boys are encouraged more so than girls to set their sights high and have high aspirations. This trend characterizes most cultures encountered in North American classrooms of today. In fact, some of the cultures of immigrant groups stress achievement more strongly than does the dominant culture, and especially the achievement of boys.

CONSTRUCTING YOUR OWN LEARNING

How have sex role expectations affected your own development? Ask yourself, and list the typical statements you remember hearing while growing up regarding your performance in school, which subjects you should study, in which activities you should participate, and which ultimate career plans you should make. Make two separate lists: one containing the messages you received from your female teachers and caregivers, and the other containing messages from male teachers and caregivers. Were you encouraged to have different expectations for yourself as a result of the sex of the person who encouraged you? Now ask a member of the opposite sex about the messages about school performance and life goals that person received while growing up. Do you observe any differences in the messages given to women and men, or in the messages given by women and men? How might your life have turned out differently if you had heard the messages that were targeted at a member of the opposite sex? Which messages will you try to send, or avoid sending, to the male and female students you teach?

Traditionally, it was the case that math and science classes provided a more encouraging atmosphere for boys than for girls—boys historically asked more questions in these classes and received more teacher attention, and boys generally dominated the math and science scene (Broome, 2001; Handley & Morse, 1984; Reis & Park, 2001; Trusty, 2002) Today, however, women enroll in as many challenging math courses as do men in high school, and women earn higher grades in these courses. Some argue that the competitive grading and solitary work often found in such courses are especially amenable to the male working style (Eccles, Wigfield, Harold, & Blumenfeld, 1993), but it is clear that women are achieving in math classes despite the fact that they do not later pursue math-based careers (Ceci & Williams, 2007). Females may prefer socially cooperative styles of working and may be doing better today than historically in math and science because these subjects now tend to be taught from a perspective of group-project work. By contrast, boys typically get more experience in competitive activities, even as early as the preschool years (Tassi & Schneider, 1997). Furthermore, despite the ability of many females to speak more fluently than males, males often dominate interactions with females as well as the decisions that are reached (Lockheed, 1986; Tannen, 1990, 1997).

THINKING PRACTICALLY

What can you do to encourage students at different grade levels who are "mathphobic," or afraid of math?

SUGGESTION: Give extra practice tests and quizzes to build confidence; play games with math concepts; give some untimed or ungraded tests; pair students with others not afraid of math on group projects; describe students who overcame math phobia and went on to achieve in math.

Which specific cultural and social-cognitive influences might account for gender differences in cognition? Researchers have considered many factors. Some gender differences in spatial abilities might be related to the fact that more males play with construction sets and video games, which hone these skills. That is, boys' toys and play activities might place greater developmental emphasis on spatial skills. Boys often are more encouraged by adults to explore their environments than girls are (Bornstein, Haynes, Pascual, Painter, & Galperin, 1999; Lindow, Wilkinson, & Peterson, 1985), and hence may develop visual–spatial skills more readily. Indeed, young girls with interests in stereotypically male activities grow up to have greater spatial abilities than other girls (Newcombe & Dubas, 1992).

In terms of math performance on standardized tests and later selection of careers involving math, our culture obviously encourages boys more than girls (Halpern, 1992, 2000, 2007; She, 2000; Tiedemann, 2000, 2002). Most math teachers have higher expectations for boys than for girls. Our society as a whole expects math to be tough for girls—a doll marketed in the early 1990s even said out loud, "Math classes are hard!" Think about how these messages affect little girls, who early in their lives form notions about their math competence and attitudes toward math that may persist throughout their lives. Expert teachers can make a substantial difference in providing equality of opportunity and experiences to both girls and boys by having the same high expectations for members of each sex (see the Implications for Teaching section).

THINKING ANALYTICALLY

Why do females typically score higher than males in classroom math grades?

SUGGESTION: Teachers, who are often female, may prefer girls' typically more cooperative school attitudes and, therefore, give girls higher grades. Girls may study more than boys. Girls may have greater ability for classroom math than boys do. Girls may pay more attention in class.

Other notable differences between the sexes include the following:

- Boys are more likely than girls to be hyperactive and to show behavior problems. Boys are more likely than girls to be referred for reading disabilities; thus teachers often must focus more on reading skills with boys (Shaywitz et al., 1990; Skarbrevik, 2002; Wehmeyer & Schwartz, 2001; Willcutt & Pennington, 2000).
- Females typically score higher than males in classroom grades in math (Kimball, 1989; Spelke, 2005).

THINKING PRACTICALLY

How might a teacher make use of the typical attitude differences between boys and girls in math?

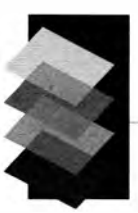
SUGGESTION: Challenge competent girls to recognize they are capable in math. Point out to girls that they can do as well as boys in math, and they should recognize this fact and not be intimidated by boys. Tell boys that attentiveness, hard work, and studying—"the way the girls do it"—are necessary to bolster good performance.

- For boys, math achievement can be predicted both from previous math achievement and expectations of success or failure in math (Ethington,1992). For girls, math achievement can be predicted both from previous math achievement and expectations of future achievement. However, other interesting findings applied only to girls: Girls who were less likely to receive help from families in math suffered more than boys in the comparable situation. Girls who viewed math as a male domain achieved less than other girls, and girls who viewed math as difficult also had lower achievement.
- According to a report by Stipek and Gralinski (1991), girls typically rate their math abilities lower than do boys, expect to do less well in math, and are less likely to attribute success in math to ability and failures to bad luck; elementary-aged girls are less likely to be confident that math success can be achieved through effort, and girls often take less pride in math success. Girls have lower expectations for math achievement than do boys (Lepola, Vaurus, & Maeki, 2000).

In recent years, male–female differences in U.S. math achievement have declined, a trend that may show the influence of changing cultural values about girls' math achievement (Friedman, 1989; Hyde, Fennema, & Lamon, 1990). In some other cultures, males and females perform comparably on math assessments; in still others, women outperform men (Mullis, Martin, & Foy, 2005; Valian, 2007; Walberg, Harnisch, & Tsai, 1986). For example, girls from Singapore and Japan do substantially better on standardized math tests than do boys in the United States and Canada. The difference between U.S. boys and girls is 5 points (502 for girls, 507 for boys), but Japanese girls score 569 and boys score 571, and Singaporean girls score 611 and boys score 601! Expert teachers remember these facts every day so that they do not bring outdated assumptions about girls' math competence into the classroom.

*i*MPLICATIONS FOR TEACHING

- **Strive to become aware of and eliminate gender bias from your thinking and teaching.** Even the slightest bias can harm students. Ask valued colleagues and other people you admire to critique your approach, looking for gender bias.
- **Do not judge any individual student based on trends that characterize the entire population.** Although biologically based sex differences do exist, none of us is an "average" or typical male or female in all of our attributes. Judge individuals as individuals, based on meaningful information.
- **Remember that most abilities do not vary between the sexes.** Even for those that do, hard work can overcome skill deficits. Differences between individual boys and girls will be greater than any population-based differences.
- **Do not add to the negative messages rampant in our society.** The cultural messages about gender-appropriate behaviors that are received by both girls and boys can be destructive. Examine your own upbringing for hints of bias, and eradicate any current behaviors that perpetuate negative or limiting gender messages.
- **Expect the same level of performance from girls and boys.** Call on both sexes equally often in every class, and do not vary your expectations of the sexes for different subjects. Do not limit any student by expecting less from her or him on the basis of gender or any stereotype.



Language Diversity

Standard English, the language of our schools, is most widely accepted as the spoken and written language of educated speakers in formal and informal contexts. It is characterized by generally accepted conventions of spelling, grammar, and vocabulary. It is the English favored by most teachers and textbook writers as well as by journalists, speech-

writers, and professionals, and it is the language people try to use when interviewing for a job. Although languages as spoken in everyday life evolve and change over time, formal use of languages is slower to catch up (for example, the word "fax" has only recently shown up in dictionaries). Students are expected to speak and write Standard English if they want to do well on tests and receive good grades. But, as Charlene Johnson learned, students have not all had equivalent exposure to Standard English.

What about the student who moves to the United States or Canada from another country and does not speak any English? What about the native-born student from the United States who speaks a **dialect** of English—a particular variety of a language distinguished by consistent pronunciation, grammar, or vocabulary that is spoken and understood by individuals from a certain region? And how about the student who is bilingual and does speak Standard English in addition to another language spoken in the home? More and more frequently, teachers find their classrooms filled with students who speak different languages, and the expert teacher must have a concrete plan for managing and teaching these students despite their language differences. The number of students from both Asia and Latin America is growing dramatically, and this growth translates into an enormous challenge for teachers.

Frank Siteman

Given the growing diversity of American classrooms, it is becoming increasingly important that teachers give students opportunities to become aware and proud of their heritage. Students in one classroom have traced their family histories and positioned their photos on a world map.

TEACHING NON-NATIVE SPEAKERS OF ENGLISH

Researchers who study linguistics and bilingual education center their questions on how best to instruct children with varying language needs so these children learn optimally within the school environment (Bielenberg & Fillmore, 2005; Fillmore, 2000; Fillmore & Snow, 2000; Genessee & Gandara, 1999; Hakuta, 1999; Hakuta & Mostafapour,1996; Pintozzi & Valeri-Gold, 2000; Romaine, 1996; Williams, Perry, Oregon, Brazil, Hakuta, & Haerte, 2007). **Bilingual education** is education that takes place in more than one language. **English as a Second Language (ESL),** also known as English for Speakers of Other Languages (ESOL), is the name used for instructional programs that teach English to students who do not speak English as their first language. Should children be allowed to speak their native language in school if it is not English? Should they be taught using their home language if they are more proficient in it? Where will we find teachers capable of teaching in these foreign languages? Research has shown that although children can reach conversational proficiency in a second language within two years, becoming academically proficient can take as long as six years (Fillmore, 1989, 1991). Not only must children learn Standard English, but they must also learn social studies, math, science, and other courses at the same time. How can a teacher be expected to get the material across to a student who does not even understand the language?

Many children who enter school in the United States not speaking Standard English come from less affluent homes. These children are often from lower socioeconomic backgrounds and have parents who themselves never learned to speak Standard English and consequently do not speak it in the home. These parents often have less formal education than the parents of native-English-speaking middle-class students. Children from higher socioeconomic levels tend to have been exposed to Standard English, either in the home or through schooling, and tend to have mastered Standard English at an earlier age than poorer children.

Children who do not speak Standard English may have had little exposure to formal schooling and less parental support in the home for helping them with schoolwork. Thus the challenge to teachers and schools represented by these students is magnified. For these reasons, some educators believe the best way to instruct these limited-English students is to teach them in their home language (Hakuta & Garcia, 1989). They suggest that the children

THINKING ANALYTICALLY

Which languages do you speak? Analyze the conditions under which you learned these languages—were these conditions favorable or unfavorable, and in what ways?

SUGGESTION: Did you learn any languages growing up in a house with relatives who spoke different languages? In special schools? From foreign travel or residence? Did everyone around you speak the same languages? Describe what you would change about your experiences if you could.

THINKING PRACTICALLY

Name three ways a teacher might motivate a reluctant student to learn English.

SUGGESTION: Start with simple and entertaining books in an area of student interest. Try putting on a play to draw the students in. Offer to have assignments and papers that can be redone, instead of mostly relying on tests that may cause anxiety. Point out similarities between works of literature and the students' lives.

THINKING ANALYTICALLY

What are the advantages and disadvantages of having a national language and requiring students to learn to speak it exclusively in schools versus allowing teaching to take place in students' specific languages?

ADVANTAGES OF A NATIONAL LANGUAGE: Students are ensured of having the best possible language-appropriate teachers, because everyone works in the same language; in addition, students are readied to compete in the work force. Students also experience more commonality and unity because of a shared language.

DISADVANTAGES OF A NATIONAL LANGUAGE: Some students might be left behind because they have not yet mastered the language. This ground might not easily be made up.

ADVANTAGES OF SPECIFIC-LANGUAGE INSTRUCTION: Students may more easily develop their literary skills. They may also receive greater support from their parents, who may not speak the national language.

DISADVANTAGES OF SPECIFIC-LANGUAGE INSTRUCTION: Teachers have to be trained in multiple languages and might not be equally effective teachers in some of them. Students might leave school unprepared for the work force and for living in the dominant culture.

will more easily develop literacy skills in their native language than in a new language. These skills can then be transferred to the new language, English. In addition, instructing students in their native language keeps the children speaking their native language, which may be the only language these children share with their parents.

Jim Cummins (1976) distinguished between additive and subtractive bilingualism. In **additive bilingualism,** a second language is taught in addition to a relatively well-developed first language. In **subtractive bilingualism,** elements of a second language replace elements of the first language. Cummins believes that the additive form results in increased cognitive functioning, whereas the subtractive form results in decreased functioning. In fact, individuals may need to be at a relatively high level of competence in both languages to experience a positive effect of bilingualism. Children from lower socioeconomic backgrounds appear more likely to be subtractive bilinguals than middle-SES children. For example, Fillmore (2000) found that first-generation Chinese-immigrants' children often replaced Chinese with English, losing Chinese in the process rather than becoming bilingual.

Krashen and Biber (1988) have recommended that limited-English students at the elementary level be taught academic subjects in their primary language, with English being taught as a second language. Instruction in English starts to replace instruction in the native language as the students master English. Under this approach, all instruction gradually becomes conducted in English, usually by around the seventh grade. More commonly, however, bilingual programs give students only a year or two of instruction in their primary language—for just a short time each day (Ramirez, 1986).

Ramirez (1986) studied some different approaches for teaching students with limited English (in this case, Spanish-speaking students) and found that being taught in Spanish for only one or two years for a period of time each day led to performance similar to being taught only in English. By comparison, being taught in Spanish almost exclusively for many years led to better reading and math performance.

Teaching students exclusively in their native language may work, but where are schools supposed to find the teachers to instruct their limited-English students? Obviously, qualified teachers are essential, and there are not enough bilingual teachers to go around: This is a point worth remembering for you as a developing teacher, inasmuch as you may want to refine and further develop any additional language capacity you already have. And what about those schools, which are often located in more urban areas, in which various children speak many different languages as their primary language? How can schools cope logistically with instructing children in all these languages, even if the schools can find qualified teachers?

A question raised by some researchers is whether too many years of instruction in the primary language may inhibit the full learning of English. To secure a well-paid job in the United States, a person usually must have mastered Standard English. Some have pointed out that Asian American students seem to master English more easily than other students whose native languages are far more similar to English than are the Asian languages (Hakuta & Garcia, 1989). The implication is that if Asian American students can learn English and function effectively in our schools, so can children from other racial and ethnic groups.

SES AND LANGUAGE USE

Use of language can differ for students from different SES backgrounds. On average, lower-SES children often use language with a focus on the present; such language is more concrete, less descriptive and flowery, and more simple and basic (Bernstein, 1961, 1979; Hart & Risley, 1995, 2003). Lower-SES children tend to use fewer words overall to express the same things compared to higher-SES children. On average, middle-class children speak in more elaborate sentences, using more words overall. Their language is more playful and complex, and they often enjoy talking and playing games with words. Middle-class children typically use more metaphorical expressions and speak in less concrete terms.

Influential early work on the differences in speaking styles associated with SES was conducted in England by Basil Bernstein (1961, 1979). Bernstein was an anthropological linguist who compared the use of language by gang members with that of middle-class students. He showed that the gang members, who were from lower-SES backgrounds, tended to use what Bernstein called "restricted code language." This form of language was sparse and simple and tended to communicate in a compact way. By comparison, the middle-class children typically used more elaborate language. Critics of Bernstein's analysis pointed out that lower-SES children can, in fact, use more elaborate language under certain circumstances (Labov, 1997).

Thus language use varies among students partly because of the customary ways of using language in the students' homes. It may be easier and more natural for middle-class students to speak in elaborate sentences rich in detail. In contrast, lower-SES students may find this type of self-expression to be a challenge, and you may have to encourage and guide them in developing more elaborate speaking styles. Our culture prizes and rewards higher levels of verbal expression: Better jobs and more money come to those who are comfortable with higher-level uses of more complex language (Hunt, 1996). These students also perform better on tests, both classroom and standardized, which represent the gateway to many avenues of success in our society (Ceci, 1996b). As with all types of group differences, language differences will raise many challenges for you as a developing teacher. Some of these challenges may be dealt with through a teaching approach known as multicultural education, which we discuss next.

THINKING PRACTICALLY

How was language used in your own family as you grew up? How has your use of language changed since you left home?

SUGGESTION: Which languages did you speak growing up? Were the adults in the household very literate, with good vocabularies? How do you speak today, compared with during your childhood?

*i*MPLICATIONS FOR TEACHING

- **Work on developing a second language if possible.** It will be a substantial asset in the classroom, because an increasing number of U.S. students are coming from homes in which English is not the first language. Take advantage of any languages you may have learned but since have forgotten—they may be easily relearned.
- **Recognize that speaking habits, such as how descriptive students' language can be, are influenced by cultural values in the home.** Model for students the types of responses sought in school so students will understand the type of speaking rewarded in school. Remember that not all students come from homes that teach appropriate means for communicating in school. Do not assume students know what is expected.

Multicultural Education

Multicultural education exposes students to the values and norms of different cultures in an attempt to show them the diversity of the human experience. If you are like most people, you probably have some strong views on the subject of multicultural education, even though you may not be sure exactly what it is or how children are educated from this perspective. Right now, before you read any further, you should examine your own views on multicultural education.

Multicultural education became a buzzword in the 1990s, and this concept continues to elicit strong reactions on all sides of the debate. Some people argue that schools must teach equally the values and customs of all cultures across the world, making absolutely no judgments about "better" or "worse" cultures or cultural practices. Others argue that only the cultures of the students in a particular school should be studied, and that the time devoted to each culture should reflect how many students in the school are members of that culture. Still other people believe that the United States is a country of Americans with a common, shared, dominant culture, and it is the job of schools to teach the values and customs of this dominant culture (although exactly what this culture consists of is often a source of controversy).

THINKING ANALYTICALLY

What are the strengths and weaknesses of each approach to teaching described here?

SUGGESTION: Teaching about many cultures can be extremely time-consuming, and students may lack direct experience to appreciate these cultures. Teaching about the cultures in the school may fractionate the students and the community by emphasizing people's differences instead of similarities. Teaching only the dominant culture can leave students without an understanding of diversity that would broaden their attitudes and be helpful in today's world.

Regardless of your personal views, you may well be called on to teach a multicultural curriculum in the future. Charlene Johnson was expected to use a multicultural curriculum in her classroom even though she had little experience with diversity issues. Therefore, to be an expert teacher, you must understand what the multicultural approach represents and how teaching from this perspective will affect your preferred methods of instruction.

THE RATIONALE FOR MULTICULTURAL EDUCATION

The idea that underlies the trend toward multicultural education is that children from certain racial and ethnic groups tend to succeed more easily in typical schools than do children from other groups. Children who do not do as well often come from cultural groups with values that differ from the values stressed in school. For example, because U.S. schools often stress Western European values such as punctuality, future planning, solitary work, competition, goal orientation, and an emphasis on the individual, children from Western European backgrounds tend to match this dominant school culture. In contrast, children from Latin American backgrounds tend to have a cultural orientation that is less rigid and more team oriented, collaborative, noncompetitive and present oriented (Miller, 1995; Sensales & Greenfield, 1995). These children may not fit in as well with the dominant scholastic environment and may fail to show what they know within the context of a typical school's demands. Indeed, students from different racial and ethnic groups may perceive aspects of the school day and typical instructional practices differently than do students from the dominant culture (Levy, Wubbels, Brekelmans, & Morganfield, 1997; Levy, Wubbels, Brok, & Brekelmans, 2003; Thorkildsen & Schmahl, 1997). Do schools have to emphasize a unique set of values? Some researchers think the answer is no: These researchers believe schools can take many different approaches to instruction, to match the values of diverse cultural groups (Bernstein, Schindler-Zimmerman, Werner-Wilson, & Vosburg, 2000; Sheets, 1999).

COMPATIBILITY OF CULTURAL AND SCHOOL VALUES

Let us examine some of the ways the cultures of certain racial and ethnic groups may sometimes be incompatible with the cultures of the schools. At the same time we'll consider how schools can be modified to be more accommodating to children from these other cultures (for a review, see Miller, 1995).

One famous program of research was conducted by Roland Tharp, who in 1970 began a school improvement program for primary-grade Native Hawaiian students. Tharp (1994; Hillberg & Tharp, 2002) has also studied teaching and learning in American Indian and Native Alaskan communities. Tharp (1989; Tharp, Cutts, & Burkholder, 1970) focused on academic learning problems that might have originated in a poor match between the culture of the home and that of the school. His work resulted in a reading program and specific techniques for adapting the findings of his research to other minority group students. Tharp focused on increasing the match between students and the classroom in four areas: classroom dynamics, sociolinguistics, cognition, and motivation.

THINKING CREATIVELY

How might you illustrate for a child (without offending her) why her way of behaving could alienate other members of the class who share a different cultural background?

SUGGESTION: An outspoken child who fails to raise her hand before offering an enthusiastic comment might be told that the other students are not getting a chance to contribute, or that her vocalizing of her answer reduces the opportunities for other students to think of the answer themselves.

■ **CULTURE AND CLASSROOM DYNAMICS: SOCIOLINGUISTICS** The typical U.S. classroom contains one teacher and many students; the teacher leads lessons and discussions; and the students listen, take notes, answer questions, and work independently at their desks. For children coming from affiliative, group-oriented cultures, this atmosphere may seem strange. These children may wish to work in groups, share resources, talk to one another, and draw on adult guidance when necessary. Tharp found that the children in his study spent half their time in peer interactions. These children sought out their peers rather than their teacher when they needed directions. Seizing on this natural inclination of the children, Tharp created small groups that worked on projects, sometimes with the teacher present in the group, and sometimes alone.

The usual manner of speaking in the classroom is for the teacher to lead and the students to follow. Students are not supposed to speak out of turn; they are supposed to wait until called on and then to speak one at a time. This style fits well with the upbringing and expec-

tations of many white middle-class children, whose parents have taught them the same rules at home (Heath, 1982). Tharp, however, found that this type of interaction was uncommon for Native Hawaiian youngsters, who tended to speak to adults as a group. Perhaps because they were unfamiliar with what the teacher expected, these youngsters did not do well when teachers asked them questions in a one-on-one manner. In contrast, when the teachers directed questions to everyone in a small group, allowing any child or children to respond, the children performed far better.

Shirley Heath's study of a working-class community of African Americans in the southern United States showed that adults usually talk in terms of stories. Children wishing to join in must initiate their own participation—adults do not invite children to participate. Imaginative and dramatic stories are highly regarded in this group. You can see how this type of training in the home environment might prepare a child to do exactly what many teachers do not like—to interrupt and to launch into imaginative and dramatic stories instead of getting quickly to the point. Shade (1982; Shade, Kelly, & Oberg, 1997) concluded that African American children may require a classroom environment that promotes group instructional activities and active, verbally demonstrative activities.

■ **CULTURE AND COGNITION** Do members of different cultures actually think differently? If different cultural, ethnic, or racial groups do think and solve problems differently, then teachers must be aware of these differences if they are to help all children succeed in the classroom. Doing well in the typical North American classroom requires analytical, abstract thinking and reasoning, which is often applied reflectively over a long period of attention to academic tasks that may have little real-world significance.

Do some racial and ethnic backgrounds lend themselves more to this type of thinking style? Tharp believes that white students find it easier to adopt a verbal/analytical thinking approach, whereas some minority group members tend to emphasize nonverbal thinking not geared toward breaking problems down into their component parts. Clearly, the more exposure a child has to formal schooling, the more accustomed the child will become to thinking in the way the school values (Ceci, 1991, 1996b). Nonverbal styles are more likely in children who have had less schooling (Cole & Scribner, 1974).

Thus, as a teacher if you encounter students without much formal schooling, you may find they are not used to solving problems in the analytical and verbal style you seek. To reach these students, you must change your focus to enable them to show in other ways what they know, as they become accustomed to the demands of the school system. For example, allow students to do creative work to show what they know—write stories, plays, poems, skits, songs, cartoons, and so on. Students with difficulty writing might be asked to tape-record their story or poem and perform it for the class, or they could draw or sculpt or otherwise create a three-dimensional model that depicts the story. You might also allow students to do meaningful, practical work to show what they know, such as planning a small park cleanup and planting project, starting a small mock business, or mentoring younger students.

Native Hawaiian children learn things at home by watching an experienced person or by trying to do a task with verbal assistance. Recognizing this background, Tharp designed a reading program that utilized small groups and emphasized comprehension of stories. The teachers tried to relate the stories to the children's lives. This approach helped the children learn to read far better, and their abilities even carried over to their performance on standardized reading tests. Matching the instructional style to the children's cultural style resulted in obvious gains in reading ability. As you prepare to teach children of different cultural and ethnic backgrounds, remember to modify your instruction to capitalize on students' culturally rehearsed favored methods of learning.

■ **CULTURE AND MOTIVATION** Motivation is the all-important push we all needed to get through school. For minority children, more than the average dose of motivation is often required so they can overcome cultural obstacles that may restrain them from succeeding in the mainstream culture (Qian & Blair, 1999). There is no substitute for motivation.

Do members of different racial and ethnic groups have differing patterns of motivation? Research suggests that Asian American children and their parents believe education is the

EXPERT TEACHER INTERVIEW

FOCUS ON: DIVERSITY IN HIGH SCHOOL

MARK H. SMITH, MEDFORD HIGH SCHOOL, MEDFORD, MASSACHUSETTS–GRADES 9–12, MATH

Mark Smith has been teaching for more than 20 years. Enrollment of students who are members of minority groups has risen from 8 percent to approximately 20 percent of the student body at his school during the past decade.

Which cultures and ethnic groups are represented in your class?

We have a pretty big population of black students, including many Haitian students. We also have a growing Latino population. We also have students who speak a lot of different languages. We have more and more students in our ESL (English as a Second Language) program.

How do language differences affect your teaching?

Initially, it's hard to know where to place ESL students. Local schools, and many American schools, follow a math sequence that progresses from pre-algebra to algebra to geometry and on up, perhaps to calculus. But other countries do not have the same sequences, and limited English can make it difficult for students to perform on placement tests. Sometimes, we find that a student has stronger or weaker math skills than we thought, and we need to move that student into a different math class.

Once they are enrolled in a class, the challenge is to figure out whether students are having problems with the language or with math skills. Many times students have great math skills, but the language blocks them. I have a girl who speaks Chinese in my class right now. She takes a long time to figure out what the problems are asking her to do because she has to understand the English. But once she understands the problem, she has the math skills to solve it.

ESL students also have a hard time with our state standardized tests. The new tests focus on problem solving that requires strong English skills.

What do you do to help English-language learners with math?

We try to get them extra help in ESL class or after school. For example, the ESL teachers often ask for the math words that we're using. In class, I have learned to be flexible and mix things up. I know that students won't understand things and I work on making them feel comfortable letting me know what they need and what they don't understand.

The kids also help tutor each other. Last year, I had three or four Spanish-speaking kids in one class. All of them were challenged by the English, but one girl had stronger math skills than the others and she would help the others, in Spanish, as soon as she understood a problem. This year, another Spanish-speaking student is helping the Chinese-speaking girl I mentioned.

answer, and that education will guarantee opportunity (Goyette & Xie, 1999; Hsia, 1988). In contrast, among African American children and their parents, there sometimes appears to be a perception that education will not lead to economic and employment opportunities (Miller, 1995).

To motivate students effectively, a teacher must understand and deal with the students' perceptions about what getting a good education is likely to bring them in life. For many Asian American students, relying on statements such as "If you work hard on this assignment and others like it, you will get the type of job you want someday" may work well, because these statements are echoed in the home environment and by the Asian American culture in general (Hsia & Peng, 1998). Conversely, for many African American students, promises of opportunity must be linked to concrete examples to overcome potential negative messages these students may have internalized from the media, their friends, our society in general, and even their family members. In this case, concrete examples such as "If you score a 90 percent in this course, you can attend the special summer math program and get college credit" may work better.

With regard to the more group-oriented structure of the Native Hawaiian society, Tharp (1989) found that praising the group as a whole for good work was more motivating than singling out individual members of the group for praise. In the typical classroom in North America, praise is given for individual and often competitive accomplishments—but for students from other cultures, this approach may not work optimally. It is up to the expert teacher to recognize these types of issues and respond to the children in a way that will motivate them most effectively. Expert teachers are flexible in their approach when

Do you notice gender differences in math performance?

No, I've had the whole spectrum. Girls who do great, girls who do poorly, boys the same. More than half the students in my honors class this year are girls, for example. Again, I think you have to get to know students individually, and find out what they can do.

What about socioeconomic status? Do you find that higher SES students are higher achievers?

At our school, parental involvement seems to be more important than actual SES. Parents who value education and who have a strong educational background themselves pay attention to their children's education. They stay in contact with the school. They keep track of their kids, and keep on them. And these parents come from all economic levels. I've seen some very poor kids whose parents are very involved in their education do very well. I've also seen some very well-off students whose parents are not involved and who don't do very well.

We try hard to get parents involved. They get a lot of things sent in the mail to them. Teachers call home, and parents can call them. But it's still difficult for many parents. When students have two parents who are both working, it's hard to keep track, especially at the high school level. And some parents just don't seem to be interested. We have low attendance at open houses, sometimes as few as 30 parents, and all of those are the parents of the top students. We have some parents who don't even know there are report cards.

What advice would you give to new teachers?

There are two big things new teachers need to know: First, be flexible. You need to be able to adjust to different situations. Don't be rigid with every single rule. Instead, you need to choose your battles, and not get upset when students forget their pencils or are a minute late.

Second, don't try to be everybody's friend. This is especially tempting for young teachers who are close to the age of high school students. New teachers have to be professional. They can't be rigid about the rules, but they also can't let students do things that make them too comfortable, and hard to discipline later. Kids will adjust if you tell them your most important standards and enforce them from the beginning. I know that students won't understand things and I work on making them feel comfortable letting me know what they need and what they don't understand.

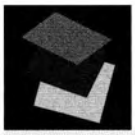
I know that students won't understand things and I work on making them feel comfortable letting me know what they need and what they don't understand.

dealing with students from different racial and ethnic groups: They use praise in the way that is most motivating (and not embarrassing) for the students, phrase and present challenges in a way that fits with students' cultural values (as just discussed), and are generally aware that subtle differences in classroom activities and structure can make a big difference to students.

AVOIDING GROUP STEREOTYPES

The point of the multicultural approach is to reach all students and to create a fair classroom environment for all students regardless of race, ethnicity, gender, culture, or other group differences. By discussing how ethnic and racial groups may vary, we do not wish to suggest that all members of each group share any characteristics. For example, not all Chinese American students are motivated to study, nor do all boys perform better than girls in math. Individuals are different from one another in every culture. Your students will differ in so many dimensions that their cultural or ethnic background may provide few clues to understanding systematic patterns of their behavior. We have provided this information in the hope that it will give you an appreciation of some cultural, social, and ethnic differences—not to create a stereotype of a typical student from each culture.

Expert teachers never assume that a given student will behave in a manner expected for her or his culture. Remember that in our discussion of socioeconomic status, we pointed out that being from a certain social class may create distinct similarities in upbringing for students from very different cultures. In fact, students from the same cultural group but from



THE FLEXIBLE EXPERT

TEACHING AND LEARNING ABOUT GROUP DIFFERENCES

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Susan asks her students to critically examine the cultural values they grew up with and ask whether these values serve society's best interest.

THE CREATIVE TEACHER: Susan has her students dress in the style of their countries of origin (extending back as many generations as they wish) and bring in typical dishes eaten on holidays to help them understand one another's cultures.

THE PRACTICAL TEACHER: Susan recognizes that certain types of facial expressions and body language may mean one thing for one group of students, but something very different for another group of students.

THE ANALYTICAL STUDENT: José is able to contrast the styles of the criminal justice system in four countries and explain how the different cultures gave rise to different attitudes about crime and punishment.

THE CREATIVE STUDENT: José writes a play for literature class in which the characters are famous women and men throughout history from different countries, all of whom became great scientists.

THE PRACTICAL STUDENT: José settles disagreements between different groups of students by talking to them about how their cultural values caused them to interpret what was said in ways different from those the speakers intended.

different income-level households may have radically different upbringings. Expert teachers view each student as a unique individual and use information about group differences to illuminate their thinking and to help explain why students may learn differently in school.

MULTICULTURAL APPLICATIONS IN THE CLASSROOM

Now that we have discussed the concepts motivating the use of a multicultural curriculum and considered some examples illustrating how to change the standard curriculum to implement multicultural approaches, we are ready to review some general principles of multicultural instruction. One thing is certain: Multicultural education means different things to different people. Banks (J. A. Banks, 1993, 1997; Banks & Banks, 2006) defines multicultural education in terms of providing educational equality for all students, regardless of gender, ethnicity, race, culture, social class, religion, or exceptionality (for example, high IQ, low IQ, or physically limited). Researchers believing in a multicultural approach advocate specific methods for making existing curricula more multicultural. We review these recommendations here. (Note that not all researchers or teachers support this perspective, as we discuss later.)

To teach multiculturally, you must first understand your students and their backgrounds: There is simply no substitute for getting to know your students' cultural backgrounds so you understand the context in which they are growing up. Once you possess this information, you can modify the curriculum to include presentations related to the cultures in the classroom, for example. You can discuss works of literature and art from each culture, political issues from the countries of origin of the students, geography and biology of the countries of origin of the students, and holidays from each culture in the classroom. When concepts are taught, you can provide examples from diverse sources across many cultures. These guidelines will help you reach every child.

To avoid stereotyping:

- Before using any curricular materials, review them to ensure they are free from stereotypes related to race, ethnicity, sex, and disability.
- Scrutinize books, illustrations, artwork, and plays chosen for production by the school, and choose culturally fair examples of these materials.

- When using pictures or verbal descriptions of individuals from different groups, including the two sexes, choose materials depicting these people in activities or jobs that are diverse and not associated with stereotypes.
- To help students overcome their stereotypes, discuss openly the current political and social status of different cultures.
- Use high-status individuals from various racial and ethnic groups, and from both sexes, as examples in classroom teaching, both through the use of case studies and through classroom visits or field trips if possible.

To achieve a multicultural perspective, follow these guidelines:

- Take pains to avoid using sexist or racist language, such as referring to the girls as "girls" and the boys as "young men," and enacting any stereotypes in the class, such as calling on boys more frequently in math or girls more frequently in language arts.
- When supervising children in the gym or at play, assign boys and girls to activities without regard to sex, and encourage all children equally. Never assume physical activity is more enjoyable for boys than girls or that girls cannot be just as talented in physical pursuits as boys.
- When possible, ask members of the class from nondominant cultures to share descriptions of their customs with the class—even bringing to the school samples of ethnic cuisines or costumes, and describing other celebrations. Draw examples of these customs from other cultures using the daily lives of the students in the class, and make the differences among cultures clear by talking in terms of how children from these different backgrounds spend family time, recreational time, and so on.
- Culture and religion are inextricably related in many holiday observances, life-cycle observances, and even special foods. If your teaching environment does not permit discussion of religion, avoid discussions of ethnic customs that include a religious component or clear them first with the administration.
- Encourage all students to have high goals and aspirations for their futures, regardless of their race or ethnicity or gender.

As a teacher, you will need ways to assess whether your multicultural approach is working. Determine whether your classroom permits and encourages the expressions of diverse opinions, even those negative toward the dominant and nondominant cultures, so these opinions and feelings can be examined and discussed in a nonconfrontational environment by the class as a whole. The classroom should be a place where the teacher encourages diverse views. The classroom that successfully integrates multicultural principles shows it in its artwork and displays. Anyone walking into the classroom should be able to tell that the values of different cultures are represented and accepted there. Students are expected to intermingle and become friends across racial and ethnic lines—teachers then know they have been getting their points across.

Expert teachers respect the needs of different students to learn in different ways, and they incorporate flexibility in the design of the curriculum to enable all students to show what they know. They make an honest attempt to understand different students' and groups' attitudes toward classroom success and the meaning of education. These teachers also try to involve the parents of culturally diverse students as often as they involve the parents of students from the dominant culture. All students who need extra help or special services should have access to such assistance without regard to race, ethnicity, or gender. By checking regularly, teachers can tell if they have been successful in implementing a multicultural approach in daily teaching and thinking about educational issues.

In your future teaching career, you will undoubtedly be expected to teach from a multicultural perspective. You may be perplexed, however, because some educators believe the move toward multicultural education is misguided. These critics of the multicultural approach believe that succeeding in North American society means becoming a member of the dominant culture of the United States or Canada. Such people argue that students will ultimately be denied opportunities if they are not immersed by the school in the dominant culture and taught its values (see the Forum feature, "Multicultural Education: A Good Idea?").

THINKING CREATIVELY

How can your own cultural background provide examples for classroom teaching?

SUGGESTION: Think of the unique talents and customs of your culture. What can students learn from these characteristics? Teachers may develop lessons about the history of cultural groups—political history, geographic history, or art history. For example, an African American teacher might present a lesson about the underground railroad used to smuggle slaves to freedom.

IMPLICATIONS FOR TEACHING

- **Recognize that multicultural education is a contentious issue that evokes strong responses from people on both sides.** Treat discussions about multicultural education appropriately. Do not assume everyone around you shares your views, regardless of what they may be.
- **Accept that, regardless of your personal views, you will probably be expected to teach from a multicultural perspective.** Do your best to be effective at your job, and make an effort to continue your own learning.
- **Work to familiarize yourself with the range of cultures you are likely to encounter in the classroom.** Maintain an open mind and attempt to learn as much as possible about these cultures. Recognize your own cultural limitations and work to broaden your perspective on other cultures.
- **Adapt instruction and assessment for students of nonmainstream cultures to provide these students with varied opportunities to show what they know.** Never assume that just because students are "different," they have less to contribute.
- **Never equate different styles of speaking and interacting with differences in intelligence.** Intelligence is impossible to judge on the basis of superficial information and observations.
- **Avoid judging individuals on the basis of group stereotypes.** A few stereotypes may be accurate in general, but they will not predict what any one individual is like. No individual is simply "just like the group."
- **Accept diverse views in the classroom, and encourage students to elaborate on these views so everyone will understand them.** Be tolerant of dominant and nondominant views. Model for students the fact that diversity does not have to be threatening.

FORUM

MULTICULTURAL EDUCATION: A GOOD IDEA?

Is multicultural education, which stresses the diversity that characterizes human beings, a good idea? Or should education stress the dominant culture to better enable students to function and compete within that culture?

FIRST VIEW: Education should stress the value of diversity and avoid portraying one culture or group as superior to others. Proponents of this view believe that, for too many years, educational systems marginalized some groups of people and their values while teaching only the values of the dominant culture. Because of this emphasis, students were denied the opportunity to examine critically the assumptions of the dominant culture, or possibly to choose alternative paths through life. Teachers praised and rewarded students who looked and acted "mainstream"; students who did not resemble the standard cultural prototypes were viewed as different and were often encouraged to assimilate and become more like members of the more prevalent culture. By stressing the many ways in which human beings differ, education can show the range of possibilities available to everyone. Students can learn there are many "correct" approaches to life and to learning and performing in school.

SECOND VIEW: Education should stress the values of the dominant culture to better enable students to understand and function effectively within that culture; an appreciation for diversity can be developed in students' lives outside of school. According to this view, education's primary goal is to equip students to succeed in the real world. Understanding diversity is not the goal of education; knowledge of

what is expected in the world outside of school is. Students who are constantly taught about diversity may fail to see that the dominant culture does label certain behaviors as appropriate and success oriented and other behaviors as unacceptable. By helping students assimilate, educational institutions can provide a link between the home worlds of students—which may vary dramatically in terms of what is expected and which values are stressed—and the public world of our society. Reminding students of their similarities to one another instead of talking only about their differences can help create a sense of community and a common set of goals among our youth. Stressing what binds us together instead of what draws us apart is a healthier emphasis for modern educational institutions.

THIRD VIEW: A SYNTHESIS. Education can explain the values of the dominant culture so students know how to behave if they want to succeed within that culture, while simultaneously stressing the values of diversity. The synthesis view recognizes the value of teaching students about the range of opportunities available to them and about the richness and diversity of the human experience. At the same time, this view recognizes that meaningful success usually derives from functioning successfully in the dominant culture, even if individuals choose to live their personal lives according to their own cultures. Thus a synthesis view recommends describing the many ways humans live and work and raise their families while also describing what is needed to make it in the real world outside of school. Students can be told that individuality and self-expression are fine, but that they must also abide by society's rules—both fair and unfair—if they are to function effectively as members of that society.

SUMMING IT UP

WHY UNDERSTANDING GROUP DIFFERENCES IS IMPORTANT TO TEACHERS

- To teach students effectively, an expert teacher must first understand that students' identities are formed in relation to the many types of groups to which the students belong: cultural, ethnic, social class, gender, ability, nationality, religious, and so on.

SOCIOECONOMIC DIVERSITY

- Socioeconomic status (SES) affects students' achievement. It also affects parental styles of child rearing, and these styles (authoritative, authoritarian, and permissive) can, in turn, affect scholastic achievement.
- Low SES is related to low achievement and to low self-esteem. However, raising students' self-esteem does not necessarily enhance their school performance.

ETHNIC AND SOCIOECONOMIC DIVERSITY

- Different ethnic groups score differently, on average, on standardized tests of intelligence and achievement. Genetic factors alone cannot account for the differences among the ethnic groups and the dramatic narrowing of the gap between the groups in test performance over the past 30 years.
- Increases in parental educational attainment, which has soared in particular for parents of minority children, have contributed to children's school success.

GENDER DIVERSITY

- Gender differences are defined as being psychologically based; sex differences, as being biologically based. Reliable sex differences exist in cognitive task performance. On average, females outperform males on many verbal ability measures, whereas males outperform females on many tests of visual–spatial ability and quantitative ability. Male scores are more variable overall than are female scores.
- Differences in average test performance between females and males are thought to have both biological and cultural roots. Because findings are based on population averages, it is wrong to use gender bias to discriminate against individual members of one gender because of general trends in the performance of their gender.

LANGUAGE DIVERSITY

- Today's teachers need to understand the best ways to instruct students who do not speak Standard English or even a dialect of Standard English. These students often are taught with an English as a Second Language (ESL) program.
- In additive bilingualism, a second language is taught in addition to a relatively well-developed first language. In subtractive bilingualism, the elements of a second language replace elements of the first language.

- The best instructional methods and the best outcomes often differ for students who speak languages other than English, depending on the socioeconomic status of the students in a particular bilingual education program.

MULTICULTURAL EDUCATION

- Given the demographic changes in the United States, the need for teachers to reach students from nontraditional backgrounds and backgrounds unfamiliar to the teachers is growing rapidly, and teachers must be sensitive to the needs of these students.
- There is a mismatch between the values of certain cultural groups and the values of traditional North American schools. The social organization typical in schools differs from the social organization with which many children are familiar and comfortable from their cultural backgrounds. Styles of communicating differ for traditional school environments and various cultural groups. It is important that teachers consider the ways of thinking and learning that are typical for various cultures and that might create problems for students from these cultures, and integrate these factors into the traditional school environment.

KEY TERMS AND DEFINITIONS

- **Additive bilingualism** Situation in which a second language is taught in addition to a relatively well-developed first language. Page 222
- **Bilingual education** Education that to a greater or lesser extent takes place in more than one language. Page 221
- **Culture** Socially communicated behaviors, beliefs, values, knowledge, and other traits that characterize a particular time period or a particular class, community, or population of people. Page 198
- **Dialect** Variety of a language distinguished by consistent pronunciation, grammar, or vocabulary that is spoken and understood by individuals from a certain region. Page 221
- **Discrimination** Treatment or consideration based on class or category rather than individual merit. Page 198
- **English as a Second Language (ESL)** Instructional programs that teach English to students who do not speak English as their first language. Page 221
- **Ethnicity** Distinct national, religious, linguistic, or cultural heritage shared in common by a sizable group of people. Page 198
- **Gender bias** Possessing different views of female versus male competencies, often favoring one gender over the other. Page 215
- **Gender differences** Psychologically and socially controlled differences between women and men; how people express their gender in behavior. Page 215
- **Minority group** Traditionally, a group smaller than the group representing the dominant culture; now, usually people from traditionally disadvantaged backgrounds. Page 198
- **Multicultural education** Education that exposes students to the values and norms of different cultures in an attempt to show students the diversity that characterizes the human experience. Page 223
- **Sex differences** Biologically controlled differences between men and women. Page 215
- **Socioeconomic status (SES)** Measure of a person's social class level based on her or his income and educational level. Page 199
- **Standard English** Variety of English most widely accepted as the spoken and written language of educated speakers in formal and informal contexts and characterized by generally accepted conventions of spelling, grammar, and vocabulary. Page 220
- **Subtractive bilingualism** Situation in which elements of a second language replace elements of the first language, resulting in decreased cognitive functioning. Page 222

QUESTIONS AND PROBLEMS

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

1. Most of your second-grade students avoid one student, who is from a lower social class than the rest of the group. You are concerned about the messages being received by the student, who is being shunned by peers. How can you convince your students that being from a different socioeconomic level does not mean a student cannot be their friend?
2. Several of your third-grade students are difficult to manage. You have spoken to their parents, and you have learned these parents are very permissive in the home. How can you convince these parents that their children are suffering because they do not pay attention—as well as hurting everyone in the class?
3. You are supervising your fourth-grade class at recess when three students begin using racial slurs while shouting at two other students. How can you handle this situation so that these students see how destructive and inappropriate their behavior is? Which classroom activities might help promote interracial understanding?
4. Several boys in your third-grade class never open their mouths during literature class. What can you do to

encourage them to contribute and give them more confidence in their abilities?

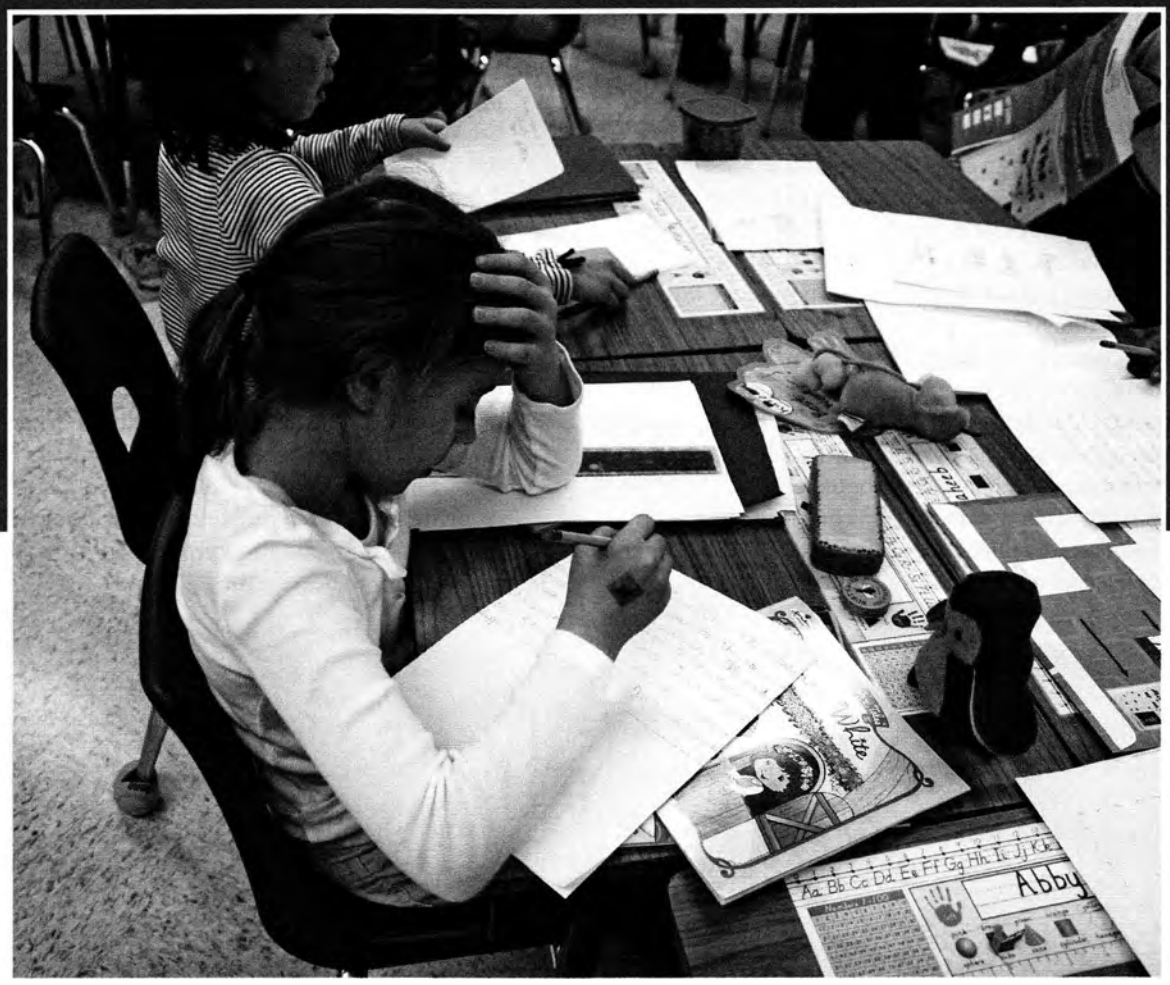
5. Imagine you are a new teacher who grew up in a small, homogeneous town. You have little to no experience with racial, ethnic, and cultural diversity. Yet you are expected to teach from a multicultural perspective beginning on your first day in front of your sixth-grade class. Which steps might you take to become more familiar with multiculturalism?

IN MIDDLE SCHOOL

1. You are concerned about one of your brightest eighth-grade students. Although she does well in nearly every subject, she seems to have a phobia about math. When you call her mother, her mother seems unconcerned about her daughter's poor math performance, blaming it on her daughter's sex. What can you say to this parent to convince her to help?
2. How can you start off the year positively with a ninth-grade student who speaks virtually no English?
3. You are teaching a diverse group of seventh graders. How can you encourage tolerance and respect for people, cultures, and customs that are very far from your students' experience? Which activities, projects, or discussions will help you get this message through to the students?
4. Sometimes you wonder whether your own behavior is completely free of damaging stereotypes that could hurt your eighth-grade students. Which steps might you take to become aware of any racial or cultural stereotypes you may have adopted?
5. Your ethnically and racially diverse group of seventh graders seem reluctant to share their home and cultural experiences with others from different backgrounds. You believe such openness would be good for all students. Which steps might you take to encourage more sharing of cultural values?

IN HIGH SCHOOL

1. Your ninth-grade social studies class includes students from two different socioeconomic levels—middle class and lower class. These students rarely interact with one another, and they do not seem to form any friendships outside of their own group. You want to encourage collaboration across socioeconomic lines. Which steps might you take to encourage your students to work together productively?
2. What should your expectations be regarding the standardized test scores of children of different races? How might your expectations influence your students' performance?
3. Every day in your twelfth-grade math class, the same hands go up—and they are mostly boys' hands. What can you do to ensure that girls are getting equal access to learning and equal time?
4. A student earns low grades in all of his subjects because of his limited proficiency in English. You do not speak his language, yet you believe your tenth-grade science class might allow him opportunities to participate in project work that he could accomplish regardless of his limited English. Which steps might you take to help this student to do well in your class?
5. Your eleventh-grade class includes six students from foreign countries where communal learning rather than competitiveness is prized and encouraged. These students are having a difficult time adapting to your classroom's and school's expectations. Which steps can you take to help them?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Behavioral Approaches to Learning 7

Why Understanding Behavioral Learning Is Important to Teachers

Learning by Classical Conditioning

The Discovery of Classical Conditioning

How Does Classical Conditioning Happen?

Generalization and Discrimination in Classical Conditioning

Classical Conditioning and Addictions

Learning by Operant Conditioning

The Discovery of Operant Conditioning

Generalization and Discrimination in Operant Conditioning

Recognizing Operant Conditioning in the Classroom

How Does Operant Conditioning Happen?

Behavioral Modification: Changing Students' Behavior

Learned Helplessness

Learned Optimism

Social Learning

The Discovery of Social Learning

How Does Social Learning Happen?

Cognitive-Behavioral Modification

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this chapter:

- What is learning? How does it differ from performance?
- What is classical conditioning? What is the role of the learner who is being classically conditioned?
- What is operant conditioning? What is the role of operant conditioning in classroom learning?
- What is social learning? How can teachers use social learning to their advantage?
- What is cognitive-behavioral modification, and how, when, and why does it work?
- What are some ways behavioral techniques may be misused in the classroom, and what can be the consequences of such misuse?

This week, Tom Douglass introduced a new teaching technique to his fifth-grade class. He asked students who were good at each subject to show the class how they worked through problems in their area of strength. Mara was the first student he selected. She got up, walked to the board, and worked through a tough math problem. She did a great job. The only trouble was that Jimmy kept starting disruptive conversations with his friends. They were soon followed by conversations among other students. Jimmy often did the same thing to Tom. Tom had tried warning and disciplining Jimmy before, but to no avail. But this time Jimmy went too far: Tom could not allow one student to interrupt another student's presentation. He sent Jimmy to the hallway for a time-out, with directions to reconsider his inappropriate behavior. Mara completed her presentation. The students were visibly impressed. A number of hands went up when Tom asked for another volunteer.

Next, Tom called on Mark, who was particularly good at science. Tom asked Mark to talk about his science project. He wanted Mark to explain how he chose his topic, how he collected the information he needed, and how he built the display. Mark turned as white as a sheet when he was asked to talk. Tom could see his hands shaking as he walked to the front of the room. Mark started talking, but he was so nervous he couldn't continue. Mark was a shy kid. Tom knew Mark sometimes had trouble speaking in front of others. Even so, he thought that because Mark loved science and had done such a terrific project, he would be able to describe its basic steps. Tom was wrong, and Mark ended up sitting down, obviously embarrassed. Suddenly none of the other students wanted to do a demonstration either. Each student Tom called on needed more time or made up an excuse.

Later that day, Tom decided he would try to draw Mark out in class. He wanted to try to help Mark mend his self-esteem. He let Mark sit in his seat, but he coached him with some questions. Tom started out by saying that lots of students are nervous about talking in front of the class. He pointed out that he himself had been petrified when he started teaching. He then asked Mark a really easy question about his project. Mark answered tentatively. Tom said, "That's great, Mark. Then what did you do? How did you find those sources of information?" Mark was encouraged. Tom coached him again, telling him what a great project he had done. He expressed confidence that Mark would do well in the science fair competition. Soon Mark was talking more about his project. He described how he had built the display, and he discussed the various problems he had encountered. Tom's strategy had worked. He had encouraged Mark to speak out. In the process, he had captured the interest of the other students. They now were fascinated by Mark's project.

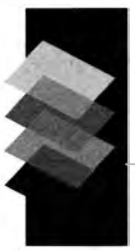
In this chapter we consider learning. **Learning** is any relatively permanent change in the behavior, thoughts, or feelings of an organism that results from experience (Mazur, 1990; Reisberg, 1999; Rocklin, 1987). As we discussed in Chapter 2 on cognitive development, learning is different from maturation. Maturation is biological change that occurs as a result of genetic programming, given the normal range of environments. Learning is also different from the moment-by-moment changes in behavior that may occur as a result of environmental circumstances. For example, when you veer to the left on the sidewalk to avoid bumping into another pedestrian, you are not "learning" a new behavior. This type of action does not represent any true relatively permanent change in the way you think about, feel about, or do things, but rather represents a momentary adaptation to an immediate problem.

In this chapter, we concentrate on **behavioral** approaches to learning. These approaches focus primarily on changes in observable behavior rather than on internal mental processes. Behavioral approaches to learning tend to emphasize the role of external events in the environment of the individual (DeGrandpré & Buskist, 2000). In Chapter 8, we place more emphasis on internal cognitive, or mental states. As we shall see, the distinction between the behavioral approaches discussed in this chapter and the cognitive ones discussed in the next chapter is not always sharp. Indeed, cognitive-behavioral modification programs such as those discussed at the end of this chapter show that what were once two distinct approaches are now often combined (Kendall, Krain, & Henin, 2000).

Behaviorally oriented science makes certain assumptions. First, it assumes that the environment has an extremely powerful effect on behavior. One early behaviorist, John Watson, believed that he could shape children to become anyone he wished, given the resources to do so (see Chapter 2). Second, behaviorally oriented science assumes that external events, such as

rewards or punishments provided by the environment, are very important. Internal events, such as feelings, are of little or no importance to behaviorists, except as they are reflected in behavior. Third, it assumes that learning is reflected in performance, though it need not be *wholly* reflected in performance. Some behaviorally oriented scientists believe in the possibility of latent learning—that is, conditioning or acquired knowledge that is not presently reflected in performance (Tolman & Honzik, 1930).

Much of the work on behavioral learning was originally done with species other than humans, such as pigeons, rats, and dogs. The principles elicted from experiments with these animals were then tested on humans. Many, but not all, have been found to apply to humans as well as other animals. For example, humans learn language, but most—and perhaps all—other species do not.



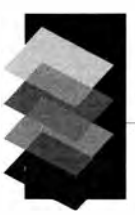
Why Understanding Behavioral Learning Is Important to Teachers

Teachers deal with student behavior every day. Hence, every teacher needs to understand behavior and behavioral approaches to learning. Consider Tom: To manage and engage his class, he used the basic principles of behavioral learning, which you will learn about in this chapter. First, Tom called on a good student, Mara, to show the class how she went about solving a math problem. The class watched and was impressed. As a result, other students wanted to demonstrate their strengths. This is an example of social learning, in which people learn how to think or act by watching someone model certain behavior. Teachers can help children learn by modeling appropriate behaviors and, equally importantly, by having peers model appropriate behaviors.

When Jimmy interrupted Mara, Tom sent Jimmy away from his friends for a time-out. Tom's goal was to make Jimmy think twice about interrupting lessons in the future. The effects of punishment on learning are also discussed in this chapter.

Next, Tom called on Mark, who became too nervous to proceed. Mark had been embarrassed in the past when he tried to speak in front of the class. This time the mere thought of doing so distressed him. His anxiety was the result of classical conditioning, a form of learning that sometimes involves emotions becoming linked with certain activities or situations. Tom worked with Mark, little by little, to build his confidence. Over time, Tom helped draw Mark out of his shell. Tom used a learning principle called positive reinforcement (Branch, 2000): He rewarded Mark with deserved praise and encouraged Mark to talk about his project. Ultimately, Mark did so. In doing so, he experienced success.

In a single day in the classroom, you will need most, if not all, of the principles of behavioral learning. Once you understand how these principles work, you will be able to use them effectively in your teaching.



Learning by Classical Conditioning

Do you get nervous when someone mentions the word *exam*? Does the sight of some kinds of food make you sick to your stomach? Do you shudder when you hear the sudden loud bark of a nearby dog? All of these common responses are the result of a single learning process. **Classical conditioning** is a learning process in which an originally **neutral stimulus**—such as the word *exam*, or a certain food, or the bark of the dog—becomes associated with a particular physiological or emotional response—or both—that the stimulus did not originally produce (Delgado, Olsson, & Phelps, 2006; LoLordo, 2000). In the chapter-opening vignette, Mark's anxiety about public speaking was a result of classical conditioning.

THE DISCOVERY OF CLASSICAL CONDITIONING

Classical conditioning was discovered by Ivan Pavlov (1849–1936), a Russian physiologist who was studying digestion in dogs. To this end, Pavlov collected dogs' saliva in a container. His goal was to measure the amount of salivation produced when the dogs smelled food (in this case, meat powder). But a curious and annoying thing was happening: The dogs were salivating even before they smelled the meat powder. Indeed, just the sight of the lab technician or even the sound of the lab technician's footsteps was enough to start them salivating. The salivating behavior was ruining Pavlov's research. Pavlov's first response, therefore, was to try to think of ways to stop this premature salivation.

Eventually, Pavlov realized that what had appeared to be an irrelevant and confounding event was of interest in its own right. He inferred that some kind of learning must have taken place for the dogs to be able to salivate even before they smelled the meat powder. Thus came the discovery of classical conditioning, also known today as Pavlovian conditioning.

Other people had observed the same kinds of phenomena as those observed by Pavlov. Indeed, some people ridiculed Pavlov's discovery as trivial, sneering that any horse owner would have observed the same phenomenon in various ways. What distinguished Pavlov, however, was that he recognized the significance of what was happening. Like all creative scientists, Pavlov made use of information whose importance was not appreciated by other people. As Louis Pasteur once said, "Chance favors the prepared mind."

HOW DOES CLASSICAL CONDITIONING HAPPEN?

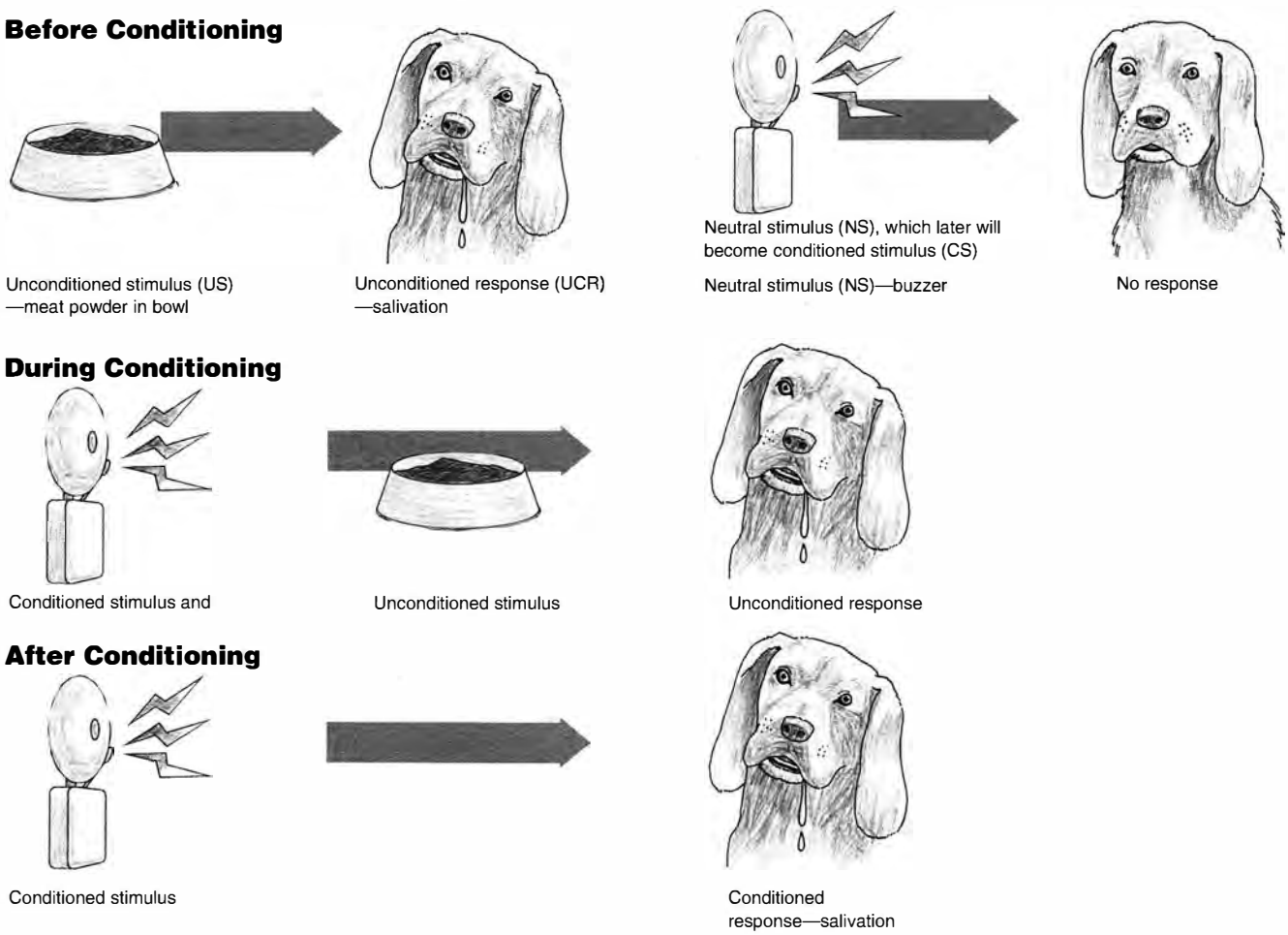
Pavlov (1955) developed a simple paradigm for studying classical conditioning, which is illustrated in Figure 7.1. The basic components of classical conditioning remain the same. They can be seen in common classroom situations:

1. Start with a stimulus that elicits a physiological or emotional response (or both). In Pavlov's experiment, this stimulus was meat powder. For Tom Douglass's student Mark, the original unconditioned stimulus might have been ridicule from his classmates. This stimulus is called the **unconditioned stimulus (US),** because it elicits a response before any conditioning takes place. In other words, the response is automatic.
2. Note your experimental subject's automatic physiological or other response to the stimulus. This response is called the **unconditioned response (UR),** because the response is the natural one of the organism. It occurs without any conditioning procedure. The unconditioned response of Pavlov's dogs was to salivate when the meat powder was on their tongues. Mark's unconditioned response to his classmates' teasing might have been feelings of humiliation and anxiety.
3. Choose a stimulus that is originally neutral but that you wish later to elicit the desired response. This originally neutral stimulus is called the **conditioned stimulus (CS),** because it is the stimulus that will come to elicit the response after the conditioning procedure takes place. Pavlov chose the sound of a buzzer. For Mark, the originally neutral stimulus was standing in the front of the room to give a class presentation.
4. Pair the CS and the US repeatedly, so that the CS and the US become associated. Eventually, you will obtain from the CS a **conditioned response (CR),** which is similar to the UR. It is elicited from the CS rather than from the US. Pavlov sounded the buzzer immediately before giving the dogs their meat powder. After a number of repetitions of this buzzer–meat powder pairing, the dogs' conditioned response was to salivate when the buzzer sounded. This response occurred even though meat powder was not yet in their mouths. Perhaps the first several times Mark stood up in front of his classmates to talk, some of them ridiculed him. Eventually, Mark came to feel humiliated and anxious whenever he was asked to come to the front of the class. Indeed, he felt anxiety even when he thought about giving a class presentation.

Why do organisms become classically conditioned? Over the years, several explanations for this phenomenon have been proposed. One explanation, dating back to the ancient Greek

FIGURE 7.1 Pavlov's Procedure

Before conditioning, the dog's unconditioned response is to salivate in response to the unconditioned stimulus of meat powder. The dog has no response to the buzzer. During conditioning, the buzzer is paired repeatedly with meat powder, eliciting the unconditioned salivation response. After conditioning, the dog salivates in response to the sound of the buzzer alone, a conditioned response.



philosopher Aristotle, is that of **temporal contiguity.** According to this view, the mere closeness in time between the CS (the buzzer or the ridicule) and the US (meat powder or an upset feeling) explains conditioning (Guthrie, 1959). In fact, we know that temporal contiguity is necessary for classical conditioning to occur.

As in telling a joke, timing in classical conditioning is critical. Not only should the CS and the US occur close together in time, but ideally the CS should also come right before the US. If the CS comes too much before the US, conditioning will be minimal or will not occur at all. For example, if a student says to Mark a week after his presentation, "You are such a show-off when you get up in front of the class," the remark might not affect Mark's future behavior as much as it would if the student said it right after Mark gave his presentation. Conditioning is also unlikely if the CS occurs simultaneously with, or after, the US.

Temporal contiguity alone is not enough to cause classical conditioning. Something more cognitive—more sophisticated and thoughtful—is involved. This "something" is contingency (Rescorla, 1967). *Contingency* is the dependence of one action or event on another event or on the presence of a stimulus. When a second event is contingent upon a first, earlier event, the earlier event in some way predicts the later one. Robert Rescorla showed that when the CS always predicts the US, learning occurs easily and quickly. When the CS does not predict the US, however, learning does not occur—even if the CS and the US occur close together in

THINKING ANALYTICALLY

In the upper-level classroom, if the school bell rings, students rush out of their classes. In other words, the bell predicts the students' "rushing-out behavior." What are some other examples of contingencies in the classroom?

SUGGESTION: Distributing "blue books" can be a contingency for the taking of an examination.

time. For example, what conditioned the dogs was not the proximity in time of stimuli, such as lab technicians to meat powder. Rather, the presence of the lab technicians predicted the appearance of the meat powder.

According to Rescorla, people try to make sense of their environments by noting which stimuli can predict events that are important to them. Tom Douglass knew this fact. He helped Mark realize, by praising and encouraging him when he talked about his science project, that speaking in front of the class does not necessarily lead to ridicule.

THINKING ANALYTICALLY

How does extinction illustrate the difference between learning and performance?

SUGGESTION: Learning can be measured by the spontaneous recovery following a rest period (extinction). Performance is merely the display of learning, and it typically does not improve without learning.

■ **PHASES OF CLASSICAL CONDITIONING** The growth of learning through classical conditioning is called the phase of acquisition. Suppose, however, that in a conditioning situation the CS were to continue, but in the absence of the US. Say you continue to present the buzzer to the dogs, but you do not give them the meat powder after the buzzer sounds. What would happen? The effectiveness of the CR would soon start to decline. Eventually, it would become useless. The dogs might salivate less and less, until finally they would not salivate at all. This phase of learning is referred to as **extinction.**

You might think that when the probability of the CR (salivation) reached zero, all the learning that took place would be gone. Chances are, however, that it is not. Suppose you give the organism a chance to rest after the extinction trials (presentations of the CS without the US). You then resume these trials. You typically then will observe a higher level of response than you observed right before the rest period. This phenomenon is called **spontaneous recovery.** The organism seems to recover some level of response spontaneously during the rest period, even though the US was absent during this time period.

Consider a classroom example. Tests often cause anxiety in students. Students learn to become anxious when they take tests. Why? Because they are graded and evaluated (acquisition). Suppose, however, a teacher starts giving tests in which students are given a second chance to improve their grades. Test anxiety may then diminish (extinction). After a vacation, however, the first self-graded test may elicit more nervousness from students than did the last self-graded test given before the vacation (spontaneous recovery).

During extinction, performance stops reflecting learning. Nevertheless, learning remains available to the individual.

GENERALIZATION AND DISCRIMINATION IN CLASSICAL CONDITIONING

A Bugandan (the Buganda people are the largest ethnic population in Uganda) proverb states, "He who is bitten by the snake fears the lizard." This proverb suggests, correctly, that when a person becomes conditioned to respond to a particular stimulus, he can experience the same conditioned response to other, similar stimuli. The mechanism by which stimuli similar to the original CS can elicit the CR is referred to as **stimulus generalization.** Consider an example. Many students become anxious when the teacher announces, "Close your notebooks," and holds up a stack of papers for distribution, because they know a test is coming. These students may also find themselves becoming anxious when the teacher says, "Close your notebooks," and holds up an activity sheet. Their anxiety level rises despite the fact that the students actually enjoy the activity. The activity sheet is similar enough to the test papers to elicit the same conditioned anxiety.

What if the teacher says, "Close your notebooks," and then, rather than holding up papers of any kind, she holds up art materials to distribute? In this case, students are unlikely to react with nervousness. In this scenario, they show **stimulus discrimination.** Discrimination is a mechanism by which organisms are able to distinguish between the conditioned stimulus, which elicits a conditioned response, and other stimuli, which do not elicit the conditioned response.

A famous experiment to examine stimulus generalization was conducted by John B. Watson and Rosalie Rayner (1920). Their study examined generalization of conditioned fear in an 11-month-old infant who has come to be called "Little Albert." Initially, Little Albert was unafraid of a live white rat. Watson and Rayner paired the presentation of the white rat with the presentation of a loud and startling noise that did evoke fear in Little Albert. After just seven pairings of the rat with the noise, the rat came to elicit fear. Then, five days later, Watson and

Rayner exposed Little Albert to similar stimuli, including a white rabbit, a white dog, and a white fur coat, among other things. The fear response generalized to these other white, furry things and even to Watson's whitening hair.

Unfortunately, Little Albert's mother removed him from the hospital setting where the research was conducted before Watson and Rayner had an opportunity to extinguish the fears they had created. As a consequence, we have no idea what eventually happened to Little Albert. Perhaps the fears were gradually extinguished over time as Little Albert learned that not all white, furry things are dangerous. Perhaps Little Albert remained phobic of white, furry things for the rest of his life. Watson and Rayner were criticized in subsequent years for failing to ensure that Little Albert's fear was extinguished. At the time, however, the stringent institutional review of experiments that now exists was not required. As a result, such fiascoes may have happened more often than we can know.

An interesting follow-up to this story is that although fears may be learned, predispositions to have certain fears may be innate. People appear to have a *preparedness* to learn, and they learn some associations more easily than others (Seligman, 1971; see also Mineka & Öhman, 2002). For example, phobias of some things, such as spiders and snakes, are much more common than phobias of objects such as flowers and rain. Many investigators believe that these differences in preparedness reflect evolutionary programming: Spiders and snakes *are* more likely to be dangerous to humans than are flowers and rain.

■ **HOW AVERSION OCCURS IN THE CLASSROOM** Classical conditioning can occur whether or not teachers are aware of it. As mentioned at the beginning of our discussion of classical conditioning, physical and emotional responses are most susceptible to classical conditioning. Indeed, the phrase **conditioned emotional response (CER)** is used to describe emotional responses that have developed from classical conditioning. Stimuli that produce negative emotional responses are called **aversive stimuli.** One of the most common conditioned responses teachers will notice is *test anxiety*—a generalized feeling of dread in response to tests (Covington & Omelich, 1987; Zeider, 2007). If severe, such anxiety can cripple a child's chances for success in the school environment. Students who have repeated aversive experiences in school also may develop a generalized aversion to schools and learning. This aversion can be a major cause of their dropping out of school at a later date. It may even affect how they react to the schools their children attend. Teachers, however, can do a great deal to prevent and alleviate such negative conditioned responses. They should remain conscious of the potential for controlling classical conditioning processes in their classrooms.

■ **CONTROLLING CLASSICAL CONDITIONING IN THE CLASSROOM** Relaxation training is a procedure in which students are taught to pair testing stimuli with a relaxation response that is incompatible with anxiety. This procedure is the basis of the success of many formal programs for reducing test anxiety (e.g., Egbochuku & Obodo, 2005; Sapp, 1996). In addition, a teacher can help a student with test anxiety get used to tests in small steps. For example, the teacher may have the student use the standard blue book or computer-grading sheet for everyday in-class assignments or even for art projects. This pairing may help diminish the student's conditioned link between seeing the familiar testing prop and feeling nervous. Tom Douglass used this method, which helped Mark take small steps toward being able to talk in class. First Mark answered questions from his seat; then he described his project in some detail.

A teacher could also give practice tests graded solely on the basis of the students' participation. The student would take the entire test, grade the test for herself, and then correct her mistakes. Upon doing so, she would receive full credit. These kinds of practice tests are good preparation for the actual tests. They also help students become familiar with the testing environment without the usual accompanying pressure.

CLASSICAL CONDITIONING AND ADDICTIONS

It is possible that some *disorders* (maladjustments in living) develop as a result of a classical conditioning. For example, we can become addicted to harmful substances through the

mechanisms of classical conditioning as well as other mechanisms. **Addictions** are persistent, habitual, or compulsive physiological or at least psychological dependencies on one or more psychoactive drugs. Such drugs include tobacco, alcohol, caffeine, and various illegal drugs. Addictions are extremely complex, which is one reason they are so hard to break. At least in part, however, addictions appear to be classically conditioned.

Consider drinking alcoholic beverages. Many people find the state of intoxication induced by the alcohol to be pleasant, so this state (or the emotion associated with the anticipation of it) becomes the US. Over time, it takes more and more alcohol (or any other drug) to produce the same effect—a phenomenon that unfortunately tends to lead to drug abuse. The need for more of the substance to produce the same effect, however, is partly driven by the environmental context. If the user abuses a drug in a novel environment, the amount of the drug it takes to attain the usual intoxication may decrease greatly. As a result, the usual amount has a much stronger effect, sometimes leading to a major overdose and potential death of the user.

Classical conditioning also has important implications for treating addictions. Simply to stop drinking—or to stop smoking, to consider another addiction—will not break the addiction (B. Schwartz, 1989), because extinction does not result from simple discontinuation of the CS. Instead, the addict must eradicate the pairing of the CS with the US. Effective procedures for overcoming addictions break this association.

One way of overcoming addictions is through counterconditioning. **Counterconditioning** is a technique in which the positive association between a given US and a given CS is replaced with a negative one by the substitution of a new US that has a different UR. For example, some specific drugs can cause violently aversive reactions when combined with alcohol (or tobacco). The idea is that this unpleasant pairing counterconditions the addict to avoid—rather than to seek out—the addictive substance. A less aggressive procedure is simply to remove the desirable properties of the addictive substance. For example, the recovering addict might start drinking nonalcoholic beer or smoking cigarettes that contain little or no nicotine. In such cases, the idea is to achieve extinction by stopping the association between the CS and the US. Regardless of the procedure, the strategy involves using principles of learning to fight the addiction.

Teachers need to be aware of the possibility of addictions among their students. When they spot students whom they suspect of substance abuse, they should consider referring them for counseling.

Classical conditioning can be important in people's lives. But in everyday life, a second kind of conditioning occurs with far greater frequency. We consider this kind of conditioning in the next section.

*i*MPLICATIONS FOR TEACHING

Teachers who wish to put classical conditioning to work in their classrooms could try the following suggestions:

- **Minimize reliance on classically conditioned negative emotions.** Learn to anticipate situations in which negative feelings might be learned through classical conditioning, and try to prevent such situations from arising (Tauber, 1990). If a student turns in a poor performance, rather than dwelling on the shortcomings, tell the student that you are sure that she will do better work next time.
- **Link learning with positive emotions.** One way to prevent classical conditioning of negative responses is to arrange repeated pairing of positive feelings with certain kinds of learning. This procedure is especially useful for subjects that are anxiety-provoking. For example, a teacher might reduce anxiety about reading by letting students read in a comfortable, welcoming reading area. Students may come to associate the pleasure they feel from being in the reading area with the task of reading.
- **Teach students to generalize and discriminate appropriately.** Teachers need to help students determine which stimuli should be linked with which responses. Poor performance on one project or test does not make the student an overall poor performer!

- **Be aware of and help students cope with classically conditioned anxiety.** Students with severe test anxiety or other anxiety problems may need outside help. Nevertheless, teachers can help many students take steps to reduce milder cases of classically conditioned anxiety.

Learning by Operant Conditioning

Suppose that there is a vending machine where you live or work. On the machine is a sign saying "1 dollar" for a can of soda. You put in a dollar's worth of change. Nothing comes out. You try shaking the machine. Still nothing happens. There is a number to call to get a refund, but you do not want to bother. You leave the machine feeling angry. A week later, you are thirsty. You pass by the machine. You decide to give it one more try. In goes your dollar. Out comes nothing. You mutter something under your breath, and then you go to a local convenience store. You never use the soda machine again. You have learned something about the machine not through classical conditioning, but rather through operant conditioning.

Operant conditioning (also called **instrumental conditioning**) is learning produced by the rewards and punishments that result from the active behavior of a human or other organism as it interacts with the environment. This active behavior is called an **operant.** It is the behavior the organism, or person, uses to "operate" on the environment. Thus, when Tom's student Mark finally began to talk about his science project, his talking was the operant. Tom's praise was the reward. Operant conditioning results in either an increase or a decrease in the probability of an operant behavior in response to environmental events.

Table 7.1 summarizes the differences between classical and operant conditioning. As you can see in the table, the crucial difference between classical conditioning and operant conditioning is in the role of the individual. In classical conditioning, the individual is largely passive; the experimenter or the environment controls the repeated pairings of the CS with the US. In classical conditioning, therefore, the crucial relationship for conditioning is between the CS and the US. In operant conditioning, the individual is largely active; he or she operates on the environment to bring about reinforcement. Indeed, this key feature is what leads to the use of the term *operant* for the basic unit of behavior studied in operant conditioning. The crucial relationship for operant conditioning is between the environment and the kinds of behavior (operants) an organism performs.

Behaviorists are scientists who believe that much—and possibly all—of behavior can be accounted for by operant conditioning. The founding father of behaviorism, John Watson (1878–1958), believed the principles of behaviorism can be applied to create virtually any behavior at all, acceptable or unacceptable, in a person (Buckley, 2000).

TABLE 7.1 Comparison of the Main Features of Classical and Operant Conditioning

	Classical Conditioning	Operant Conditioning
Key relationship	Between conditioned stimulus and unconditioned stimulus.	Between operant behavior and its consequences (either reward or punishment).
Student's behavior	Involuntary. Behavior is elicited by the unconditioned or conditioned stimulus.	Voluntary. Behavior occurs; then its likelihood is increased or decreased by its consequences.
Sequence of events	At the start of conditioning: NS US UR After conditioning is acquired: CS CR	Operant behavior: Reinforcement—increase in behavior or Operant behavior: Punishment—decrease in behavior.
Example	Teacher repeatedly raises hand before shouting, "Quiet." Unconditioned response of being quiet when shout is heard is similar to conditioned response of becoming quiet when hand is raised.	Reinforcement: Teacher praises students when they happen to be quiet. They are more likely to be quiet in the future. Punishment: Teacher ends students' free time when they get too noisy. They are less likely to be noisy during future free time.

The most influential of the modern behaviorists was Burrhus F. Skinner (1904–1990), who developed a theory and set of methods known as the experimental analysis of behavior. According to this point of view, all behavior should be studied in terms of the effects of the environment on behavior. Skinner believed the study of animals, such as rats and pigeons, is particularly useful for understanding the principles of learning (Coleman, 2000). The boxes into which he placed these animals so as to study conditioning are sometimes called Skinner boxes in his honor.

Skinner believed that much of life involves learning to deal with the effects of the environment on our actions. Hence, he argued, the principles of conditioning can be applied widely in life. At some level, Skinner was certainly right: Rewards and punishments shape much of our daily behavior. But how was such a powerful phenomenon first discovered?

THINKING ANALYTICALLY

Think about the cat that learned to open the latch in Thorndike's puzzle box through a process that began with the cat inadvertently opening the latch. What might students perceive about learning classroom lessons through instrumental conditioning that is much like that experienced by the cat in the puzzle box?

SUGGESTION: They might understand that learning one lesson provides the key to learning the next. Also, they may realize that their own actions are important in learning each of those lessons.

THE DISCOVERY OF OPERANT CONDITIONING

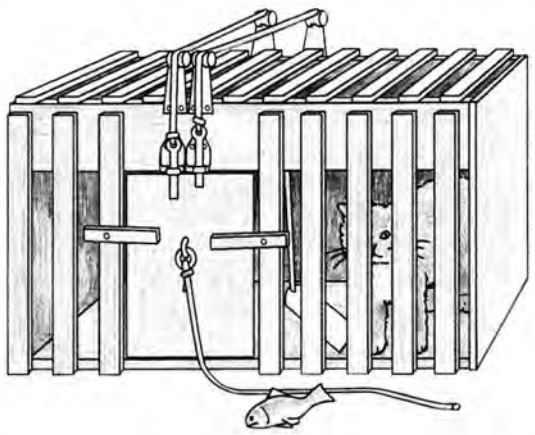
At some level, people have always known that organisms respond to rewards and punishments. Thus the discovery of operant conditioning was more the identification of an existing phenomenon than it was an actual discovery.

Edward Lee Thorndike (1898, 1911) studied cats placed in puzzle boxes (see Figure 7.2). The door to the puzzle box was held tightly shut by a latch, but the latch could be easily opened. All that was required was the triggering of its fastening device (which was located inside the cage). The cat inside the cage could see a delicious piece of fish, located just outside the cage. At the beginning of the study, the cat would try to reach the fish by extending its paws through the slats of the cage. Of course, it would not succeed. It would then start scratching, bumping, and jumping around in its cage. Eventually, through a process of trial and error, it would accidentally release the latch. Once it did so, the door to the cage would open. The cat would then run to get the fish.

Next, the cat would again be placed in the cage. The whole process would be repeated. This time, however, the scratching and jumping around would not last very long. After many trials, the cat could be placed in the box, and it would immediately claw the button to release the latch. It would thus be able to get to the fish. The cat had learned how to open the cage.

Thorndike proposed a mechanism to account for operant conditioning, which he referred to as the **law of effect.** This law states that those actions that are rewarded—"the effect"—will tend to be strengthened; they will be more likely to occur in the future. In contrast, those actions that are punished will be weakened; they will be less likely to occur in the future. Thus, according to Thorndike, the crucial variable for operant conditioning is reward or punishment. In Thorndike's time, reward and punishment were viewed simply as having opposite effects.

FIGURE 7.2 **Edward Thorndike observed that cats could learn to release themselves from puzzle boxes such as this one when they were rewarded for doing so.**



Today, educational psychologists know the situation is much more complicated. Punishment, especially, often has unintended related consequences.

Operant conditioning occurs in the classroom with great frequency. It affects teachers as well as students.

GENERALIZATION AND DISCRIMINATION IN OPERANT CONDITIONING

Stimulus generalization and stimulus discrimination can apply in operant conditioning as well as in classical conditioning. The basic ideas are the same, although the implementations are different.

In the context of operant conditioning, *stimulus generalization* results when an operant that occurs with one stimulus spreads to another stimulus. Suppose a child is reinforced for pleasing her first-grade teacher. She is likely to continue to act in ways to please that teacher. Then, the next year, the child is reinforced for pleasing her second-grade teacher. It is likely that in the subsequent year, she will wish to please her third-grade teacher because she has learned that pleasing teachers, in general, results in reinforcement.

Stimulus discrimination results when an operant that occurs with one stimulus does not spread to another stimulus, even though that other stimulus may be similar. To continue our example, suppose that originally the child seeks to please her third-grade teacher. Unfortunately, the third-grade teacher does not seem to care, and he does not reward the child for acting in pleasing ways. Eventually, the child makes a discrimination between the effects of her behavior on her third-grade teacher and the effects on her first two teachers, and she stops acting so as to please the third-grade teacher.

RECOGNIZING OPERANT CONDITIONING IN THE CLASSROOM

Suppose you teach two main kinds of lessons in an English class: literature and grammar. On the whole, the students love the literature but hate the grammar. When you teach literature, the students seem to light up. They smile. They respond actively. They are happy. When you teach grammar, they are, at best, silent and sulky. At worst, they are noisy and disruptive. Slowly you may find yourself spending more and more time teaching literature and less and less time teaching grammar. You have been instrumentally conditioned! An expert teacher is alert to the possibility of being conditioned by his students. He does not allow himself to be conditioned in this way, but rather looks for ways to make the subjects he teaches (including grammar!) more interesting.

Operant conditioning also occurs in interactions among the children you are teaching (or in your own interactions with your peers). Suppose two girls want to work together in an art workshop. One wants to work with paints, the other with clay. A heated discussion ensues. Eventually, one of the girls finally gives in. She points out that although she wants to work with paints, she values the friendship more than the choice of art medium. She suggests, therefore, that the pair work with the clay. The other girl, embarrassed, looks the first girl straight in the eye. She suggests they work with paints after all.

The next time the girls have an argument, whether about art media or something else, the argument may be briefer. The first girl again will give in. She thereby ends up getting what she wants. She has been instrumentally conditioned. In the process, she has learned that, paradoxically, she can get her way by giving in. Many of us can remember similar situations in our daily lives with our families or spouses.

What are the key principles of operant conditioning? First, we examine how desired behavior can be increased, or even created, by using reinforcement.

HOW DOES OPERANT CONDITIONING HAPPEN?

As Thorndike's law of effect states, the consequences, or environmental responses to operant behaviors, are the key to operant conditioning. The consequences of behavior can be divided into two broad categories, rewards and punishments. They are also known as reinforcers. Let us explore each of these two options in some depth.

Laura Boletsa/Merrill

An expert teacher takes great care in punishing a student for inappropriate behavior—explaining the problem clearly, immediately instituting the punishment, punishing consistently, and coupling the punishment with positive reinforcement.

■ **REINFORCEMENT** A **reinforcer** is a stimulus that increases the probability that the operant associated with it will happen again. The reinforcer typically occurs immediately or very soon after the behavior in question. If it does not occur soon thereafter, learning either does not take place or is weakened. Reinforcers are of two kinds: positive and negative.

A **positive reinforcer** is a reward that follows an operant, which increases the likelihood of that operant occurring again. Sometimes a positive reinforcer occurs soon after an operant behavior, thereby strengthening the response. The pairing of the positive reinforcer with the response is positive reinforcement. Classrooms encompass many examples of positive reinforcers. They include a teacher's approval, as indicated by a smile or a favorable comment, or an A on a test. Teachers frequently use praise as a positive reinforcer. The Flexible Expert feature, "Teaching and Learning About Effective Praise," shows how some expert teachers and students use praise.

A **negative reinforcer** is an unpleasant stimulus that ceases or is removed following an operant behavior. Negative reinforcement is the removal of an unpleasant stimulus that results in an increased probability of the response's occurring. "Negative" here refers not to something bad, but rather to the removal process. In other words, negative reinforcement comes not from the presenting of a stimulus, but rather from taking it away. Although negative reinforcement and punishment are sometimes confused with each other, they are actually completely different concepts. Punishment decreases the probability of a response, whereas negative reinforcement, like positive reinforcement, increases it.

An example of a negative reinforcement is the way an annoying buzz or bell in a car stops when all the occupants have fastened their seat belts. The termination of the sound is usually rewarding enough to increase the chances that you will fasten your seat belt the next time you enter the car. The punishment, in contrast, is the annoying buzz or bell. The sound is the punishment you get for not putting on the seatbelt!

Consider an example of the use of negative reinforcement in the classroom. An elementary school teacher says, "We will go outside for recess just as soon as you clean the classroom." The negative reinforcement is release from the cleaning of the classroom. This release may be rewarding enough that students will clean up the room more promptly the next time the teacher asks. Consider another example. A teacher allows students who get 100 percent on a practice spelling test to skip the later formal test. Unfortunately, there is a problem with the deliberate use of negative reinforcement: It requires the introduction of some level of unpleasant stimulation, which is to be alleviated through the technique.

Students regularly negatively reinforce teachers. When a teacher gives in to students' whining requests to skip homework or a quiz, the students may reward the teacher by ceasing their whining requests. Such negative reinforcement could increase the chances that, the next time students beg for a reprieve, the teacher will give up even faster.

THINKING PRACTICALLY

How might you positively reinforce your students? Now, how might students positively reinforce you?

SUGGESTION: You give praise to reinforce students. When students pay attention, they reinforce you.

■ **CHOOSING REINFORCERS** Psychologists distinguish between two main kinds of reinforcers. **Primary reinforcers** are rewards, such as food and shelter from the elements, that provide immediate satisfaction or enjoyment. **Secondary reinforcers** are rewards that gain reinforcement value through their association with primary reinforcers. Unlike primary reinforcers, they are not inherently reinforcing, or satisfying in a basic biological sense. Rather, they are learned to be reinforcing. Examples of secondary reinforcers include grades, money, and objects associated with status, such as clothing or fancy cars. Money, for example, is paper with no value in itself—but it can buy us food, shelter, and much more. Most of the reinforcers you will use as a teacher are secondary reinforcers.

One way some teachers—especially those in elementary school classrooms—use secondary reinforcers is by creating token economies. Token economies are systems in which token-based reinforcement is used to change behavior (Kazdin, 2000; Tarbox, Ghezzi, &

THE FLEXIBLE EXPERT

TEACHING AND LEARNING ABOUT EFFECTIVE PRAISE

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Tanisha would like all her students to complete a term paper. She breaks the assignment into several steps, and then praises and rewards students as they finish each step.

THE CREATIVE TEACHER: Tanisha practices several different ways she can provide encouragement—both verbally and nonverbally—without repeating herself too often.

THE PRACTICAL TEACHER: Tanisha keeps careful records and samples of students' past work, so she can always find something specific about which to offer genuine praise when she writes comments on homework papers.

THE ANALYTICAL STUDENT: Austin points out to the other members of his social studies project team that they have all really learned a lot about Brazil since they started the project, and lists the accomplishments of several students who deserve thanks.

THE CREATIVE STUDENT: Austin, realizing he has been paying more attention to achieving length than to coming up with good ideas for his term paper, decides to reward himself not by how much he writes, but by how original he thinks his ideas are for that day of work on the paper.

THE PRACTICAL STUDENT: Austin, realizing he has been hogging the soccer ball, starts praising himself each time he makes a pass to a teammate.

Wilson, 2006). The tokens are objects that in themselves have no value. Examples are a certificate or a star on a chart. Tokens are exchanged for other things that do have value. In a typical arrangement, students are rewarded for performing a desired behavior with a token. After accumulating a certain number of tokens, students can exchange them or use the tokens to "buy" desired rewards. For example, ten certificates may earn the student a chance to choose from a selection of small toys or school supplies. Ten stars may be worth ten minutes of free time on Friday.

Teachers have successfully used token economies to improve student conduct as well as academic performance (McLaughlin & Williams, 1988; Reitman, Murphy, Hupp, & O'Callaghan, 2004; Shook, LaBrie, Vallies, McLaughlin, & Williams, 1990). Some commentators, however, have raised questions about the ethics and long-term effectiveness of reward systems, and the use of behavioral learning methods in general. These questions are explored in the Forum feature, "Are Behavioral Approaches Ethical?"

THINKING ANALYTICALLY

Many schools overuse one kind of secondary reinforcer to a point that this reinforcer may not help students to develop as well as they might. What kind of reinforcer might this be?

SUGGESTION: Grades sometimes are overused. This process can lead students to place too much emphasis on grades rather than on what they are learning.

FORUM

ARE BEHAVIORAL APPROACHES ETHICAL?

The research summarized in this chapter clearly indicates that behavioral approaches can be powerful tools to affect student learning. Some teachers and commentators, however, suggest that the use of behavioral learning approaches is ethically unacceptable. Moreover, it is not always effective. Much of the debate has focused on operant conditioning, particularly rewarding students.

FIRST VIEW: AGAINST BEHAVIORAL APPROACHES. Some scholars have suggested that behavioral techniques are too controlling. They view them as "a way of doing things to children rather than working with them" (Kohn, 1993, p. 784). Teachers could easily misuse rewards and punishments. For example, as we saw in Chapter 6, a teacher may inadvertently reward boys more often than girls for raising their hands and speaking in class. By doing so, the teacher inadvertently teaches girls to avoid class participation. The dangers of punishment are detailed later in this chapter.

In addition, behavioral principles may backfire, becoming ineffective in the long run. Some schools, for example, have used rewards, including cash incentives, to reinforce attendance, reading, or good grades (Gorman, 1994). Critics of reward plans warn that students may perform the tasks required to earn rewards or avoid punishment only temporarily. They do so only as long as the rewards or punishments remain in effect, and they may never make a commitment of their own to learning (Bracey, 1994; Kohn, 1993). Worse yet, rewarding behavior for which a student is already intrinsically motivated can actually *decrease* the student's intrinsic motivation (Sethi, Drake, Dialdin, & Lepper, 1995; Spence & Helmreich, 1983; Swanson, 1995). A student who enjoys reading, for example, may not respond well to rewards and punishments. She may find that being required to read two books a week to earn reward points actually diminishes her pleasure in reading. In other cases, extrinsic rewards may serve as a bridge to intrinsic ones. A student may first be rewarded extrinsically for doing something, find it pleasurable, and thereafter do it because he or she likes to.

SECOND VIEW: IN DEFENSE OF BEHAVIORAL APPROACHES. Defenders of behavioral learning approaches point out that students' actions are rewarded or punished all the time in various ways. Controlling behavioral consequences, they argue, actually provides for more fairness in education than leaving the possibility of rewards up to chance. For example, a math teacher can praise students as they learn each of the steps in subtraction. Such praise may be superior to letting students who learn faster be the only ones to earn rewards, in the form of the highest test scores. In addition, behavioral approaches provide feedback to students about their performance. According to Paul Chance (1993, p. 788), "[P]eople learn best in a responsive environment. Teachers who praise or otherwise reward student performance provide such an environment."

The effects of rewards on intrinsic motivation are not entirely clear, as you will learn in Chapter 10 (see Cameron & Pierce, 2002; Cameron, Pierce, Banko, & Gear, 2005). A student may be highly intrinsically motivated, but he or she also may have a high need for extrinsic motivation (i.e., motivation coming from outside the self). For example, a student may enjoy reading about people in other countries during social studies class, but he or she also may savor a teacher's praise for a good class presentation about Venezuela. In addition, the nature of the task may be related to the effectiveness of rewards. Some research has suggested, for example, that rewards can enhance creativity on difficult tasks, but not on easy tasks (Eisenberger & Selbst, 1994).

THIRD VIEW: A SYNTHESIS. Behavioral approaches to learning, operant conditioning in particular, are here to stay. The challenge for expert teachers is to use behavioral learning techniques wisely. Students need not be passive recipients of behavioral techniques. Instead, teachers can involve students in plans for modifying the students' behavior and encourage students to reward themselves as they progress. External rewards, whether given by the teacher or self-rewarded, may help students overcome their initial difficulties or lack of interest in some subjects. In fact, some school districts have offered high school students incentives simply for attending school. The underlying idea is that, once the initial hurdle of showing up is passed, students may reap intrinsic rewards from their participation (Phillipps, 1995).

Once the initial stages are mastered, whether through the help of rewards or not, students' growing competence can become its own reward (Chance, 1992). For example, a student may need rewards for undertaking each of the component steps required in learning to write a short story. Once he or she becomes able to craft stories without help, the joy of writing may then become intrinsically motivating. The goal of behavioral learning techniques, and of all teaching, is for students to master the desired behavior themselves. In this way, they can move beyond their need for the teacher.

■ **MAKING REINFORCERS EFFECTIVE** Is a primary reinforcer or a secondary reinforcer more effective? Which kinds of secondary reinforcers might work with your students? The answers to these questions will be different for every student. Expert teachers realize that

what is reinforcing for one person may not be for another. Usually teachers need to do some experimentation to find what works best with each student.

This principle was demonstrated by David Premack (1959). He experimented with two different rewards, playing with a pinball machine and eating candy. Premack found that some children preferred one of the rewards, whereas other children preferred the other reward. You may have noticed the same phenomenon yourself. Perhaps a good friend rewards himself or herself for a productive afternoon of studying by spending an hour in a lively pickup basketball game. This might be an activity you would find unrewarding in the extreme, preferring instead to treat yourself to an hour-long nap.

The idea that different people like different things is certainly useful to keep in mind—but an even more useful discovery is the Premack principle. The **Premack principle** states that more preferred activities reinforce less preferred ones (Premack, 1959). According to Premack, everyone has a reinforcement hierarchy. In this hierarchy, (1) reinforcers higher in the hierarchy are more likely to produce operant behaviors than are reinforcers lower in the hierarchy and (2) activities higher in the hierarchy reinforce those lower in the hierarchy. Premack found that, for children who preferred the candy, he could reinforce playing with the pinball machine by giving the children candy. For children who preferred playing with the pinball machine, he could reinforce eating the candy by allowing the children to play with the pinball machine. Like operant conditioning itself, the Premack principle has been known informally for a long time. In fact, some people refer to it as "Grandma's rule," based on the type of bargains made every day by some clever grandmothers. An example would be "You can go out to play after you finish eating your vegetables."

The Premack principle can be useful to people who want to become expert teachers. To be an expert teacher who uses reinforcement effectively, you need to determine each of your students' reinforcement hierarchies. You can find out by observing what they like to do in varying degrees. You can then use your observations to provide appropriate reinforcements to the children. That is, you can apply those reinforcements that will work best for them (and are acceptable to you!). You can also use your observations to reinforce less desired behaviors (say, doing math for a given child) with more desired behaviors (say, playing at recess). Consider the active practice of the Premack principle in a classroom of first graders who love crafts: A teacher might reinforce the increased use of correct grammar by bringing in special clay for students to play with during free time.

THINKING PRACTICALLY

Think of a child you have taught or interacted with whose preferences you know quite well. How might you use the Premack principle to reinforce the kinds of behavior you desire in that child?

SUGGESTION: Find out which kinds of rewards will reinforce the behavior you want to see in that child. Then use those rewards.

■ **SCHEDULES OF REINFORCEMENT** Neither you nor your students are always rewarded for good behavior, nor are you always punished for bad behavior. Yet you behave well, at least a good part of the time! Why is this so?

We are reinforced in life on a **schedule of reinforcement,** a pattern by which reinforcements follow operants. In our preceding discussion, we actually assumed a schedule of **continuous reinforcement**—that a reinforcement always follows a particular desired behavior. For example, in the early Thorndike experiments, the cat got to eat the fish every time it was able to open the latch. In everyday life, we are much more likely to encounter schedules of **partial reinforcement** (also called **intermittent reinforcement**). In these schedules, the desired behavior is reinforced only some of the time. Gambling is a good example of partial reinforcement: People keep gambling because they are partially reinforced.

The two basic types of reinforcement schedules are ratio schedules and interval schedules. In a **ratio schedule,** a certain number of the desired operants is reinforced, without regard to the passage of time. For example, if you pay a child something for every eight empty bottles she returns, the reinforcement schedule is a ratio one. The critical variable here is the number of times the operant has occurred. In an **interval schedule,** reinforcement is a function of the time that has passed, regardless of the number of operants that have occurred (as long as there has been at least one operant). Being paid every two weeks is an example of delivering a reinforcement on an interval schedule. Furthermore, there are two types of both ratio and interval schedules: fixed and variable.

How do the four partial reinforcement schedules work?

- In a *fixed-ratio reinforcement schedule,* reinforcements always occur after a certain number of responses have occurred. For example, some libraries have summer book

clubs and recognize children for having read a fixed number of books. In such a program, there might be some recognition for the child's having read five books, further recognition at ten books, and so on. Similarly, if students must complete ten homework assignments over the course of an academic term to earn an A, this is a fixed-ratio schedule of reinforcement.

- In a *variable-ratio schedule of reinforcement*, the individual is rewarded, on average, for a certain number of responses. The exact number of responses needed to gain a reward can vary from one reinforcement to the next. Teachers usually reinforce students on a variable-ratio schedule for raising their hands to answer questions in class. The teacher may call on each student an average of once out of every four hand raises, for example. The actual number of times that a student must raise his or hand before being called on varies, however.
- In a *fixed-interval schedule of reinforcement*, individuals are always reinforced for the first response that occurs after the passage of a fixed amount of time, regardless of how many operant responses have taken place after that time interval. Fixed-interval reinforcements are fairly common in our lives. Consider fixed marking periods, after which grades are assigned for a given period of time (perhaps every six weeks or quarterly). The grades teachers give can serve as fixed-interval reinforcements.
- In a *variable-interval schedule of reinforcement*, individuals are reinforced for the first response after the passage of an average interval of time, regardless of how many operant responses have taken place after that time interval. The specific amount of time between reinforcements can change from one reinforcement to the next. For example, in some countries, people who are supposed to be paid on a fixed-interval schedule actually are paid on a variable-interval schedule!

THINKING CREATIVELY

Give one example, in addition to those in the text, of one of the four kinds of partial reinforcement schedules as it occurs in a school setting.

SUGGESTION: Teachers typically orally praise on a variable-ratio schedule students who do excellent work. That is, they do not always praise the students, but do so after some number of excellent performances.

Table 7.2 shows the patterns of behavior that each of the schedules of reinforcement tends to produce. As you can see, the various schedules are associated with different patterns of behavior. Continuous reinforcement tends to produce behavior quickly, but it also eliminates

TABLE 7.2 Schedules of Reinforcement

Schedule	Description When Reinforcement Starts	Example	Pattern of Response: During Reinforcement	Pattern of Response: When Reinforcement Stops	Pattern of Response: After Reinforcement Stops
Continuous	Every operant is reinforced.	Gold star for every paper turned in.	Rapid increase in operants.	Steady response as long as reinforcer is desired.	Operants rapidly stop.
Fixed ratio	Reinforcement occurs for first response after a certain fixed number of operants.	Gold star for every five papers turned in.	Fairly rapid increase in operants, but not as fast as under continuous reinforcement.	Usually high response rate, but with a pause after each reinforcer.	Operants stop rapidly if reinforcement does not occur after expected number of operants.
Variable ratio	Reinforcement occurs for first response after varying numbers of operants.	Teacher picks a different "magic number" every day for number of papers to be turned in to earn a gold star.	Slow increase in operants.	Steady and high—less pause after each reinforcer.	Operants stop slowly.
Fixed interval	Reinforcement occurs for first response after a certain fixed period of time.	Gold star every week after weekly paper is turned in.	Somewhat faster increase in operants than in variable schedules, slower than under continuous reinforcement.	High, but response rate often increases as time for reinforcement approaches, then drops after each reinforcement.	Operants stop rapidly if reinforcement does not occur after expected amount of time.
Variable interval	Reinforcement occurs for first response after varying amounts of time.	Surprise "Gold Star Days" when turning in paper earns gold star.	Slow increase in operants.	Constant high response rate with little pause after each reinforcement.	Operants decrease slowly and gradually.

behavior more quickly if the reinforcement stops. With regard to partial schedules, ratio schedules generally produce more of the desired behavior than do interval schedules. For fixed schedules, there tends to be a pause in behavior right after reinforcement is administered. Variable schedules maintain a more nearly constant rate of responding than do fixed schedules.

In everyday life, schedules of reinforcement are often much more complex than our discussion here might suggest. For example, certain kinds of rewards and recognitions are given out according to a system that contains aspects of both variable-ratio and variable-interval schedules of reinforcement. Awards for good teaching, in places where they are given, might represent systems that combine ratio and interval schedules. Moreover, schedules of reinforcement can change. A teaching technique that worked almost all the time in your early years of teaching may start working less frequently in your later years because of societal changes in the behavior patterns of the children.

■ **UNDERSTANDING THE CONSEQUENCES OF OF BEHAVIOR** Expert teachers know that if they wait for a desired behavior to occur before providing reinforcement, they may end up waiting a long time. Similarly, if they wait for an undesired behavior to occur before punishing it, frustration and unhappiness may result for both student and teacher. The solution to both of these problems is to prepare students with some idea of what kind of behavior is expected of them.

Students can act on their knowledge about potential consequences either to achieve promised rewards or to avoid threatened punishment. Teachers can use several approaches to cue students about the potential consequences of their acts. First, teachers can simply tell students what will happen. For example, a teacher may say, "If you hand in all ten homework assignments on time over the course of the semester, you will earn fifty points toward your final grade." Tom Douglass might have given his student Jimmy a cue about the upcoming punishment for interrupting Mara by saying, "Jimmy, if you interrupt Mara once more, I will send you to the hallway for a time-out." Second, teachers can create written or visual reminders, such as posters of class rules or checklists for projects or activities (Sulzer-Azaroff & Mayer, 1986). A formal method of informing students about the consequences of their behavior is to draw up a contingency contract. A **contingency contract** is a written or oral agreement between student and teacher specifying desired behavior and promised reward. For example, the contract might state that, if a student hands in all homework assignments between a specified time and the end of the term, and the assignments are satisfactory, the student will be excused from a course-paper assignment that he or she otherwise would have to do. These contracts are useful tools for improving the behavior of a variety of students (Gurrad, Weber, & McLaughlin, 2002; Mruzek, Cohen, & Smith, 2007).

■ **PUNISHMENT** Mr. Clemens believes in very strict discipline in his classroom. He seeks to establish order and control on the very first day of class. By making an example of any transgressors, he believes he can quickly get the students in line. This year, the first one to get out of line was Ricky, who taunted another student for being stupid. Mr. Clemens scolded Ricky for taunting the other student and then put Ricky in a corner for the rest of the day. Ricky was facing the wall; he was unable to see or interact with other children. Mr. Clemens made assorted jibes at Ricky during the day. He noted that the only way he seemed to learn how to behave with others was to be by himself. He didn't look so tough with his back facing the class.

Mr. Clemens seems to have established an orderly classroom. As always, the principal is impressed when she comes to observe. Other teachers, however, have complained that Mr. Clemens's students are far more aggressive than are the other students at recess. They cause trouble on the playground when anyone except Mr. Clemens is supervising them. Also, a disproportionate number of antisocial events outside the school have involved Mr. Clemens's students. Worse, Ricky has become a hero to some of the students in Mr. Clemens's classroom. Moreover, the student Ricky taunted has been ostracized by these children. Mr. Clemens has modeled the very behavior he criticized, and he has now lost the respect of many of his students.

Mr. Clemens has reached his main goal: Through frequent and harsh use of punishment, he has established order in his classroom. As a result, he rarely has classroom incidents. Were

that his only goal, he might be viewed as successful. However, to the extent that his behavior has been aimed at reducing aggression in his students, his policies not only seem to have been unsuccessful, but have actually backfired. Other teachers find his students to be the most aggressive of all outside the classroom. Such patterns are not uncommon. Highly punitive parents often find they are able to achieve discipline in the home at the cost of producing a bully in the outside world.

What exactly is happening here? Might there be other ways Mr. Clemens can teach children good behavior? How much should a teacher depend on punishment?

Punishment is the use of a stimulus that decreases the probability of a response (Steinberg, 2000). A response can be discouraged through **presentation punishment,** the application of an aversive, or unpleasant stimulus. Examples of aversive stimuli are failing grades, being yelled at, or, in the case of Ricky, feeling humiliated. A response can also be discouraged through **removal punishment,** taking away a pleasant stimulus. Removal of a pleasant stimulus is also referred to as a penalty. Common examples of penalties include losing recess privileges or access to a desired toy or book.

In some situations, teachers cannot avoid using punishment. For example, punishment may be called for if a student or other child has done something that places herself or another student in danger. Also, if attempts to use reinforcement have failed, punishment may be advisable. If you decide to use punishment to correct errant behavior, a number of guidelines can help you use it more effectively (Parke & Walters, 1967; Walters & Grusec, 1977). In particular, the person administering the punishment should consider the following options:

- *Suggest alternative ways the student can get what he or she wants.* If the student does not see any alternatives to what he or she is doing, it is difficult to change the behavior. For example, assume that Ricky wanted praise for his science skills. Mr. Clemens could have sent Ricky to the corner to think about why he taunted another student. He then could have taken Ricky aside after class and helped him create a special science project. Once Ricky finished the project, Mr. Clemens could allow Ricky to present his work to the class. This alternative way of gaining peers' attention has many benefits. For example, it allows Ricky to change himself from a negative role model into a positive one.
- *Find a way to follow punishment with positive reinforcement.* Complement punishment with positive reinforcement that rewards the behavior you desire to replace the unacceptable one. For example, Mr. Clemens could have reinforced Ricky's interest in science by giving Ricky opportunities to exhibit his science skills. Homework is one commonly used opportunity. In instances of aggression, a teacher should reward students when they are gentle and considerate. Such rewards are appropriate even at times when students are not interacting much with others.
- *Explain the problem.* Ensure that the student being punished understands just what behavior is being punished, and why. Do not assume that because it is obvious to you why punishment is called for, it will be obvious to the student as well.
- *Punish immediately.* Administer the punishment immediately after the undesirable operant behavior, or as soon as possible thereafter.
- *Use appropriate intensity.* Administer punishment that is appropriate for the infraction, neither greater nor longer than necessary to make the point.
- *Punish consistently.* The inappropriate behavior always should be punished.
- *Make escape impossible.* Try to make sure it is impossible for the student to escape the punishment if the behavior is demonstrated.
- *Use penalties.* Use removal punishment (withholding of rewards or other desired things) wherever possible, in preference to presentation punishment. For example, ideally Mr. Clemens would have removed attention from Ricky because attention seemed to be what Ricky was seeking.
- *Ensure appropriateness.* Above all, make sure the punishment is appropriate in the first place and that it will not backfire. Assigning English compositions as a punishment, for example, may lead to an aversion to doing such compositions. Emotional abuse may damage a child's psychological well-being. After the time Ricky spent in the corner, a public apology from him to the taunted student would have been appropriate. The emotional abuse that Mr. Clemens inflicted on him was not.

THINKING ANALYTICALLY

Think of a situation in which you have used punishment. Using the principles described here, state how you might have made the punishment more effective.

SUGGESTION: You can make a punishment more effective by rendering it immediately after the provocative act.

Recall the vignette at the beginning of this chapter that described fifth-grade teacher Tom Douglass. He followed the guidelines outlined here when he punished Jimmy, who was interrupting another student's presentation to the class. Tom promptly applied a punishment that was appropriate for the situation—a time-out. He also provided instructions for an alternative behavior—Jimmy's quietly thinking about how he could behave better when he returned. **Time-out,** a brief period of social isolation, serves as a punishment, depriving a student of pleasant social stimulation. It also removes a reward that the student may have been receiving for his or her unacceptable behavior, the attention and approval of classmates (O'Leary & O'Leary, 1977). It seems to be effective in changing behavior.

Another effective form of punishment is a **response cost,** a small penalty imposed for each instance of the undesirable behavior. Suppose Tom had told Jimmy that, for each time he interrupted Mara, he would lose one minute of recess. He would have been using response cost.

Although only of use in a few situations, another technique that can sometimes effectively decrease the likelihood of an undesirable behavior is **satiation.** Satiation involves compelling students to continue a behavior until they are tired of it. If Jimmy had been interrupting Mara by flying a paper airplane across the room while she was talking, Tom Douglass could have used satiation. In this case, he might have presented Jimmy with 100 sheets of paper and told him to make paper airplanes from every sheet. The chore of making dozens of paper airplanes might cause Jimmy to become less interested in making them in the future.

Some educators have suggested the use of *assertive discipline* to control behavior. Such discipline involves carefully stating rules and describing specific reinforcements and punishments that will follow from obedience or disobedience (Canter & Canter, 1992; Swinson & Cording, 2002). Such discipline has the advantage that the consequences of behavior are clearly spelled out. Nevertheless, this method of discipline has been criticized for putting teachers and students into antagonistic roles. It also stresses obedience at the expense of learning (e.g., McLaughlin, 1994). Thus the program is controversial but is still widely used.

Table 7.3 reviews the four most common forms of operant conditioning—positive and negative reinforcement, presentation punishment, and removal punishment—and their effects on operant behavior.

Though it may be effective in changing certain classroom behaviors, punishment should never be used for retribution or retaliation. Expert teachers know that punishment can be less effective in achieving behavioral change than reinforcement. Ultimately, punishment should be used to produce positive behavior; this behavior can then be rewarded. Moreover, as you can see in Table 7.4, punishment can lead to unfortunate side effects, including escape attempts, backfires, increased aggressiveness, decreased self-esteem, or even injury (Bates, 1987; Bongiovanni, 1977). Corporal punishment, or hitting, is likely to lead to the last of these dangers, injury to students. There are risks of injury, as well as other dangers inherent in the use of punishment. Hence, teachers should refrain from using corporal punishment. In fact, the practice is banned in more than half of all U.S. states (Evans & Richardson, 1995).

THINKING CREATIVELY

A teacher yells at her students for talking during her lectures. How might she instead use reinforcement to change that behavior?

SUGGESTION: Instead of punishing students' talking, she could reward their silence.

TABLE 7.3 Consequences of Operant Behavior

Name of Consequence	Description	Effect of Consequence on Future Operant Behavior	Example
Positive reinforcement	A pleasant stimulus is presented following operant behavior.	Increases likelihood.	Student receives a gold star for handing in assignment on time.
Negative reinforcement	An unpleasant stimulus is removed following operant behavior.	Increases likelihood.	Student goes to recess only after assignment is completed.
Presentation punishment	An unpleasant stimulus is presented following operant behavior.	Decreases likelihood.	Student is scolded for failing to turn in assignment.
Removal punishment (penalty)	A pleasant stimulus is removed following operant behavior.	Decreases likelihood.	Student loses gerbil-feeding privilege for failing to turn in assignment.

TABLE 7.4 The Dangers of Punishment

Danger	Description	Example
Escape attempts	Students try to continue with the behavior being punished, yet find a way of continuing without being punished (such as by hiding the behavior).	Ricky may continue to taunt other students, being careful to do so only when Mr. Clemens has his back turned or is out of the room.
Backfiring	Punishment, especially when harsh, may cause unintended, or even the direct opposite of intended, results.	Mr. Clemens's punishment of Ricky may cause Ricky to become so afraid of being punished that he starts skipping class to avoid Mr. Clemens.
Increased aggressiveness	Punishment can increase aggressive behavior on the part of the person being punished. Sometimes the behavior of the individual will improve in interactions with the person administering the punishment, but the individual will then show the same or similar punishing behavior with others.	Mr. Clemens used punishment to elicit compliance, and gained it, but at the expense of his students' acting out aggressive behavior outside the classroom.
Loss of self-esteem	Even when behavioral change is achieved, it sometimes occurs at the expense of a severe loss of self-esteem, which can be more damaging, in the long run, than the behavior that was punished.	Mr. Clemens's taunts may have convinced Ricky that he is, indeed, stupid and ill behaved, an image he will now reflect in his future behavior.
Injury	Punishment can result in inadvertent (or occasionally, intentional) injury. Punishment becomes child abuse when a child is physically or psychologically harmed as a result of the punishment.	Ricky may develop depression as a result of his low self-esteem and subsequent poor relations with teachers, classmates, and parents.

CONSTRUCTING YOUR OWN LEARNING

Practice shaping techniques using yourself as a subject. Think of a goal that you would like to reach. An example might be learning to read music or getting in shape to run a 10-kilometer race. Make a list of small steps that you could take that would lead to the goal. The steps should be ones that you will carry out over a period of days, weeks, or even months, rather than simply tasks you can complete right away. Plot out a plan for reaching the goal. Ensure that each step along the way is sufficiently realistic that you could attain it without giving up on the whole plan. Decide how you could reinforce yourself for attaining each step. Consider how, if you falter at some point, you could get back on track. You might share your plan with others, asking them if they have suggestions as to how better to reach your goal. You might also want to commit yourself to the plan publicly, which would likely increase your incentive to follow through on it. Now, go ahead and execute the plan. Be sure to keep a record of your progress. What, if anything, would you do differently if you were planning to shape the behavior of students you taught, instead of your own?

BEHAVIORAL MODIFICATION: CHANGING STUDENTS' BEHAVIOR

When teachers use operant conditioning in the classroom, they are generally interested in **behavioral modification.** That is, they may wish to change students' behavior by managing the consequences of that behavior. For example, teachers may be interested in increasing such desired behavior as completing homework or expressing respect toward fellow students. Alternatively, they may need to decrease incidents of unwanted behavior, such as disrupting a class by talking out of turn or being aggressive toward classmates. The ultimate goal of any behavioral modification program is to produce self-regulated learners who will be able to control and modify their own behavior.

In using behavioral modification, keep in mind that you are dealing with people, not rats or pigeons. All teachers must show respect for their students' humanity. They must also carefully consider the ethical issues involved in changing students' behavior. Is it truly the teacher's prerogative to shape a particular kind of behavior? If so, what is an appropriate way to shape it? Behavioral modification techniques are justifiable only when used with full respect for the student's well-being.

■ **INCREASING DESIRED BEHAVIOR** Many of the aspects of reinforcement we have described, including the use of various schedules and types of reinforcers, can help you increase the frequency of desired behavior that students already are performing. In addition, you can use antecedent cues to get students to perform new behavior, if the students already understand how to perform the new behavior. But what about behavior students do not yet know how to do? Helping students acquire a complex new skill, such as solving algebra problems or writing persuasive papers, is the core of teaching.

One very effective method of teaching a complex behavior is to use **successive approximations.** With this approach, you reward behavior that comes closer and closer to the desired behavior. Animal trainers use this method when they teach whales, lions, and other show business animals to perform elaborate tricks. You or anyone else can shape behavior. You first reward a very crude approximation to the behavior that is desired as the result. After you have succeeded in establishing that behavior, you reward only behavior that represents a closer approximation to what you want. You then stop rewarding this behavior and reward only a still closer approximation. Although it may sometimes take years of training, eventually the animal or the human student reaches the desired behavior, whether aiding in naval tactics (dolphins) or solving algebra problems (students).

Parents and teachers often shape the behavior of their charges without even realizing what they are doing. For example, when toilet training a child, no reasonable parent expects perfection right away. Rather, parents may first reward the child even if he or she makes it to the toilet only once in several tries. Then the parents' expectations increase. Rewards may be doled out only if the child makes it most of the time. Eventually, of course, the parents expect the child to make it all the time.

Similarly, teachers instructing children in writing do not expect perfectly formed letters the first time. Rather, expert teachers first praise when a letter has some of the main features that distinguish it from others. Then, like the toilet-training parents, teachers gradually raise their expectations. They require students to have the correct number of horizontal lines, three, in an E. Then they expect the child to make the E "stand up straight" with right angles between the vertical and horizontal lines, and so on. Eventually, the child makes a perfect E every time.

In the story at the beginning of the chapter, Tom Douglass used shaping techniques to help Mark speak in class about his science project. Tom first rewarded Mark for answering a really easy question. Then Tom continued to ask increasingly in-depth questions. He praised and encouraged Mark as he gave longer and more elaborate answers. Finally Mark was able to describe the project without any prompting.

Teachers' classroom shaping of student behavior includes a number of specific steps (Walker & Shea, 1991):

1. Select the target behavior they wish students eventually to perform.
2. Determine how often the target behavior occurs before shaping.
3. Choose the reinforcers to be used.
4. Reinforce successive approximations of the target behavior on a continuous schedule—that is, every time they occur.
5. Reinforce the target behavior, when it first appears, on a continuous schedule.
6. Switch to variable reinforcement to maintain the target behavior.

Rewarding small successive approximations is an essential part of the expert teacher's behavioral modification plans. Expert teachers have learned that people who expect total change typically become disappointed very quickly. When these people do not see total change right away, they often give up. The method of successive approximations allows both student and teacher to see progress as it occurs.

As you know by now, one of the most effective ways to shape behavior is by giving praise and avoiding harsh or destructive feedback (Pintrich & Schunk, 1996). Teachers use praise considerably less often than most people think (Brophy, 1981). On average, they give praise fewer than five times per class session. Also, as students reach upper levels of schooling, they get increasingly less praise. It's possible that this trend occurs because older students tend to discount praise, particularly when they are praised for completing relatively easy tasks

EXPERT TEACHER INTERVIEW

FOCUS ON: METHODS OF BEHAVIORAL CONDITIONING

SCOTT TURNER: BURTON VALLEY ELEMENTARY SCHOOL, LAFAYETTE, CALIFORNIA–GRADE 2

Scott Turner uses conditioning and reinforcements to encourage students to respect each other and remain on task. The atmosphere in his classroom is relaxed and nonpunitive. Students often view the behavioral methods as fun or helpful. Although Scott teaches second grade, the principles he uses can be applied to other grade levels as well.

Do you use behavioral methods with your second-grade students?

Yes. For example, when I need to say something important, I ring a bell and students are supposed to freeze. We practiced it in the beginning of the school year. It works well. Sometimes I need to ring the bell twice. If there are a few kids who are not standing still, they feel self-conscious because all the other kids are frozen. They quickly get the point.

What methods do you use to reinforce good behavior?

I reinforce good behavior from the class, as a whole, with a handful of marbles. I have an empty glass jar, and when the students are well mannered I put a handful of marbles in the jar. For example, if another teacher comes to my class to teach a lesson or if we go to the library and the students are quiet and good listeners, I give them a handful of marbles. My one rule is that they can't ask for the marbles. I tell them that these are things they should be doing anyway, like walking in a straight line and not talking during a fire drill. I probably give the class a handful of marbles two or three times a week; it's a variable schedule. When the jar is full, they get a class party. We watch a short video cartoon, and I bring in ice cream or pizza.

To reward individual students, each day I give a starfish card to one student who shows a positive attitude—cooperation, dependability, sharing, responsibility. This is a big deal for the kids. For example, one student continued to write on his paper even after I called "time." When I was correcting his paper, I noticed that he had erased some writing. He told me, "I realized I shouldn't have kept writing, so I erased that part." He received a starfish card for dependability.

How do you discourage inappropriate behavior? Do you ever use punishments?

Yes. We have a pocket chart in the classroom. Each kid has a card in the chart that is green on one side, yellow on the other. If a child misbehaves, I give him or her a verbal warning. If they do the same thing a second time, they

(Emmer, 1988; Good, 1987). Teachers often praise students not because of particular work or responses, but because of the teachers' perceptions of the kinds of students with whom they are dealing. Thus students who are perceived by teachers as high achieving, well behaved, and highly motivated tend to receive praise, with the praise often coming independently of any particular work they do.

Praise is most effective when it is (1) genuine, (2) immediate, (3) specific, (4) judicious, and (5) in response to effort (Brophy, 1981; Dweck, 1999a, 1999b; see also Maclellan, 2005). For example, consider the student who has just mastered copying the shapes of the letters in cursive. Another student in her class has just mastered writing whole words in cursive. The expert teacher would recognize that both students deserve equal praise for their accomplishments, despite the difference in the levels achieved.

*i*MPLICATIONS FOR TEACHING

- **Try to avoid using punishment to modify behavior.** Instead, reinforce desirable behavior that is compatible with the behavior you'd like to see. For example, try praising and rewarding students for raising their hands in class, before considering punishment for shouting out answers.
- **Try ignoring the behavior.** For example, you might ignore answers that students call out until the same answer is offered by a student who has raised his or her hand. As a result, students may be less likely to call out answers in the future. Sometimes, however, classmates will provide the reinforcement that a disruptive student is seeking. In these cases, teachers must act to decrease the disruptive behavior.

have to turn their card to yellow on the chart. For a third offense, they lose recess time. The final stage, which I've never used, is a note to the child's parent. We've talked about this system ahead of time, and students know the consequences if they misbehave.

I also pair this system with rewards for good behavior. I use money that I've invented, called "Turner dollars." Students can earn Turner dollars by keeping their card on the green side and by turning in their homework. They collect the dollars and, at the end of every month, they can use them to go "shopping." They shop at a treasure chest I've stocked with small toys and candies.

Do students ever become able to reinforce or monitor their own behavior?

I try to help students learn to change their own behaviors. For example, quiet time is critically important during writing; students shouldn't be chatting. Students are aware of this rule. If they are talking, they tend to look at me, because they know they are not behaving appropriately.

When these distractions happen—about two or three times a week—I give students the opportunity to choose a different behavior. I provide choices that let them be the decision makers. For example, I have a desk for students who are distracted or who are bothering their neighbors. I call it "Australia." Students can volunteer to move over there. I make it clear they volunteer to move; it's not a punishment. I'll say something like, "Oh, why don't you go to Australia, maybe you can work better there." With this method, it's not a big stigma.

Students are not trying to make your life difficult when they misbehave. Instead, they are showing how much they need your help in learning appropriate behaviors.

What advice would you give to new teachers?

Don't take students' misbehavior personally. When I first started teaching, I was frustrated by student misbehavior. Eventually, I came to realize that the cause of the behavior might not be obvious. I now see misbehavior as almost a plea for help. Students are not trying to make your life difficult when they misbehave. Instead, they are showing how much they need your help in learning appropriate behaviors.

- **Provide warning cues before applying punishment.** For example, if a teacher says the next student who shouts out an answer will give up one gold star on the class reward chart, students may become very careful to raise their hands.
- **Consider appropriate modifications of the environment.** For example, if children are wiggling and bumping each other as they sit on the floor during story time, try having them sit on chairs. Perhaps you will need to do nothing more.

When you have tried all these tactics and the behavior still persists, you may need to incorporate punishment into a behavior-modification plan. Behavior-modification plans based on operant conditioning principles modify the behavior of each student directly by changing the consequences he or she experiences. Expert teachers are aware, however, that students can also learn from the consequences of their classmates' behavior, a form of learning we discuss next.

LEARNED HELPLESSNESS

Some types of conditioning, particularly punishment, may lead to a serious negative consequence: the phenomenon of *learned helplessness*. Learned helplessness occurs when an individual is conditioned to escape punishment by doing nothing at all. Consider an example. In a classic experiment, Martin Seligman and S. F. Maier (Seligman, 1975; Seligman & Maier, 1967) placed dogs in a chamber where they received painful (but not harmful) electric shocks. The dogs were unable to escape the shocks. Later, the chamber was divided into two parts. The dogs could then escape the shock simply by jumping over a barrier that separated the electrified part from the nonelectrified part. Because the dogs had previously learned that they could not escape, however, they made no effort to escape. Instead, they just whined.

In contrast, consider the behavior of a second group of dogs, which did not have the previous experience of being unable to escape. These dogs were placed in the cage, and the shock was turned on. At first, the dogs ran around frantically. Eventually they saw the barrier and jumped over it, escaping the shock. On subsequent trials, when the shock was turned on, they quickly jumped over the barrier, minimizing the time that they felt pain. It is evident that the first group of dogs' feelings of helplessness rendered them unable to learn.

Unfortunately, humans, too, are susceptible to learned helplessness. We try something; we fail. Maybe we try again and fail again. Soon we have learned to believe that we cannot perform that task or master that skill, so we never try again. The child who fails in school, the adult who fails on the job, the lover who fails to sustain a lasting romantic relationship—all of these people are susceptible to learned helplessness. Our conditioning may tell us that we cannot succeed. Some people stop accepting challenges because they feel sure that they cannot cope with them. Some researchers believe that many emotional and behavioral problems can be in part explained through learned helplessness (Sutherland, Singh, Conroy, & Stichter, 2004). Furthermore, students who encounter learning difficulties are more prone to learned helplessness (Hersh, Stone, & Ford, 1996).

It is worthwhile to analyze our own behavior in terms of learned helplessness. For example, one of the authors of this book was only a middling French student. He became convinced that he simply did not have the ability to learn a foreign language adequately. One day his French teacher confirmed his impression by telling him that she could tell from the kinds of mistakes he made that he had little foreign-language learning ability. He stopped trying in the course, which just reinforced the futility of his efforts. He was convinced he was unable to master foreign languages, and he never took another foreign-language course during his school years. He experienced learned helplessness.

As an adult, his work required him to learn Spanish. He learned it quite easily because it was taught by a method that better fit his learning style than the way he had been taught French. He realized that he had incorrectly learned to feel helpless about his language-learning skills. With dedication and a style of teaching that fit his needs, he could learn a new language.

Ask yourself whether you are missing out on opportunities just because you have convinced yourself that you cannot take advantage of them. You may find, as the author did, that you really can do "impossible" things if you just set your mind to them.

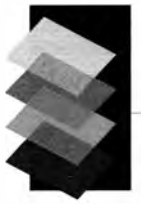
LEARNED OPTIMISM

Recently, Seligman (1998, 2004) and other researchers have turned their attention to how people can become more optimistic and happier in their lives (see also Hoy, Tarter, & Hoy, 2006; Smith & Hoy, 2007). The basic premise underlying this work is that people are not born with the ability to be optimistic, but rather can learn how to be optimistic and happy. Although people may have different "set points," or natural levels of happiness, we all can increase our levels.

Individuals can use any of several techniques to achieve this goal. First, we can let go of the notion that our past negative experiences determine our future—because they don't. But if someone believes that his or her future happiness is determined by past failures, then the individual may not allow him or herself to experience happiness. Second, we can increase our gratitude for the good things that have happened to us in the past. Often, we tend to forget the good things and remember only the bad. We can become happier if we dwell more on the happy things in our past, and not just the unhappy ones.

Third, we can learn to forgive past wrongs that others have done us. When we hold onto grudges against other people, we are the ones who suffer, much more so than the targets of our ire do. Fourth, we can maintain a more positive view toward our future. To the extent that our outlook is negative, we risk it's becoming a self-fulfilling prophecy.

Fifth, we can seek things in life that gratify us—that make us truly happy over the long run as well as during the short term. Too often, we expect good things to just happen, rather than actively seeking them out. We can become happier by pursuing good things, and making them a regular part of our lives.



Social Learning

Social learning takes place as we learn from observing other people's behavior and the results of their behavior (Bandura, 2000, 2007). For example, a child engages in social learning when she watches a parent act aggressively and then starts to act the same way. Note that social learning is, in a sense, indirect. It occurs by observing others. For this reason, it is sometimes called observational learning or even vicarious learning.

THE DISCOVERY OF SOCIAL LEARNING

The concept of social learning gained attention through the work of Albert Bandura (1965, 1969). Bandura, and a number of colleagues, studied children who watched films featuring an adult interacting with an inflatable toy known as a Bobo doll. The adult was highly aggressive, hitting, kicking, punching, and throwing things at the doll. The film then ended in one of three ways, depending on the group to which a given child was assigned. In one group, the adult was rewarded for behaving aggressively. In another (the control group), the adult was punished. In a third, there were no consequences at all.

After watching the film, the children were allowed to play with a Bobo doll. The results were simple and clear-cut: Children who had seen the adult rewarded for aggressive behavior were more likely than children in the control group to behave aggressively toward the doll. In contrast, children who had seen the adult be punished for the aggressive behavior were less likely than the controls to behave aggressively. In other words, children had learned merely through observation, without any active participation on their own part.

Later observations showed that children do not even have to see aggressive behavior being rewarded to **model** it—that is, to behave as the role model did. In one such subsequent study (Bandura, Ross, & Ross, 1963), children watched an adult model either sit quietly next to a Bobo doll or attack the doll. No rewards or punishments of any kind were given to either adult. Children who had seen the adult attack the doll were later more likely to behave aggressively with it than were children who had not seen the aggressive behavior.

Much of the learning that children and adults do as they develop is social learning. For example, much of gender development occurs through watching the role modeling provided by the same-sex parent (Thompson, 1975). As teachers, our goal is to serve as positive role models to help children. However, it is likely that your students are exposed to a tremendous amount of negative role modeling as well.

For example, many children and adults spend countless hours watching violent behavior on television. Bandura's early experiments suggested that television could be a powerful medium for observational learning. There is considerable evidence that exposure to violent activity on television leads to aggressive behavior (e.g., Browne & Hamilton-Giachritsis, 2005; Bushman & Huesman, 2006; Friedrich-Cofer & Huston, 1986; Huesmann, Lagerspetz, & Eron, 1984; Ostrov, Gentile, & Crick, 2006; Parke, Berkowitz, Leyens, West, & Sebastian, 1977). Fortunately, it is possible to design intervention programs to reduce such aggression (Eron, Huesmann,

THINKING ANALYTICALLY

What do you see as the main positive and negative effects of television on children? What is one change you would most like to see to improve children's television programming?

SUGGESTION: One positive effect of television is increasing everyday vocabulary. One negative effect of television is massive exposure to violence. This exposure should be reduced.

Albert Bandura, D. Ross & S.A. Ross

After watching a film of adults interacting with a Bobo doll, children who had seen the adult rewarded for aggressive behavior were more likely to behave aggressively toward the doll than were children who had seen the adult punished for the aggressive behavior.

Spindler, Guerra, Henry, & Tolan, 2002; Henry, Guerra, Huesmann, Tolan, VanAcker, & Eron, 2000). One of the most effective ways of combating aggression is to set norms, in classrooms and elsewhere, that make aggressive behavior unacceptable. Aggression then may cease to be reinforced and, when necessary, may be punished.

Exposure to violence is not limited to television, of course. Many children are exposed to large amounts of violent behavior on their streets or in their backyards. Teachers have to overcome a lot of negative role modeling. Expert teachers use the principles of social learning described in the next section to encourage what they see as positive modeling.

HOW DOES SOCIAL LEARNING HAPPEN?

Teachers often want their students to learn by observing. For this learning to be successful, teachers must make sure four necessary conditions are met (Bandura, 1977a, 1977b).

THINKING PRACTICALLY

Describe one way you could get students' attention.

SUGGESTION: One strategy to get students' attention is to start a class period with a joke.

■ **ATTENTION** For learning to take place, the individual needs to be paying attention to the behavior to be learned. *Attention* is active perception. It is the filter between the vast amounts of information that assail our senses to the relatively limited amount of information we actually perceive. Some modern theories of attention suggest that people have one or more fixed pools of attentional resources. They can allocate resources as various tasks require (e.g., Kahneman, 1973). For example, in the classroom, a student may be dividing attention among your lesson, another student's classroom antics, and a pounding headache that is making it hard to concentrate on what you are saying. Expert teachers attempt to reduce distractions in the classroom. In this way, as much as possible of each student's attention is focused on the teacher rather than on lesson-irrelevant stimuli.

In addition to reducing distractions, teachers sometimes have to grab students' attention to focus it on the lesson at hand. Some of the common and useful devices teachers can use include the showing of enthusiasm, being passionate about what they teach, and varying the types of activities they do. Suppose, for example, a teacher wants students to learn to recycle paper. He might attract students' attention by mentioning aloud that he is about to put a piece of paper in the recycling bin, instead of just silently placing the paper in the bin.

■ **RETENTION** For learning to be effective, the individual has to remember what he or she observed when later given the opportunity to act in the same way. To help your pupils better retain the positive behavior you want them to model, encourage them to use active memory techniques. The more clearly students are able to state what they observed, and the deeper they understand it, the more likely the behavior will be retained in memory. Ask students to recall and describe how you handled a certain kind of task for which you served as a role model. Encourage them to figure out why you handled the task as you did. You might even quiz them to ensure that they remember.

This enthusiastic teacher obviously has the attention of her young students.

David Mager/Pearson Learning Photo Studio

For example, suppose the behavior to be learned is paper recycling. A teacher might ask students to recall what they saw him or her do with the empty paper milk cartons at lunchtime. The teacher might then ask students what they thought would eventually happen to the paper milk cartons that were sorted into a separate bin.

■ **MOTIVATION** The individual has to be motivated to model the observed behavior. One way to motivate students to behave in a certain way is to give them reasons to behave that way. Another is to reinforce them. Reinforcement can take any of the following forms:

- **Direct reinforcement,** as when you reward students for behaving the way you wish them to.
- **Vicarious reinforcement,** which occurs when children watch someone else being reinforced (as in real life or on TV).
- **Self-reinforcement,** or rewards people deliver to themselves for showing desired behavior. Children need to learn to reinforce themselves so they can become self-regulated learners.

The teacher who wants to teach environmentally responsible habits, for example, might point out to students the general environmental benefits of paper recycling, such as more space in landfills and inexpensive recycled paper products. He or she could praise students when they remember to put paper in the recycling bin instead of the trash. Showing videos or movies in which children are rewarded for recycling activities would provide vicarious reinforcement. Students could even be allowed to reinforce themselves, perhaps by putting stickers onto a class recycling chart, whenever they put their papers into the correct bin.

■ **POTENTIAL FOR MODELING** Can the students actually do what you want them to? For example, you could show films of star racers running a 4-minute mile to your class, but the chances are that none of your students would be able to imitate this behavior. The children need to be not only physically capable, but also mentally and emotionally capable, of doing what you wish them to do. As discussed in conjunction with moral development in Chapter 2, you might want young children to understand what the universal principles of justice are and how these principles apply to their lives. At this age, however, the children are unlikely to be ready to understand your lesson. Sometimes external factors stand in the way of a student's reproducing the desired behavior. The teacher who wishes to teach paper recycling may increase classroom recycling, for example. If students' parents refuse to institute paper recycling at home, however, students cannot reproduce their new behavior outside of the classroom.

THINKING PRACTICALLY

Given what you have just read, what is one specific thing you can do to increase the likelihood that your students will model behavior you wish them to model?

SUGGESTION: Be very clear about what the behavior is you want the students to model.

The likelihood that a behavior will be modeled is also affected by the nature of the model, or the person performing the behavior. As detailed in Table 7.5, many factors affect the chances that the behavior will be imitated. They include how the model stands out in relation to other models, the degree to which the student likes and respects the model, the amount of similarity between model and student, and the consequences the model is seen as experiencing (Schunk, 1996a, 1996b; Sulzer-Azaroff & Mayer, 1986). A student is likely to imitate a person who stands out from the crowd, especially if the student likes or respects the person. It also helps if the student believes he or she actually stands a chance of experiencing rewards similar to those the model receives.

The ultimate goal of social learning is to teach students **self-regulation,** the ability to control their own behavior (Pressley, 1995; Winne, 1995; Zimmerman, 1995). Recall from Chapter 2 Vygotsky's (1978) notion of internalization. Internalization represents the idea that children learn by first seeing things happen socially, or watching someone with more expertise perform a task, and then by taking what they see and making it a part of themselves. Internalization is really what social learning is about. It is teaching children to take what they see—not only academic knowledge, but all kinds of desirable behavior—and make it their own. Your students will not always have you, or other adults, looking over their shoulders.

TABLE 7.5 What Makes a Good Model for Social Learning?

Characteristic	Why It Works	Example
Salience: the model stands out in relation to competing models.	The behavior of a salient adult (parent or teacher), or of a salient age-mate (best friend), is more likely to be imitated than is the behavior of a random adult or child.	A high school math teacher demonstrates the correct way of solving a problem, knowing that, as teacher, he or she is a salient model for some students.
Liking and respect: the model is liked and respected by the individual.	A child is more likely to model the behavior of a respected teacher or friend than of a stranger or someone who is disliked.	To provide another model who is liked and respected, the math teacher asks a popular student to be the first student to solve a problem at the chalkboard.
Similarity: the individual views the model and herself or himself as being alike in key ways.	A parent or best friend is more likely to serve as a role model because of perceived similarity to the individual who is doing the learning.	The math teacher asks several students to come up and solve problems, so each student begins to envision himself or herself as the next one at the chalkboard.
Reinforcement: the consequences of a model's behavior are observed.	An individual is more likely to imitate a model's behavior if the model is rewarded for his or her acts.	The math teacher liberally praises each student, not only stepping up in front of the class, but also for each step leading to a correct problem solution.

THINKING CREATIVELY

What is one behavior you think is really important for your students to show that most of them have not shown in the past? How might you use social learning to help them acquire that behavior?

SUGGESTION: Each individual must answer for himself or herself.

They must learn—and the sooner, the better—how to look over their own shoulders. Social learning can help them do so.

Cognitive-behavioral modification techniques, considered next, have been developed with the goal of teaching students self-regulation.

iMPLICATIONS FOR TEACHING

Social learning can be used to help you and your students accomplish the objectives outlined here (see Bandura, 1986a, 1986b; Schunk, 1987):

- **Acquire new behavior.** As an instructor, one of your main goals will be to teach students behavior you want them to acquire. These behaviors include how to interact with peers and adults, how to read effectively, how to think critically and creatively, and how to write clear sentences, for example. Serving as a role model is one of the most effective means you have for teaching your students (Schunk, 1987, 1996a, 1996b).
- **Manifest already learned behavior.** Often, your students will know what they need to do, but they may need your role modeling to compel them to do it or to do it more often. By showing respect for others, for example, you encourage students to manifest the behavior they already have available but may not quite be ready to display.
- **Strengthen or weaken inhibitions to action.** Inhibitions can prevent someone from doing something he or she ought not to do, such as taking drugs. Inhibitions can also prevent someone from doing something she or he should do, such as learning math or science. As a teacher, you can serve as a model for inhibiting certain behavior and for diminishing the inhibition of other behavior.
- **Direct attention toward what is important.** In the classroom, in reading, and in life more generally, children need to learn what is important and what is not. Some teachers seem to pay attention to the smallest details of students' behavior or work, without seeing either in a larger context. Your behavior can provide the larger context, as well as suggest which of the details are the important ones.
- **Arouse appropriate emotions.** Enthusiasm is contagious. Expert teachers convey the enthusiasm they have for subject matter and the repulsion they feel toward inappropriate behavior such as cheating. In this way, they help students learn both how to behave and how to feel about the way they behave.

Cognitive-Behavioral Modification

Throughout the chapter, we have talked about how to use behavioral principles in the classroom. We have also pointed out the role of cognitive processes in each kind of behavioral learning. Some researchers suggest, for example, that predicting contingencies of conditioned stimuli involves cognitive processes. The effectiveness of antecedents in operant conditioning, such as behavioral cues or contracts, depends heavily on a student's cognitive activity. Bandura's ideas about social learning emphasized that cognitive processes are as important as observable behavior. In discussing further ways to apply these concepts in the classroom, we again find that the division between behavioral and cognitive perspectives is a fuzzy one. Indeed, many techniques for shaping behavior use a combination of the two perspectives to produce the most effective results.

Cognitive-behavioral modification techniques use a combination of cognitive and behavioral learning principles to shape and encourage desired behavior. In cognitive-behavioral techniques, learners' thoughts become either discriminative stimuli to which the learners respond, or reinforcing stimuli, as in the case of self-reinforcement (Schunk, 1996a, 1996b). Not surprisingly, giving students instructions that are based on cognitive and behavioral

principles of learning work better than instructions based only on behavioral principles. One idea that has had very promising results is self-instruction.

Students can use a set of steps to engage in **self-instruction**—that is, teaching themselves (Meichenbaum, 1977). In this way, self-speech can be used to organize behavior. In Chapter 2, we described Vygotsky's (1962) idea that mature thinking is basically inner speech. Children develop the capacity for inner speech by learning external speech through talking with others. In general, people do talk to themselves when they are given difficult problems to solve. Here are the steps of self-instruction (Meichenbaum, 1977):

Scott Cunningham/Merrill

A teacher guides one of her students in solving a difficult problem.

1. **Demonstration by model.** A model demonstrates the performance to be modeled. Models are typically adults, but expert students also can serve as models. For example, consider a teacher demonstrating how to solve addition with carrying. The teacher speaks aloud while he or she is performing the task. In this way, the student can become aware of the thought processes the model engages in while carrying out the needed steps.
2. **Modeling with overt adult guidance.** The learner then performs the same actions while talking aloud. At the same time, the model supervises the learner's performance. For example, a student might solve the addition problem, talking aloud while doing so. The teacher guides the student on what he or she is doing correctly and incorrectly.
3. **Modeling with overt self-guidance.** The learner now performs the task while instructing himself aloud, without the guidance of the model. In essence, the learner is guiding himself. For example, the student solves the addition problem with carrying. He says to himself to carry over the ten digits from the ones to the tens column, and to do the same for the hundreds digits, moving them from the tens to the hundreds column.
4. **Modeling with faded self-guidance.** The learner does the same as in step 3, except now whispering the self-instructions rather than saying them aloud.
5. **Modeling with covert self-guidance.** The learner again models the behavior, but by speaking silently to himself or herself. The behavior has now been internalized through this inner speech.

Brenda Manning (1991) suggests that teachers can consistently model self-instruction by talking through the steps of doing tasks aloud. For example, a teacher can demonstrate the steps of writing a research paper by saying:

> *Okay, how should I start? Get my notes. Get the materials. Before writing, I should look at this stuff, organize my ideas. As I read, I will jot down the main points. I will then make them into an outline that makes sense. I need some other information. I will find it now, before I start writing. At last, I am ready to plan the composition. What would be a good way to open the paper to catch the teacher's attention? What did she like and dislike about my last paper? What should I do differently this time?*

Teachers perceive students who have received self-instruction training as more self-controlled and on task more of the time than students who are not trained in self-instruction (Manning, 1988). Students who receive the training also believe themselves to be more in control of their behaviors. One girl went from being on-task 15 percent of the time before receiving training in self-instruction to being on-task 80 percent of the time after training (Manning, 1990). This gain persisted for three months after training had ended.

Self-instruction can be used effectively with a number of different student groups. Children as young as preschoolers have been taught to use self-speech, including self-questioning, to resist temptations and to improve their performance on intellectual tasks (Fjellstrom, Born, & Baer, 1988; Patterson & Mischel, 1976). Research has also explored using self-instruction techniques to help students with special needs. The techniques have helped impulsive children become more reflective, have enhanced the reading comprehension of

students with learning disabilities, and have improved the ability of students with mental retardation to apply problem-solving skills in new situations (Graham & Wong, 1993; Meichenbaum & Goodman, 1971).

The principles of operant conditioning, and of social learning, can be used in self-instruction. An important part of many self-instruction programs, for example, is training students to become more expert in self-reinforcement. Through such programs, individuals learn how to provide their own rewards and punishments, and not always have them provided by others. In fact, one study concluded that two of the most effective self-instruction techniques for hyperactive children are to use self-talk to interrupt impulsive behavior and to give themselves reinforcement for regaining control (Zentall, 1989).

Self-instruction training brings lasting benefits to both teachers and students. This training gives students their own internalized set of rules and procedures to get things done. Systems based on external reinforcement and punishment take a lot of the teacher's energy to maintain. Without such reinforcements or punishments, the desired behavior may not occur. Self-instruction training, by contrast, gives students the internal understanding of what they're doing and why, and the motivation to keep on doing it. This motivation may persist even long after a particular teacher or class is just a picture on the wall. All in all, self-instruction is one of the more exciting and promising approaches being used in education today.

SUMMING IT UP

WHY UNDERSTANDING BEHAVIORAL LEARNING IS IMPORTANT TO TEACHERS

- Learning is a relatively permanent change in the behavior, thoughts, or feelings of an organism that results from experience. Behavioral accounts of learning deal with the causes of and changes in observable behavior. Cognitive learning models, in contrast, deal with mental processes.

LEARNING BY CLASSICAL CONDITIONING

- Classical conditioning is one of the two main types of conditioning. In classical conditioning, an unconditioned stimulus (US), which produces an unconditioned response (UR), is paired with a conditioned stimulus (CS), which originally does not produce such a response. After repeated pairings, the conditioned stimulus may come to elicit a conditioned response (CR). The CS and US must occur close together in time. Despite appearances, classical conditioning is largely a cognitive phenomenon that occurs as a result of learning contingencies—the connections—between stimuli and responses.
- Once learning has been acquired, it can be extinguished—that is, it is no longer demonstrated. The phenomenon of spontaneous recovery, however, illustrates that learning has taken place or been maintained even though performance does not reflect it.
- Although learning typically takes place in response to a particular stimulus, we show both stimulus generalization and stimulus discrimination in our ability to respond appropriately to different stimuli.

LEARNING BY OPERANT CONDITIONING

- Operant conditioning, unlike classical conditioning, is largely learner controlled. Behaviorists, such as B. F. Skinner, have studied humans and animals to determine how the consequences of a behavior affect the likelihood of the behavior recurring. The law of effect states the basic principle of operant conditioning: Responses are strengthened when rewarded. The particular behavior targeted in any operant conditioning procedure is called the operant.
- Unwanted behavior can be reduced through punishment. Presentation punishment is the administration of an aversive, or unpleasant, stimulus; removal punishment is the withholding of a positive stimulus. Common classroom punishments include time-out, response cost, and satiation. Punishment easily can be misused or backfire, so teachers must use it only as a last resort and with care.
- Positive and negative reinforcement both involve rewards, or reinforcers. In the latter case, the reward is in the removal of the organism from an uncomfortable or even painful situation. The Premack principle can be used to produce desired behavior by taking into account the hierarchy into which reinforcements are organized. Teachers should also distinguish between primary reinforcements, such as food, and secondary reinforcements, such as grades.
- People do not usually receive continuous reinforcement. Instead, reinforcement is usually partial, provided on some sort of intermittent schedule. Common schedules of reinforcement include ratio schedules, both fixed ratio

and variable ratio, and interval schedules, both fixed interval and variable interval. Each schedule has a different effect on behavior.

- Antecedent events, or cues, help alert students to the potential consequences of their behavior. A formal agreement regarding desired behavior and its consequences is called a contingency contract.
- Teachers often apply the principles of operant conditioning as part of behavioral modification plans for their students. Reinforcements can be used to shape desirable behavior through the method of successive approximations, in which reinforcement is progressively given for behavior that comes closer and closer to the behavior ultimately desired.

SOCIAL LEARNING

- Social learning takes place when students learn from watching other individuals' behavior and then model the behavior they have learned. The salience of the model may affect the amount of social learning that takes place. Social learning can be used to teach new behavior, encourage students to show (or avoid showing) behavior they already have learned, or to arouse emotions in students. Attention is a key to social learning.
- The consequences observed along with a certain behavior may vicariously reinforce learning, thereby encouraging learning, as can certain characteristics of the individuals demonstrating the behavior. Students also can learn self-reinforcement. These ways of receiving reinforcement are in addition to direct reinforcement.

COGNITIVE-BEHAVIORAL MODIFICATION

- The goal of education, in general, and cognitive-behavioral modification, in particular, is to encourage self-regulation in students. The idea of cognitive-behavioral modification shows once again how closely related the behavioral and cognitive approaches to learning can be. Teachers can use the techniques of cognitive-behavioral modification to help students learn self-instruction, whereby the students teach themselves.

KEY TERMS AND DEFINITIONS

- **Addictions** Persistent, habitual, or compulsive physiological or at least psychological dependencies on one or more psychoactive drugs. Page 242
- **Aversive stimulus** Something unpleasant that can produce a negative emotional response. Page 241
- **Behavioral modification** Changing students' behavior by managing the contingencies, or consequences, of that behavior. Page 254
- **Behavioral approaches to learning** Approaches to learning that focus primarily on changes in observable behavior, rather than on internal mental processes. Page 236
- **Classical conditioning** Learning process in which an originally neutral stimulus becomes associated with a particular physiological or emotional response (or both) that the stimulus did not originally produce. Page 237
- **Cognitive-behavioral modification** Learning techniques that use a combination of cognitive and behavioral learning principles to shape and encourage desired behavior. Page 262
- **Conditioned emotional response (CER)** Emotional response that has developed through the process of classical conditioning. Page 241
- **Conditioned response (CR)** Physiological or emotional response that is elicited from a conditioned stimulus as a result of classical conditioning. Page 238
- **Conditioned stimulus (CS)** Originally neutral stimulus that comes to elicit a response as a result of classical conditioning procedures. Page 238
- **Contingency contract** Written or oral agreement between student and teacher specifying desired behavior and promised reward. Page 251
- **Continuous reinforcement** Operant conditioning schedule of reinforcement in which a reinforcement always follows a particular desired behavior. Page 249
- **Counterconditioning** A technique in which the positive association between a given unconditioned stimulus and a given conditioned stimulus is replaced with a negative one by the substitution of a new unconditioned stimulus that has a different unconditioned response. Page 242
- **Direct reinforcement** Rewarding individuals for behaving the way you wish them to. Page 260
- **Extinction** Phase of classical conditioning during which conditioned responses occur less and less frequently in response to a conditioned stimulus, and eventually stop. Page 240
- **Interval schedule of reinforcement** Operant conditioning schedule of reinforcement in which reinforcement is given for the first response after a certain amount of time has passed. Page 249
- **Law of effect** Thorndike's explanation for operant conditioning, which states that those actions that are rewarded tend to be strengthened and more likely to occur in the future, whereas those actions that are punished are weakened and thus less likely to occur in the future. Page 244
- **Learning** Any relatively permanent change in the behavior, thoughts, or feelings of an organism that results from experience. Page 236
- **Model** To behave as the role model has behaved. Page 259
- **Negative reinforcer** Operant conditioning involving the removal of an aversive stimulus soon after an operant response, thereby strengthening the response. Page 246
- **Neutral stimulus** Stimulus that does not evoke any particular response until it becomes linked with a conditioned response via classical conditioning. Page 237
- **Operant** Active behavior that the organism uses to operate on the environment. The basic unit studied in operant conditioning. Page 243
- **Operant conditioning (instrumental conditioning)** Learning produced by the rewards and punishments of active behavior (an

operant) of a human or other organism interacting with the environment. Page 243

- **Partial reinforcement (intermittent reinforcement)** Schedules of operant conditioning reinforcement in which desired behavior is reinforced only some of the time. Page 249
- **Positive reinforcer** Operant conditioning in which a positive reinforcer is paired with an operant response, thereby strengthening the response. Page 246
- **Premack principle** Law of operant conditioning that states that more preferred activities reinforce less preferred ones. Page 249
- **Presentation punishment** Application of an unpleasant stimulus to discourage a response. Page 252
- **Primary reinforcers** Operant conditioning rewards, such as food or shelter from the elements, that provide immediate satisfaction or enjoyment. Page 246
- **Punishment** Use of a stimulus that decreases the probability of a response, either through the application of an unpleasant stimulus or through the removal of a pleasant one. Page 252
- **Ratio schedule of reinforcement** Operant conditioning schedule of reinforcement in which a certain number of desired operants are reinforced without respect to the passage of time. Page 249
- **Reinforcer** Stimulus that increases the probability that the operant associated with it will happen again. Page 246
- **Removal punishment** Taking away a pleasant stimulus to discourage a response. Page 252
- **Response cost** Form of punishment in which a small penalty is imposed for each instance of the undesirable behavior. Page 253
- **Satiation** Compelling individuals to continue a behavior until they are tired of it. Page 253
- **Schedule of reinforcement** Certain pattern by which reinforcements follow operants during operant conditioning procedures. Page 249
- **Secondary reinforcers** Operant conditioning rewards that gain reinforcement value through their association with primary reinforcers. Page 246
- **Self-instruction** Teaching of oneself. Page 263
- **Self-regulation** Control of one's behavior. Page 261
- **Self-reinforcement** Administration of reinforcers to oneself. Page 260
- **Social learning (observational learning, vicarious learning)** Learning that takes place when people learn from observing the behavior of others and the environmental outcomes of others' behavior. Page 259
- **Spontaneous recovery** Classical conditioning phenomenon in which a conditioned response returns after an extinction period. Page 240
- **Stimulus discrimination** Classical conditioning mechanism whereby an individual distinguishes between the conditioned stimulus and another stimulus that is sufficiently unlike it so as not to elicit the same (or possibly any) level of conditioning. Page 240
- **Stimulus generalization** Classical conditioning mechanism by which stimuli similar to the original conditioned stimulus can elicit the same conditioned response. Page 240
- **Successive approximation** Operant conditioning method of teaching complex behavior by rewarding behavior that comes closer and closer to the desired behavior. Page 255
- **Temporal contiguity** Principle of classical conditioning that states that the mere closeness in time between the conditioned stimulus and the unconditioned stimulus helps explain conditioning. Page 239
- **Time-out** Punishment by enforcing a brief period of social isolation. Page 253
- **Unconditioned response (UR)** An organism's natural response to a stimulus, which occurs without any conditioning. Page 238
- **Unconditioned stimulus (US)** Stimulus that elicits a physiological or emotional response (or both) before any conditioning takes place. Page 238
- **Vicarious reinforcement** Reinforcement that occurs through the observation of someone else's behavior being reinforced. Page 260

QUESTIONS AND PROBLEMS

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

1. How could you use the principles of classical conditioning to start a lifelong love of reading in your second graders?
2. Describe how you could set up a token economy or other operant conditioning system that would reward fourth graders for cooperative behavior during group projects. Is there a way you could eventually phase out the reward program, yet still expect cooperative behavior from your students?
3. What are some ways you could avoid punishing your third-grade students, yet still reduce the frequency of insults and name-calling in class?
4. You have just witnessed several of your first graders during recess reenacting violent scenes from a popular movie. What are some ways you can counteract this negative example of social learning?
5. What kind of a cognitive-behavioral modification program would you set up to help fifth-grade students begin to check their own math homework?

IN MIDDLE SCHOOL

1. Which steps could you take to reduce the anxiety of a student who becomes too nervous to speak when called on during pronunciation practice in your eighth-grade Spanish class?
2. Some of the students in your seventh-grade biology class have been making crude jokes and profane comments during the lab session on animal reproduction. How can you use operant conditioning principles to stop this behavior?

3. What are some ways you can use social learning principles to help students in your social studies class develop and internalize map-reading skills?
4. Who would you point out as a model of nonviolent behavior for students in your seventh-grade social studies class?
5. Your sixth-grade English students are used to receiving small rewards, such as stickers or pencil erasers, whenever they finish reading a book. How can you move them from this continuous reinforcement schedule, with rewards provided by you, to a partial reinforcement schedule and, eventually, to a point at which they reinforce themselves for reading books?

IN HIGH SCHOOL

1. It is halfway through the academic year, but your first-year English students are still depending on you to give them instructions every time they have to do library or Internet research for a paper. How can you get them to internalize research skills?
2. You have been allowing students who have completed their physics homework by Friday 15 minutes of "free exploration" time in the lab at the end of each Friday's class session. The students seem to like this opportunity and most of them turn in their papers, but you have recently noticed that the students seem to turn in homework only on Thursdays, leaving you with a pile of grading to do each weekend. How can you change your reinforcement schedule to get students to do homework all week long?
3. A number of students in your life-skills class will be seeking their first full-time jobs immediately after graduation. How could you use social learning principles to help these students learn effective job search and interview skills?
4. How could you help a student in your junior-level biology class who has become classically conditioned to feel queasy and faint whenever the class discusses animals of any kind?
5. What kinds of rewards do you think might be effective for increasing the amount of homework your remedial math students turn in on time?

MY FIRST
BOOK OF
TIME

Cognitive Approaches to Learning

8

CHAPTER OUTLINE

Why Understanding Cognitive Approaches to Learning Is Important to Teachers

The Standard Memory Model

Encoding Knowledge into Three Memory Stores

Types of Storage in Long-Term Memory

Explicit versus Implicit Memory

Alternative Models of Memory

Connectionist Models

The Working-Memory Model

The Levels-of-Processing Model

Retrieving Information

Tasks Used to Assess Students' Memories

Facilitating Students' Retrieval

Retrieval Failure

Biology of Memory

Constructivist Approaches

Constructivist Approaches to Memory

Constructivist Approaches to Learning

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this chapter:

- How is information entered or encoded into memory? How do we go from seeing or hearing information, to learning the information, to putting it into memory?
- How is information stored in memory? What are the different kinds of memory storage that people use?
- Which models have been proposed to account for how information is stored in memory?
- How do we retrieve information from memory? Which factors influence remembering and forgetting?
- What can people do to improve their memories? Which specific techniques can students and teachers use to enhance their memories?
- How do the conditions under which we learn something influence our likelihood of remembering and using the information?

Bill Norton is pleased. He has finally found a way to help the eighth-grade pupils in his fifth-period English class remember their vocabulary words! On a recent vocabulary test, the average score was a discouraging 59 percent. This poor result occurred even after Bill had spent a whole class period conducting a review drill with the students. He had said each word on the vocabulary list. The class had then repeated the definition in unison. Bill had reviewed the list with the students three times, noticing each time that the definitions seemed to come out a little more rapidly. He had been confident that the students were learning the words and their meanings. The test scores seemed to prove, however, that repetition drills were not the best way to teach vocabulary words.

Bill realized that he had to rethink his plan. He had read an article in a magazine for teachers that described ways several expert teachers taught new concepts and terms by making them interesting and meaningful for students. Making the terms more interesting certainly made sense, based on Bill's own school experiences. So he decided to make the vocabulary words more meaningful to his own students. He began by introducing the vocabulary words in the context of the novel the class was reading. Before the class read the assigned chapters, Bill supplied each student with a worksheet listing the vocabulary words. Instead of giving the students the definitions for the words, this time Bill asked the students to use their own words to supply the definition for each new term themselves. In the review session, Bill read off each word and called on one of the students to read his or her definition of the word. He clarified any answers that seemed off-track. Then, for each word on the list, he asked several students to use the word correctly in sentences they created about their own lives. The scores on the next test showed that Bill's new method worked a lot better—the average score was now 82 percent!

Clearly, something was wrong with Bill Norton's original method of teaching vocabulary words. In terms of cognitive theories of learning (the subject of this chapter), Bill had made several mistakes. Here, we consider what those mistakes were. We also discuss why Bill's next plan to raise vocabulary scores was so successful.

In Chapter 7, which explored behavioral approaches to learning, we focused on changes in behavior. In this chapter, we discuss the changes in thought: cognitive approaches to learning. Learning is any relatively permanent change in thought or behavior that occurs as a result of experience. **Cognitive approaches** focus on the changes in thought that are part of learning. They differ from behavioral approaches in that they emphasize the mental mechanisms that underly the processing and representation of information during learning.

One cognitive function that plays a key role in learning is memory. **Memory** is the active mental mechanisms that enable people to retain and retrieve information about past experience (Baddeley, 1999; Crowder, 1976). For learning to take place—that is, for any changes in thought or behavior to be "relatively permanent"—students must remember their experiences.

How do students learn and remember? We consider a number of models of memory in this chapter. We also discuss the implications of each for how well students remember information and how useful their memorized knowledge is. We further consider the importance of the **context,** or learning environment, to memory and learning.

Why Understanding Cognitive Approaches to Learning Is Important to Teachers

To get a feel for some of the topics of this chapter related to the nature of learning and memory, read the following passage and see if you can figure out what it describes:

The procedure is actually quite simple. First you arrange items into different groups. Of course, one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities, that is the next step; otherwise, you are pretty well set. It is important not to overdo things. That is, it is better to do too few things at once than too many. In the short run, this may not seem important but complications can easily arise. A mistake can be expensive as well. At first, the whole procedure will seem complicated. Soon, however, it will become just another facet of life. It is difficult to foresee any end to the necessity for this task in the immediate future, but then, one can never tell. After the procedure is completed, one arranges the materials into different groups again. Then they can be put into their appropriate places. Eventually they will be used once more and the whole cycle will have to be repeated. However, that is part of life.

Most people find this passage (from Bransford & Johnson, 1972; cited in Bransford, 1979, pp. 134–135) difficult to understand and perhaps even meaningless. Our lack of context for the passage makes it difficult. We are unable to apply much of our prior knowledge because we do not know what kind of knowledge to use—we do not have a context. Suppose, however, you were told the title is "Washing Clothes." Now reread the passage. You will find it makes perfect sense! The procedure described in the passage has been transformed from something nearly incomprehensible to a familiar, commonplace experience. You now have a context. A context sets up expectations for what you are about to read, making it easy to apply your prior knowledge. Cognitive approaches to learning have become popular among educators because they can be so directly applied to help students learn (Anderson, 1995; Bruer, 1993; Goodrich Andrade & Perkins, 1998).

This demonstration points out that learning is more complicated than simply seeing or hearing something and then committing it to memory. You can memorize the passage here word for word without ever knowing the topic, for example. Of course, it will probably be of little use to you in the future. Knowledge committed to memory without adequate understanding is inert, or unavailable for full use (Bransford, Burns, Delcos, & Vye, 1986). Although memory is key to learning, memorizing information without knowing how to apply it represents incomplete learning.

Like researchers, teachers want students not only to remember the material they are taught but also to be able to use that material later. Expert teachers are always looking for ways to ensure that students are able to use what they learn. There are many such uses—whether on tests and assignments, or in future classes, or outside school when students need to write a letter, balance their checkbooks, or build shelves for their home theater equipment. The teachers know that if there is a fundamental principle of teaching subject matter, it is to make the material meaningful to the students. If possible, the material should also be relevant to students' lives (Schank & Joseph, 1998).

Obviously, memory is an important part of the learning process. Understanding what we know about the workings of memory can help expert teachers create memorable lessons that will be the foundation of complete learning.

The Standard Memory Model

A number of alternative models explain exactly what happens when information is stored in memory. Most of these models have in common three basic operations: encoding, storage, and retrieval.

- *Encoding* refers to how you transform a sensory input into some kind of representation that you can place into memory.
- *Storage* refers to how you retain encoded information in memory.
- ***Retrieval*** refers to how you gain access to information stored in memory.

For example, suppose a teacher wants his students to learn vocabulary words. The first thing the students need to do is to see the words on the printed page. Then they must place

THINKING ANALYTICALLY

An English teacher presents a new vocabulary word and its meaning. The next week, the teacher gives a quiz that asks the students to write down the word's meaning. How might the concepts of encoding, storage, and retrieval apply to the learning of the vocabulary word? Be specific.

SUGGESTION: Encoding is involved in placing the word and its corresponding meaning into memory. Storage is involved in keeping them there. Retrieval is involved in taking them out of memory when they are needed.

the sensory information they absorb from the page into their memories (encoding). Next, they have to keep that information in memory (storage). Later, they have to get the information out when they are tested (retrieval).

Typically, encoding, storage, and retrieval are viewed as sequential stages. First you encode the information. Then you store it. Later you retrieve it. However, the three processes are also interactive. For example, students usually learn information better if they test themselves periodically. In other words, contrary to Bill Norton's first procedure, students should not just repeat to themselves the definitions of vocabulary words, but rather should test themselves as they go along. With this approach, they alternate between encoding, storage, and retrieval. Such a procedure is more effective than students doing only encoding and storage and hoping that retrieval will work when they later take a test.

As illustrated in Figure 8.1, the standard model of memory assumes there are three basic kinds of memory storage (Atkinson & Shiffrin, 1968; see also Waugh & Norman, 1965, for a related model). For a student to remember something, the information must be encoded in three steps. In each stage, it goes from one memory storage area to the next.

ENCODING KNOWLEDGE INTO THREE MEMORY STORES

The first store of memory is a **sensory register.** Here much information is first stored when it is sensed. The sensory register is capable of holding relatively small amounts of information for brief moments of time.

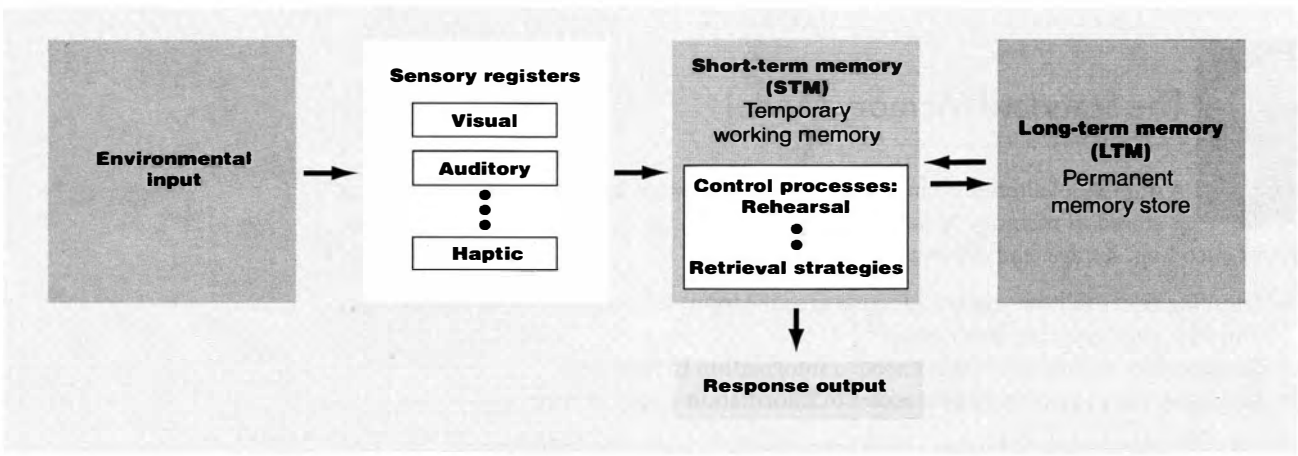
The second store is **short-term memory.** This store is capable of holding relatively limited amounts of information for a matter of seconds and, in some cases, up to two minutes.

The third store is **long-term memory.** It has very large—possibly unlimited—capacity. It is capable of storing information for very long periods of time, possibly indefinitely.

As you can see, the three kinds of storage differ primarily in terms of the length of time information is held in them. They also differ in several other respects, including the form in which the information is represented, the amount of information that is lost or forgotten, and the way information is lost. For example, information can be lost from the sensory register in less than one second. In contrast, once knowledge makes it into long-term memory, it may remain there for much or all of the rest of a person's life.

■ **THE SENSORY REGISTER** The sensory register is where much information is first stored when it is sensed. This register holds an accurate representation of every sensation, but holds that information for only a very brief time (Crowder & Surprenant, 2000). When you first see something, the image of that thing is placed into sensory memory. You see in your

FIGURE 8.1 Characteristics of Three Memory Stores in the Standard Memory Model



mind an image of all or part of what you have seen on a page, or on a television screen, or elsewhere in the environment. Sensory memory is precategorical. In other words, it stores information we have not yet understood and categorized.

If you have ever "written" your name with a lighted sparkler on the Fourth of July, you have experienced the persistence of sensory memory. You briefly "see" your name. In reality, the sparkler leaves no physical trace. Visual sensory memory lasts for only about one second. It can hold only about nine items in memory. When one blinks voluntarily or suffers from a cognitive impairment, the visual memory degrades even more quickly (Lu, Neuse, Madigan, & Dosher, 2005; Thomas & Irwin, 2006). An auditory sensory memory may exist, though the evidence supporting it is inconclusive (Cooper, Todd, McGill, & Michie, 2006; Crowder & Surprenant, 2000; Darwin, Turvey, & Crowder, 1972; Greene & Crowder, 1984; Spoehr & Corin, 1978; Watson, Titterington, Henry, & Toner, 2007).

The sensory register gives students a chance to catch important information that they might otherwise have missed. Suppose, for example, that a student's attention wanders for a moment away from the teacher's notes on an overhead projector. Suddenly the student notices that the teacher is saying "and this term will be on the test." That student would have only about a second to shift attention and transfer the information to the next store, that of short-term memory.

■ **SHORT-TERM MEMORY** As noted earlier, sensory memory holds information for only about a second. Short-term memory, in contrast, can hold information for as long as a minute or two. You use short-term memory when you look up a number in the phone book and try to hold it in memory long enough to enter it into the telephone. Similarly, sometimes teachers say something, and then check whether the students have listened by immediately or almost immediately asking students what they just said. In doing so, the teachers are checking whether the students have placed the information into their short-term memory.

Information will disappear rapidly from short-term memory unless you take action to ensure its survival. This action is typically rehearsal. **Rehearsal** is the repeated recitation of an item. For example, sometimes you repeat a phone number to yourself over and over again. In doing so, you are more likely to remember it.

Rehearsal may seem like a natural, inborn process. You know to keep saying the number over and over again. Perhaps no one ever explicitly told you to do so. Even so, rehearsal is a learned process. In fact, as we discussed in Chapter 2, a major difference between the learning of younger and older children is in the differential use of strategies by the two groups (Flavell & Wellman, 1977; Moses & Baird, 1999; Schraw & Moshman, 1995). Rehearsal is an example of such a strategy. Younger children's knowledge and control of their memories—skills referred to as **metamemory** skills—are generally poorer than are those of older children (Friedman, 2007). That is, older children have developed more expertise in using their memories. Metamemory skills in later childhood are strongly related to both language and theory-of-mind abilities in early childhood (Lockl & Schneider, 2006, 2007). The strategies to assist memory described later in this chapter also make use of metamemory skills. They are learned ways in which we can improve our learning and memory.

For rehearsal to succeed, you need to do more than just mindlessly repeat words. You must make an active effort to encode and store the information. Indeed, rehearsal is the major way in which people can transfer information from short-term memory to a more nearly permanent form of storage, which we consider soon. Recall Bill Norton, the teacher in the vignette at the beginning of the chapter. In his first attempt to teach vocabulary words, Bill had his students repeat back definitions again and again. He did nothing to encourage his students to actively process the information they were repeating. The result was that little learning took place. Mere repetition of words is not sufficient to guarantee learning (Tulving, 1966).

Short-term memory holds roughly seven items, plus or minus two (Baddeley, 1994; Miller, 1956; Thompson, 2000). The actual amount of information that short-term memory can hold depends, in part, on how the information is encoded. For example, suppose you simply try to remember as separate numbers 1-6-2-0-1-7-7-6. You probably cannot hold much more in memory than these eight digits. Now suppose instead you reencode the digits as the year in which the Pilgrims landed and the year in which the Declaration of Independence was signed.

Then you are storing these eight numbers as just two pieces of information, or chunks of information. **Chunking,** or grouping items of information, expands the amount of information you can store in short-term memory.

■ **LONG-TERM MEMORY** When people talk about memory, they typically are talking about long-term memory (also called the long-term store). Much of who you are is determined by your long-term memory. This form of memory can hold essentially unlimited amounts of information. Moreover, it can hold the information for extremely long periods of time, perhaps forever. How well information is encoded into long-term memory depends on how the information is learned.

One important principle of learning is called the **total-time hypothesis.** It suggests that how much you learn typically depends on how much time you spend studying. Within a given study session, you can budget your study time in different ways. According to this hypothesis, the results will be similar for each study session. For example, if a student is learning vocabulary words, the student can study each word once for one minute, or each word twice for thirty seconds. Because the total study time for each word within the session was the same, it will probably make little difference.

There are three constraints on the total-time hypothesis, however (Cooper & Pantle, 1967). First, you must use the full amount of time allotted for study actually to study: Daydreaming doesn't count! Second, you must encode the information in a way that is consistent with the way in which you are tested. For example, suppose you need to recall words in order. In such a case, you will do well on a test only if you memorized the order of the words as well as the words themselves. Third, you must **elaborate** the information as much as possible, thinking about it carefully and associating it with other things you know.

The third constraint is the basis for an important principle of learning. Learning psychologists distinguish between two kinds of rehearsal strategies: maintenance rehearsal and elaborative rehearsal. In **maintenance rehearsal,** you simply repeat items to be learned. This is what Bill Norton's students did before their first vocabulary test. Such rehearsal may be useful for keeping items in short-term memory for small amounts of time, but it is less useful for transferring information to long-term memory. The other kind of rehearsal, **elaborative rehearsal,** involves taking the information to be learned and trying to associate it with other things you know. You may also use elaborative rehearsal to try to associate various items of the to-be-learned information (Willoughby, Wood, & Khan, 1994). This kind of rehearsal is generally more useful if you want to retain information over time in long-term memory.

Research has shown that maintenance rehearsal, such as simply repeating flash cards, is not as helpful for encoding long-term memory as elaborative rehearsal.

Table 8.1 summarizes the characteristics of the three kinds of memory in the standard model.

Bill Norton's students improved their vocabulary scores when they used elaborative rehearsal to learn the vocabulary words. This strategy resulted in the words becoming more firmly implanted in their memories. To encourage the students to use elaborative rehearsal, Bill related each word to the assigned reading. He also asked each student to craft a meaningful sentence for each word related to the student's own experience. He could have asked students to write a sentence with a word they already know that means about the same thing as the new word being learned. Or, he could have asked students to say to what extent each word could be used to describe someone in their family. These techniques are all likely to lead to a deeper level of processing.

Scott Cunningham/Merrill

Maintenance rehearsal is learning through repetition with little attempt to add or find meaning in the information. It is sometimes known as **rote learning.** In U.S. schools, this kind of learning was more prevalent in the past than it is today (Johnson, 1994). It is also more common outside the United States than within this country.

TABLE 8.1 The Three Memory Stores of the Standard Model

Name	Type of Information Stored	Amount of Information Stored	How Long Memories Last	Examples
Sensory register	Visual (and possibly auditory)	About nine items	Up to one second	The image left after "writing" name with a sparkler, or after a teacher turns off an overhead projector
Short-term memory	Information that is being currently used	Five to nine items; storage can be increased by chunking information into groups	Up to one minute without rehearsal	A telephone number; a list of vocabulary words
Long-term memory	Information that has been learned or encoded for long-term storage	Possibly unlimited	Possibly for life	The square root of 144 is 12; the name of your favorite candy bar; how to open your bicycle lock

Schools and students in Asian countries are often stereotypically portrayed as relying heavily on rote learning (Kember & Gow, 1991; Watkins, Reghi, & Astilla, 1991). The comparative advantage of Asian students on standardized tests in some academic areas is sometimes used as a basis for calls for a return to more rote learning in the United States. The Forum feature, "Is There Ever a Need for Rote Memorization?", explores whether there are some cases in which rote learning is, indeed, the most appropriate strategy.

FORUM

IS THERE EVER A NEED FOR ROTE MEMORIZATION?

Much of the information covered in this chapter suggests that students learn better when information is meaningful to them. The standard model of memory suggests that elaborative rehearsal is more effective for encoding information in long-term memory. Constructivist approaches to memory suggest that new knowledge must build on previous knowledge. Are there ever times when students need just to memorize information by rote, or simple repetition without elaboration?

FIRST VIEW: Rote memorization is unnecessary. Many educators say there is never any need for students to subject themselves to the process of repetitive or rote memorization. Even information typically learned by rote can be learned in more meaningful ways. For example, theatrical lines, which are generally learned using repetition methods because they must be spoken word for word as written, are actually recalled better by actors who first comprehend the meaning, or gist, of their lines (Noice, 1993).

Furthermore, some theorists suggest that information simply memorized without meaning is inert—that is, students can never make full use of the information. One group of researchers compares inert knowledge to tools (Brown, Collins, & Duguid, 1989). A person can acquire a tool and not be able to use it. In the same way, a person can acquire knowledge, such as facts or formulas, that he or she is not able to use. Many researchers claim that knowledge acquired through rote memorization is more likely to be inert than is knowledge that is learned in more meaningful ways.

Finally, proponents of meaningful learning methods point out that students prefer such methods over rote repetition methods (Yuen-Yee & Watkins, 1994). Students who enjoy the learning methods used in their classes are less vulnerable to boredom and other problems that can undermine learning and teaching.

THINKING PRACTICALLY

Suppose a student comes to you and says that she spent a lot of time studying for a history test, with disappointing results. She describes how she studied, and you recognize that she used maintenance rehearsal: She repeated several times each day a long list of facts, dates, and figures about World War II. How might you help this student to improve her performance on the next test?

SUGGESTION: Encourage her to spend more time on elaborative rehearsal, associating the facts with each other, or with other information, and thus making the material more meaningful to her.

SECOND VIEW: Rote memorization can be useful. Some educators believe that, although currently unpopular, rote memorization continues to be a valuable learning technique. They believe that learning "by heart" through repetition is the most efficient way to encode some information. Examples are vocabulary words in both native and foreign languages (Cook, 1994). Information learned by heart may also be less likely to be forgotten. One study, for example, found that students who learned foreign language words by rote remembered more words than those who used a mnemonic method to learn the words (Wang, Thomas, & Ouellette, 1992). Finally, proponents of rote learning suggest that a base of memorized facts helps students better develop complex thinking and problem-solving skills (Rist, 1992).

THIRD VIEW: A SYNTHESIS. Teachers can combine the techniques of rote memorization, such as repetition and drilling, with more meaningful learning methods. In this way, they give their students the advantages of both methods. For example, teachers can have students practice vocabulary words by drilling with flash cards of the words. However, the students might use flash card drills with a more meaningful twist. Each time a student sees a word, for example, he or she might try to make up a new sentence using the word.

Teachers of older students can also explicitly teach students about the advantages and disadvantages of different ways of learning or memorizing information. They then can let students choose whichever method works best for them on given materials. Students may find that their improved awareness of their own memory and learning processes, or metacognition, will help them make more efficient use of their study time. They will become better able to distinguish information that needs more elaborative rehearsal from information that needs more repetitive rehearsal.

THINKING ANALYTICALLY

If, on one Friday, you introduce students to a list of vocabulary words or other facts to be learned, and you plan to test the students the following Friday, how would you suggest they study for the test?

SUGGESTION: Students should distribute their learning rather than massing it. Cramming is relatively ineffective as a means of study.

The total-time hypothesis applies within a single study session. If you look across sessions, however, the distribution of time becomes important. Suppose, now, that your students have to study for a test. In general, would they do better to cram as much as they can the night before, or to divide up the same amount of time across multiple study sessions? In fact, students generally do better to study via **distributed learning** (i.e., learning spaced out over several learning sessions) than via **massed learning** (i.e., learning that is crammed, occurring all at one time) (Bahrick & Phelps, 1987). Expert students and teachers know that cramming the day before a test, as Bill Norton's students originally did, is not a particularly effective way to learn. Moreover, even if you do remember the information for a test the next day, chances are you will forget it rather quickly thereafter. Bill Norton's new method of having students define the words as they read the novel, and then practice those words again later, led to better test scores. It also improved the chance that the students would remember the words for life.

TYPES OF STORAGE IN LONG-TERM MEMORY

We have talked about storage of information in long-term memory as though it were a singular phenomenon in all respects. In reality, it is not. For example, several kinds of long-term storage exist, each of which is important to us in different ways. Table 8.2 depicts the types of knowledge stored in long-term memory. As you can see in the table, the two main categories of long-term memories are declarative and procedural. There may also be a third category, conditional knowledge.

Mental representations are the ways in which knowledge is stored in memory (Von Eckardt, 1999). These representations preserve certain information about, and our interpretations of, objects and events in the world. They can be operated on by a variety of mental processes (McNamara, 1994). Concepts can be represented in multiple ways, and having multiple representations may later enhance recall of those concepts. It thus is useful for teachers to present information in multiple ways, such as orally and visually (Mousavi, Low, & Sweller, 1995). Next, we look in detail at declarative and procedural knowledge and the ways each is represented in long-term memory.

TABLE 8.2 Types of Knowledge Stored in Long-Term Memory

	Declarative ("Knowing that")	Procedural ("Knowing how")	Conditional ("Knowing why" or "Knowing when")
Type of memory used for storing it	Semantic memory: widely known facts Episodic memory: personal experiences	Procedural memory: ways to do things	Conditional memory: involves knowing when and how to apply the declarative and procedural knowledge you have
Form in which it is stored	Hierarchies or other organized networks of representations, either: Analogical (images) or Symbolic (propositions)	Ordered sequences of productions (condition–action sequences)	Cognitive strategies: information about the conditions under which certain declarative or procedural knowledge is useful
Examples	Knowing what you did with your best friend yesterday (episodic), or planning for your best friend's birthday (semantic); can be stored as a mental picture of you and your friend at the movies (analogical representation), or as a set of propositions to indicate the birthday (propositional representation)	Knowing how to ride a bicycle or write a research paper	Knowing when to stop doing research for a research paper

■ **DECLARATIVE KNOWLEDGE** **Declarative knowledge** comprises knowledge of facts stored in semantic or episodic memory. It is sometimes described as "knowing that" (Anderson, 2000; Sylvester, 1985). For example, you may know that the sun rises in the east and sets in the west. Category knowledge, such as that a cat is an animal, also is declarative (Gagné Yekovich, & Yekovich, 1993). Declarative knowledge can be divided into two types: semantic and episodic (Squire, 2004; Tulving, 1983). Each type of memory involves somewhat different kinds of information.

Semantic memory consists of long-term memories that hold our general knowledge—what a zebra is, what the word *bitter* means, and what the color of leaves on trees is in the spring (Tulving, 2000). Such information is not unique to people as individuals, and people usually do not even remember when they first learned the information.

Episodic memory comprises long-term memories that hold knowledge of personally experienced events, or episodes (Tulving, 2000). People use this kind of memory when they learn lists of words. They also use it when they need to recall something they learned in a particular personal context. For example, suppose you saw a fellow teacher, named Tom Gordon, in the principal's office yesterday. Remembering that you saw Tom there yesterday is an episodic memory. Your knowledge of Tom's name, however, is a semantic memory. The experience of seeing him yesterday is a personal, time-tagged experience. In contrast, Gordon's name is a general semantic fact, known to all, with no attached time tag.

A number of studies have demonstrated impairments in one but not both types of declarative memory. For example, in one study, children with amnesia formed new semantic memories in the absence of new episodic memory (Guillery-Girard, Martins, Parisot-Carbuccia, & Eustache, 2004).

Although we believe the distinction between semantic and episodic memory is useful, not all investigators of memory accept this demarcation (see, for example, Anderson, 2000; Baddeley, 1984; Eysenck & Keane, 1990; Johnson & Hasher, 1987; McKoon & Ratcliff, 1986; Richardson-Klavehn & Bjork, 1988). Expert teachers know that students learn facts, or semantic information, in the course of their everyday experiences. That is, they encode semantic knowledge along with episodic knowledge. If the experience or learning episode is memorable, students may be better able to recall the semantic knowledge (Martin, 1993). For example, suppose a chemistry teacher creates an explosion to demonstrate the body's metabolic processing of sugar. Students may, as a result, remember the facts about sugar metabolism more easily than they would have if they had learned the facts from a lecture or textbook.

Index Open

When this girl thinks about sunsets at another time, she will recall the mental image she formed while looking at this one.

Declarative knowledge is represented in memory in two main ways: analogical and symbolic representations (Kosslyn, 1995; McNamara, 1994). **Analogical representations** are declarative memories that preserve many of the aspects of the original stimulus, whether object or event (Anderson, 2000; Palmer, 1978). The most well-known analogical representation is mental imagery. Mental imagery is a mental picture that people believe looks like the objects or event they have seen. For example, suppose you see a beautiful sunset, and then imagine the sunset in your mind. You may well form a mental image of what the sunset looked like.

In one study of imagery (Kosslyn, Ball, & Reiser, 1978), research participants were shown a map of an imaginary island. The participants studied the map until they could reproduce it accurately from memory, placing the locations of each of the six objects in the map no more than a quarter of an inch from their correct locations.

Once the memorization phase of the experiment was completed, the critical phase began. Research participants were instructed that, upon hearing the name of an object read to them, they should follow a series of steps. In particular, they should picture the map, mentally scan directly to the mentioned object, and press a key as soon as they arrived at the location of the named object. This procedure was repeated a number of times, with the participants mentally moving between various pairs of objects on successive trials. The experimenter kept track of response times on each trial—how long it took to scan from one object to the next. An almost perfect linear relation was found between the distance separating successive pairs of objects in the mental map and the amount of time it took people to press the button. In other words, people seem to have encoded the map in the form of an image and actually to have scanned that image as needed.

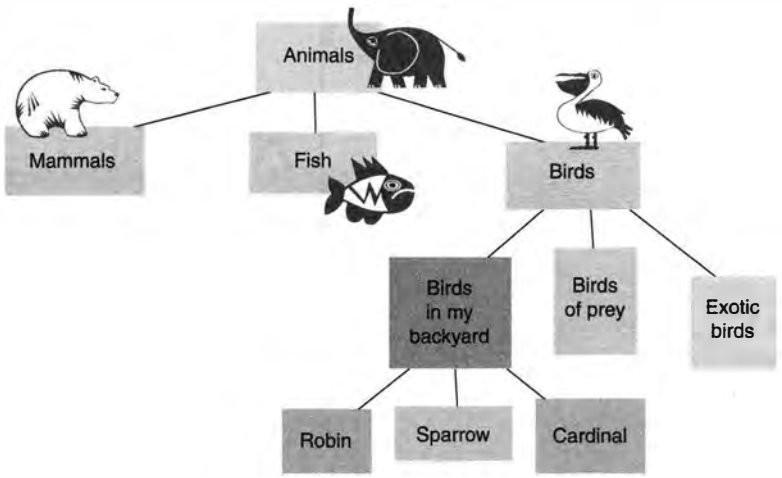
People also may use mental images to store geographical information in memory (Stevens & Coupe, 1978). For example, many people have stored a rough map of the United States. Which city is farther west: Reno, Nevada, or San Diego, California? Most people believe San Diego to be west of Reno. Actually, Reno is west of San Diego. The kinds of errors people make in this task suggest the use of mental imagery representations.

Symbolic representations are declarative memories that rely on arbitrary symbols that bear no obvious relation to whatever is being represented (Anderson, 2000; Palmer, 1978). The word *dog* bears no physical resemblance to a dog, despite the fact that it represents the concept of a dog. Similarly, nothing about the numeral 8 is reminiscent of "eightness." Yet people use this numeral to represent the number eight. The most well-known symbolic representation is a proposition. A proposition is an abstract way of representing the underlying (or "deep structural") relations among things. For example, the statement "John is heavier than Sam" might be represented in terms of the proposition *HEAVIER* (John, Sam). This proposition expresses an abstract way of comparing the weights of the two individuals.

Both semantic and episodic memory can be represented in either analogue form, as images, or in symbolic form, as propositions. Dual-trace theory suggests that people can represent information both in the form of mental images and in the form of mental propositions (e.g., Paivio, 1971, 1986). The implication of dual-trace theory for teachers is that students are more likely to retain important information if it is presented to them both as words and as pictures (Small, Lovett, & Scher, 1993).

Propositions are combined through **propositional networks,** schematic integrations of interrelated propositions. Figure 8.2 shows an example of a propositional network about animals. Obviously, the figure is not intended to convey the full extent of people's knowledge about animals. Rather, it conveys only a small portion of this knowledge. What you can see, however, is that information about animals is interrelated in a roughly hierarchical fashion. For example, people have various pieces of information stored about animals in general. They also have information stored about specific types of animals,

FIGURE 8.2 A Propositional Network



such as birds and fish. Finally, they have information stored about specific types of birds and fish. But what led researchers to believe that long-term memories might be stored in a hierarchical organization?

Until 1969, almost all experiments on memory had investigated episodic memory. People were given lists of words, numbers, or other items to remember. Then they were quizzed on what they had learned. A landmark experiment investigating the structure of semantic memory was carried out by Allan Collins and Ross Quillian (1969). These investigators timed people while they verified the truth or falsity of statements such as "A robin is a bird" and "A robin is an animal." The more remote the subject of the statement (e.g., robin) was from the conceptual category of the predicate (e.g., bird versus animal), the longer it took their research participants, on average, to verify the statement as true. These results demonstrated that it is possible to study the structure of semantic memory as well as of episodic memory. The results also provided one of the first suggestions that information is stored in memory in some kind of hierarchical form, as shown in Figure 8.2.

Researchers disagree about the basis people use to organize declarative knowledge. For example, Collins and Quillian (1969) noticed that it took people longer to verify that "A lion is a mammal" than to verify that "A lion is an animal." This result is surprising because *animal* is a more remote category with respect to *lion* than is *mammal*. The result suggested at least some important exceptions to the hierarchical rule. (Of course, it is possible—albeit unlikely—that students did not recognize the word *mammal*.) An alternative model suggests that people store information based on a comparison of semantic features, or the possible meanings of the target information (Smith, Shoben, & Rips, 1974). Another alternative is that people store information based on a combination of semantic features and hierarchical categories (Collins & Loftus, 1975).

Consider, for example, members of the set of mammal names. Mammal names could be represented in terms of three features: size, ferocity, and humanness (Henley, 1969). A lion, for example, would be high in all three, whereas an elephant would be particularly high in size but not so high in ferocity. A rat would be small in size but relatively high in ferocity, and so on. Figure 8.3 shows how information might be stored and accessed in semantic memory if a semantic-feature-based theory of storage were correct.

THINKING CREATIVELY

How might you use a network representation such as that shown in Figure 8.2 to help you teach children about dinosaurs?

SUGGESTION: Have children represent various dinosaurs in a network according to different principles of classifications—for example, land, air; carnivore, herbivore.

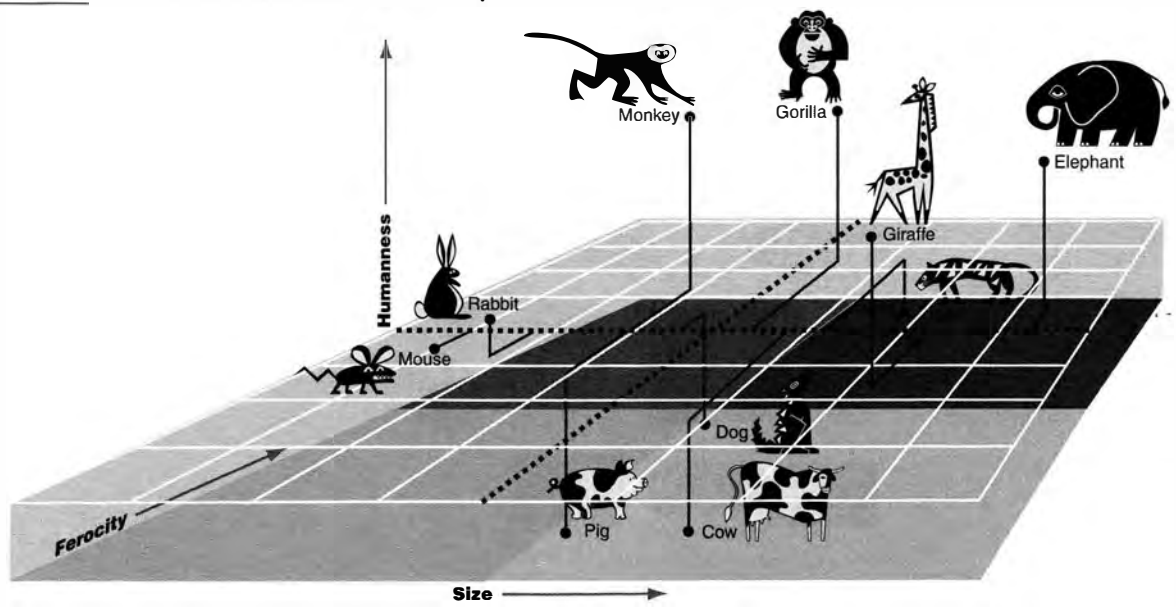
THINKING ANALYTICALLY

Which other kinds of information might people be likely to store hierarchically? What are some kinds of information that do not seem to lend themselves to a hierarchical form of storage?

SUGGESTION: Types of plants may be stored hierarchically: trees, bushes, flowers, parts of flowers. Relatives among a group of friends would not be well represented hierarchically.

■ **PROCEDURAL KNOWLEDGE** **Procedural knowledge,** or "knowing how" (Reed, 2000a, 2000b; Sylvester, 1985), is knowledge of how to do certain things. Knowing how to tell time according to the position of the sun is an example of procedural knowledge.

FIGURE 8.3 Feature Model of Semantic Memory



Declarative and procedural knowledge appear to be held in distinct stores in long-term memory. In addition, each type of knowledge seems to be represented in memory in a different form. Procedural memory holds our knowledge of how to do things. Examples include how to drive a car, ride a bike, and teach a class (see Cohen & Squire, 1980; Reed, 2000a, 2000b; Squire, 1987). The independence of procedural knowledge from declarative knowledge in long-term memory is demonstrated in cases where declarative memory is impaired while procedural memory is spared (Churchill, Stanis, Press, Kushelev, & Greenough, 2003).

Generally, procedural memories are remarkably long-lasting. For example, once a person has learned how to ride a bicycle, the person usually can remember how to do it for a long time after learning. Suppose the person has not been on a bicycle for years. After a brief reorientation period, he or she usually can ride it as well as before. Part of what enables people to be procedurally expert is the development of automaticity. Automaticity refers to the execution of procedures that is largely unconscious, effortless, and noninterfering with the performance of other unrelated or weakly related tasks. For example, you can drive and listen to the radio at the same time.

Procedural knowledge appears to be represented in the form of what are called **productions,** or **condition–action sequences** (Anderson, 1976, 2000; Newell, 1973; Newell & Simon, 1972). These forms of storage tell us, "If this, do that." An example of a production would be "If the teacher says *stop*, then discontinue work on the test." When the "if" condition is met, the action is executed.

Productions are integrated through production systems, which are ordered sequences of productions (e.g., Anderson, 1976, 1983, 1993, 2000; Kintsch, 1988, 1998; Newell & Simon, 1972). In a production system, you go down a list of if–then statements until you find one whose condition (if statement) is satisfied. When you find such a statement, you execute the action. Then you return to the top of the list. An example of a simple production system would be the following:

- If the teacher says *start*, then begin work on the test.
- If the teacher says nothing, then continue work on the test.
- If the teacher says something to clarify a test item, then listen to what the teacher is saying while continuing working.
- If the teacher says *stop*, then discontinue work on the test.

■ **CONDITIONAL KNOWLEDGE** Are other types of knowledge stored in memory, besides declarative and procedural knowledge? One possibility is that higher-order metamemories—knowledge and control of your memory—might form a distinct kind of knowledge. Another possibility is **conditional knowledge,** or knowing when and how to apply the declarative and procedural knowledge you have learned (see Gagné, 1985; Paris & Cunningham, 1996; Paris, Lipson, & Wixson, 1983). Such information might be stored as cognitive strategies, or information about the conditions under which declarative and procedural knowledge is useful (Gagné, 1985). Whether such higher-order knowledge really requires separate storage is not well understood. Nevertheless, such knowledge clearly is important for success in school.

Students need to develop expertise in discerning when they should apply particular study strategies (Palincsar & Collins, 2000; Roediger, 1980). They must recognize, for example, the need to study facts and definitions for a multiple-choice test. Similarly, they may need to practice summarizing and applying broad principles for an essay test measuring general understandings. In a comparable fashion, you do not read a mathematics textbook from cover to cover in the same way you read a novel for pleasure.

Some students experience low levels of success in school because they fail to apply useful study strategies to the information they need to remember. If the teacher were to talk to these students, she would discover the students knew much more about the target information than they displayed on tests. The problem for these students lies not in their memory ability, but rather in their ability to apply appropriate study skills to the given information. For example, one student may study vocabulary words using a procedural memory strategy. This student may understand how to spell the words and use them in a sentence. However, when the student is required to list all the vocabulary words during her test, she might not remember many of the words. Had this student been tested on the meanings and uses of the vocabulary words provided on the test, she may have performed well. Given the way she was tested, this student should have used a declarative memory strategy to learn all of the vocabulary words.

Expert teachers look for this problem in students who seem to work hard in school but who perform poorly on measures of their knowledge. Several solutions are available for students who struggle to achieve conditional knowledge. For example, some teachers indicate directly how they expect their students to study. Other teachers assign designated students who display good conditional knowledge as peer leaders of group study sessions in the classroom.

THINKING ANALYTICALLY

How would conditional knowledge be important to students when they do their homework?

SUGGESTION: The students need to know, for example, when to use which mathematical formula.

IMPLICATIONS FOR TEACHING

THE THREE MEMORY STORES

Teachers can help students move information from the sensory register through short-term memory and into long-term memory. Some of the ways in which expert teachers use the standard model of memory to help students learn more effectively include the following:

- **Get students' attention.** The standard memory model emphasizes getting students' attention. Attention is a prerequisite for information in the sensory register to be transferred to short-term memory, where it will be processed further. A creative way of getting your students' attention is to use large, colorful visual aids to accompany the key points of a presentation. Identify critical concepts and information, and repeat them to emphasize their importance.
- **Help students develop metamemory.** Teach students techniques such as chunking information (for example, French words by topic). Demonstrate the techniques in class. Model them yourself. Help students identify which memory strategies work best for them. For example, suppose the class is quizzed on key terms every week. Then for several weeks a teacher could prescribe a different memory strategy each week. After this trial period, the teacher could ask students to indicate their preferred strategies. The students also should explain why they believed these strategies worked.

- **Allow time for rehearsal.** Presenting too much information or presenting information too quickly does not give students the opportunity to rehearse it. Expert teachers pause occasionally. They also ask if students have questions.
- **Help students elaborate.** Elaborative rehearsal is more effective than maintenance rehearsal in transferring information into long-term memory. It may also aid recall from long-term memory. Bill Norton, for example, helped students engage in elaborative rehearsal by having them define the vocabulary words in the context of the book they were reading. He also helped them by asking them to make up a sentence about themselves. Teachers can reward students for elaborative rehearsal during practice tests.
- **Schedule frequent practices of new information.** Expert teachers provide students with several opportunities, spread out over time, to rehearse or elaborate on new information. For example, a biology teacher might present the parts of a cell one day. She might then ask students to draw a cell and label the parts as homework. Finally, she might schedule a review of the parts of the cell at the beginning of the next class before talking about the function of each part.

LONG-TERM MEMORY

The different models of how knowledge is stored in long-term memory have many implications for teachers who wish to enhance their students' memories:

- **Arrange memorable learning experiences.** Expert teachers know that certain days or moments in class certainly do stand out in students' recollection. Research on the role of highly memorable experiences in increasing semantic memory suggests that teachers should plan memorable learning experiences. For example, provide students with more opportunities to complete projects either on their own or in teams. Doing so may increase their store of both episodic and semantic knowledge.
- **Use pictures.** Expert teachers encourage the development of both analogical and semantic representations in their students' memories. They facilitate such representations by visually demonstrating topics on the chalkboard or overhead projector or by using posters, timelines, or movies. They also encourage students to create their own mental pictures. For information that includes both pictures and meanings, students might draw models of their ideas, or of the information they are trying to remember. In this way they can facilitate development of a dual-memory trace.
- **Organize information.** Provide students with advance organizers. Examples include outlines or lists of key points that are distributed before a lecture or reading assignment. Consider organizing information in ways that memory may be organized. For example, an English teacher can present information about parts of speech in a hierarchical fashion, from most to least important in a sentence.
- **Teach conditional knowledge.** Include appropriate rules or guidelines for using newly acquired knowledge. When reading for English class, for example, students might identify the important elements of a story by using a list of "questions that should be answered by the time the story is finished."
- **Encourage "learning by doing."** Procedural knowledge may best be learned by doing. Drivers' education is the ultimate example of the need for students actually to perform a procedure to truly learn it. Other procedural knowledge that is best learned by doing includes handwriting, math skills, science experiments, computer programming, and map reading. Sports and playing an instrument are also learned through lots of practice.

EXPLICIT VERSUS IMPLICIT MEMORY

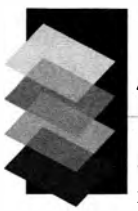
Some of school learning requires explicit memory. In explicit memory, an individual consciously acts to recall or recognize particular information—for example, words from a list given to the person earlier.

Educators also find it useful to understand the phenomenon of **implicit memory** (Graf & Schacter, 1985; Roediger, 1990; Schacter, 1987; Schott et al., 2005), in which an individual

recalls or recognizes information without consciously being aware of doing so. Every day, you engage in many tasks that involve your recollection of information without your being consciously aware of the recall involved. As you read this book, for example, you are remembering the meanings of particular words, some of the psychological concepts you read about in earlier chapters, and even how to read—all without being aware of doing these things.

In the laboratory, experimenters sometimes study implicit memory by studying people's performance on word-completion tasks. In a *word-completion task*, the research participant is presented with a word fragment, such as the first three letters of a word. He or she then is asked to complete the fragment with the first word that comes to mind. For example, suppose that you were asked to supply the missing five letters to fill these blanks and form a word: imp_ _ _ _ _. Because you had recently seen the word *implicit*, you would be more likely to provide the five letters l-i-c-i-t for the blanks than would someone who had not recently been exposed to the word. In general, research participants perform better when the word is one they have seen recently. Even though they have not been explicitly instructed to remember the list, their improved performance on the word-completion tasks shows they may have remembered implicitly.

Implicit memory encompasses a number of other phenomena. For example, procedural memory is typically implicit. When you ride a bicycle, you are not typically aware of recalling how to mount, how to steer, how to use the brakes, and so on: You just do it. The same is true when you write a paper for a course. You are not typically aware of recalling a set of procedures—first I need a title, then I need an opening sentence, then I need to make sure that sentence has a subject and a verb and that it ends with a period, and so on.



Alternative Models of Memory

Support for the standard model of memory is not definitive. In other words, information may enter into the brain and be stored there in other ways. Because alternative models suggest several implications for teachers, we describe three of the major alternatives to the standard model: connectionist models, the working-memory model, and the levels-of-processing model. We also discuss the major classroom implications of each.

CONNECTIONIST MODELS

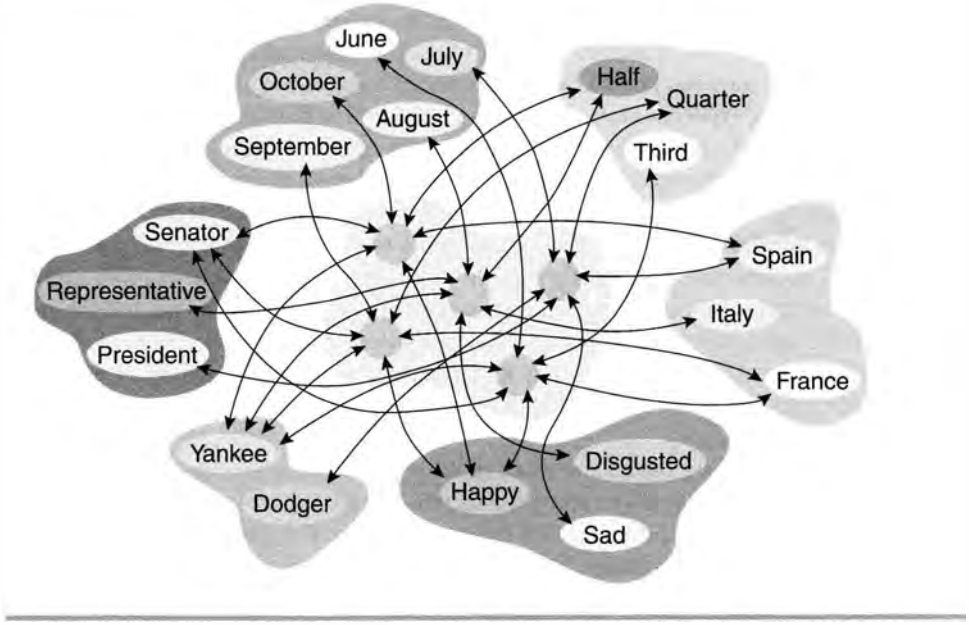
For people to be able to use information in their memories, they clearly need some way to combine declarative and procedural knowledge. They need to know both about certain things and about how to use those things. One model of memory suggests how we are able to do so.

The **parallel distributed processing (PDP) model,** or **connectionist model,** focuses on the ways declarative and procedural knowledge are combined via a series of connections among elements (Smolensky, 2000). Consider how such models work.

In a network representation, such as a network of propositions, information is stored via a series of interconnected nodes, or slots in the network. There is no consensus as to the exact form the networks of propositions take (e.g., Norman & Rumelhart, 1975, versus Schank, 1972). Even so, the basic idea of a series of interconnected, labeled nodes is common to all of the alternative representations that have been proposed. In connectionist models, the key to knowledge representation lies in the connections among nodes, not in the nodes themselves. Figure 8.4 shows a connectionist model.

In the model, nodes are activated by some kind of stimulus. That is, they come alive to a certain degree. More importantly, activation of one node may prompt activation of another, connected node. This phenomenon is called **spreading activation** (Reisberg, 1997). A node that activates a connected node is termed a prime. The resulting activation is termed a priming effect (Matlin, 1998). As shown in Figure 8.4, for example, if you hear the word *Senator*, the node for *Senator* is activated. This activation is then likely to spread to other, connected nodes, such as

FIGURE 8.4 A Connectionist Model of Memory



those for *Representative* and *President.* Perhaps there is even some spread of activation to the nodes for *White House* and *Capitol.* In this way, the activated node for *Senator* becomes a prime for the activation of the other nodes. An important feature of this model is that the spread of activation occurs in parallel. In other words, activation spreads simultaneously across many interconnections in the network. For example, activation may spread simultaneously to *Representative* and *President.* Although there is considerable evidence of priming effects (e.g., McClelland & Rumelhart, 1985, 1988), researchers disagree on whether the priming is actually due to spreading activation (e.g., McKoon & Ratcliff, 1992). The details of this disagreement go beyond the scope of this text.

The important thing to remember about connectionist models is that your useful knowledge resides in the connections among nodes. For example, everything you know about dogs—that they are animals, that they bark, that they have fur, even that they exist—is stored in connections among nodes. Without connections, you would know nothing. You would not even be able to retrieve the concept of *dog* itself.

Connectionist models also suggest that if you want students to learn about a topic, it helps to prime them. Priming students consists of preparing them with background information and concepts related to the topic. One way to conceptualize priming is through the use of a metaphor. A metaphor for the connectionist view of memory is the idea of a person's train of thought. Say a woman walks past a flower shop and sees a yellow tulip. This experience reminds her of her aunt. She remembers that the last time she visited her aunt, there was a vase of yellow tulips in her aunt's window. After the woman thinks of her aunt, she starts wondering how her three cousins, the sons of this aunt, are doing since they moved to Boston. Then the woman starts thinking about Boston. It is on the way to Martha's Vineyard, where she spent a summer during college. . . . And so her thoughts move on. In this scenario, the sight of the yellow tulip served as a prime for the woman. The subsequent thought about her aunt primed other thoughts. The way that this woman's thoughts moved from one idea to another reflects what happens in spreading activation.

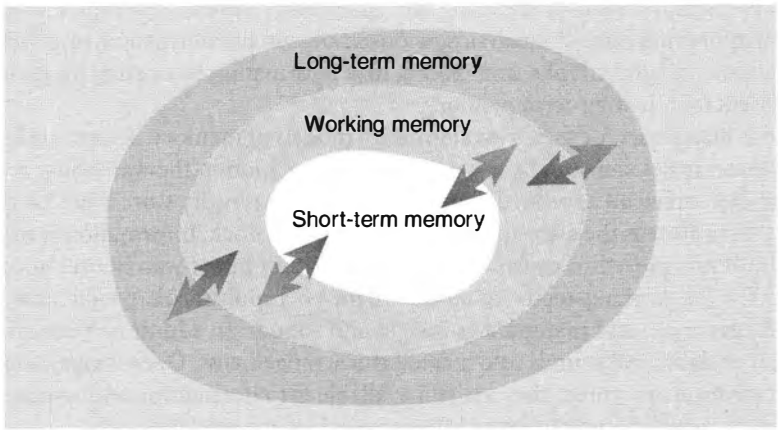
THINKING ANALYTICALLY

How might advance organizers function to prime students for learning the text they read?

SUGGESTION: The advance organizers—for example, summaries of text before the actual text—can organize related concepts and prime material that is to follow.

Connectionist models are certainly appealing. Researchers have been able to build computer simulations based on the assumptions of connectionist models that react as humans would. This result suggests that humans may, in fact, use parallel distributed processing. PDP models also make assumptions essentially identical to those used by psychologists who directly study how the brain functions via neural networks, or actual interconnections

FIGURE 8.5 The Working-Memory Model



THINKING ANALYTICALLY

Why might it be important that a cognitive model of memory have direct links to what psychologists have learned from biological studies of the brain?

SUGGESTION: Each kind of model (cognitive and biological) can help explain the other model. For example, biological processes place constraints on which cognitive processes are possible.

among neurons (nerve cells) in the brain (Hendry & King, 1994; Matlin, 1998; Solso, 1995). In this sense, connectionist models seem to have a certain direct tie to the biology of the brain that is less obvious in other models.

In the field of education, priming can set the stage for introducing new information in class. Teachers can strengthen certain connections in their students' memory networks through reviews of information and concepts. For example, a teacher might strengthen the connection between Spanish words and their pronunciations by having students conduct conversations in Spanish two days a week.

THE WORKING-MEMORY MODEL

As mentioned earlier in this chapter, the emphasis in the standard model of memory is on three memory stores. There is a continual flow of information among these three elements—from the sensory register to short-term memory and then to long-term memory. An alternative model places the emphasis on working memory. **Working memory** is an active part of long-term memory that also includes short-term memory. As you can see in Figure 8.5 (see, e.g., Baddeley, 1994; Cantor & Engle, 1993; Daneman & Carpenter, 1980; Daneman & Tardif, 1987; Engle, 1994; Engle, Cantor, & Carullo, 1992; Smith, 1999), working memory holds the most recently activated portion of long-term memory. It moves these activated elements into and out of brief, temporary memory storage. Working memory may operate via at least some amount of parallel processing, as described earlier.

Thus working memory is an active form of storage. Table 8.3 shows that this characteristic is a key difference between the working-memory model and the standard model. In that

TABLE 8.3 Standard Memory Model versus Working-Memory Model

	Standard Memory Model	Working-Memory Model
Terminology	Short-term memory is sometimes called working memory, but it is distinct from long-term memory	Working memory includes both short-term memory and long-term memory
Relationship of memory stores	Short-term memory is distinct from long-term memory, although information may move between the two stores	Short-term memory is not entirely distinct from long-term memory; rather, it is a part of working memory along with whatever information in long-term memory is currently activated
Key emphasis of model	On the distinctions between different memory stores	On the role of activation in moving information into working memory and on the errors of working memory in memory processes

earlier model, the memory stores are more passive receptacles of information. The working-memory model even emphasizes the functions of working memory in governing other processes of memory, such as encoding and integrating information. Some functions of working memory may include integrating acoustic and visual information, organizing information into meaningful chunks, and linking new information to existing forms of knowledge representation in long-term memory.

Consider metaphors for these two alternative models of memory. The metaphor for the standard three-stores view can be a warehouse. Information in the warehouse is passively stored and then called on as needed. In this metaphor, the sensory store is the loading dock. The short-term store is the area surrounding the loading dock. Information is stored temporarily until it is moved to or from the proper location in the warehouse. In contrast, a metaphor for the working-memory model might be a multimedia production house. It continually generates and manipulates images and sounds. In addition, it coordinates the integration of sights and sounds into meaningful arrangements. Once images, sounds, and other information are stored, they are still available for reformatting and reintegration in novel ways, as new demands and new information become available.

THINKING ANALYTICALLY

In what ways would working memory be especially important to students when they are doing arithmetic computations?

SUGGESTION: Working memory could be important for holding in mind intermediate steps and results. For example, the Pythagorean theorem might already be in a student's long-term memory. When she sits down to do her geometry homework, she places this knowledge into her working memory and uses it as she completes her homework.

The concept of working memory has an important implication for teachers: Activating knowledge—that is, getting students to recall knowledge they already have—helps the students integrate new knowledge into their long-term memories. The working-memory model further suggests the importance of integrating new, incoming information with information already stored in long-term memory. For example, consider the case of an expert teacher who wants to correct students' misconceptions about people in another country. The teacher starts by asking students what they know about people in the other country. She then shows a film or reads a story about the foreign land. Subsequently, she asks the students to compare what they first thought about the people in that land with what the film or story suggests about the people. Students should alter their long-term memory preconceptions about the other country and its people based on the new information entered into working memory during the lesson.

THE LEVELS-OF-PROCESSING MODEL

Another alternative model of memory is the **levels-of-processing model** (Craik & Lockhart, 1972). According to this model, memory does not comprise three or even any specific number of separate stores. Instead, as shown in Figure 8.6, storage varies along a continuous dimension in terms of depth of encoding. In other words, theoretically, there are an infinite number of levels of processing (LOP). Items can be encoded at each level, with no distinct boundaries between one level and the next. The level at which information is stored will depend, in large part, on how it is encoded. Furthermore, the deeper the level at which an item is processed, the higher the probability that the item will be retrieved.

FIGURE 8.6 The Levels-of-Processing Model

Level of Processing		Example
Deep Level	Semantic Processing	"I like to pet the goats on my aunt's farm."
Middle Level	Acoustic Processing	"Goat rhymes with boat."
Shallow Level	Physical Processing	"Goat starts with the letter G."

There is an exception, however. Suppose students encode information deeply, but are then tested in a superficial manner. They may, as a result, do poorly on the test. For example, if students study deeper meanings in a history lesson and are then tested only on dates, their in-depth studying may actually hurt them.

In one set of studies, participants were presented with a list of words. Each word was preceded by a question (Craik & Tulving, 1975). The questions, however, were not of a uniform kind. Rather, the questions were varied to encourage three different levels of processing, in progressive order of depth—physical, acoustic, and semantic. The results of the study seemed clear-cut: The deeper the level of processing encouraged by the question, the higher the level of recall later achieved. According to the levels-of-processing model, the way a word looks (its physical appearance) is only superficially processed in the brain. The way that word sounds (its acoustic character) helps the word to be processed more deeply in one's memory. However, the meaning of the word (its semantic character) is most deeply processed in the brain, so it provides the best way to commit that word to memory. Students' eyes and ears receive many sensations from the environment. When sensed objects become meaningful to students, students will better remember those objects.

According to the levels-of-processing model, teachers should help their students encode information at the deepest level possible. Return for a moment to Bill Norton, the teacher from the chapter-opening vignette. Consider the first rote-memorization task he had his students do. You can see why, from the LOP point of view, his students would show relatively poor recall of the vocabulary words. Having students merely repeat words and definitions encourages them to process the words only at a shallow level. Bill's second try at teaching the vocabulary words used methods that encouraged deeper levels of processing. Of course, there are several ways he could have led students to deeper processing. For example, Bill might have asked students to also supply a synonym for each word, or he might have asked them to categorize the words in some meaningful way. Expert teachers remember that making ideas meaningful for students is the best way to help students learn.

The technique Bill chose—asking students to construct a sentence about themselves using each word—was especially effective in encouraging deeper levels of processing. It made use of the **self-reference effect,** by which people show very high levels of recall when asked to relate words meaningfully to themselves by determining whether the words describe themselves (Rogers, Kuiper, & Kirker, 1977; see also Bower & Gilligan, 1979; Brown, Keenan, & Potts, 1986; Fujita & Horiuchi, 2004; Ganellen & Carver, 1985; Katz, 1987; Reeder, McCormick, & Esselman, 1987; Stewart, Stewart, & Walden, 2007; Sui & Zhu 2005). Even words that people decide are not very descriptive of themselves are recalled at high levels when they are learned using this technique. The reason for this success is that the person *considered* whether the words were self-descriptive. The best recall, however, results when the words actually *do* describe the person who evaluates them. For example, sixth graders assigned to learn about the turn of the twentieth century and the World's Fair in San Francisco could use self-referencing to study. Students could decide which exhibits at the fair they would have enjoyed most and which they would have enjoyed least. The students would be sure to remember the events that surrounded the World's Fair. They also would probably remember more of the history related to the particular exhibits they believed they would have liked or disliked.

The self-reference effect has been interpreted as possible support for the LOP model. Each of us has a very well-developed self-schema. A self-schema is an organized system of internal information regarding ourselves, our attributes, and our personal experience (see Mills, 1983). Because this self-schema is so well developed, you can richly and elaborately encode information related to yourself. You can do so particularly well if the information is also related to other topics (Anderson, 2000; Bellezza, 1984, 1992). Stated in terms of levels of processing, the self-reference effect means that people process information about themselves at a very deep level.

The self-reference effect suggests that students will better recall information to the extent that they can see its relevance to themselves. The information effectively becomes a part of the students as people. As teachers, we know that we listen more intently to and learn better from in-service lectures or workshops when we realize how we can use the information

THINKING CREATIVELY

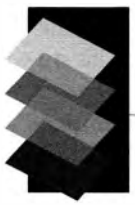
Suppose you want to encourage students to learn a set of facts about life in colonial America in a way that will maximize their recall. How might you use what you have learned about levels of processing in order to maximize their later recall?

SUGGESTION: Have students relate each new concept to something meaningful that they already know. For example, have students compare the time it took colonial women to make a meal to the time it takes us to make our meals today. Or have students look for similarities between the town councils in colonial times and modern-day town councils.

in our own lives. Students, of course, are no different: The more closely the information relates to them as people, the more likely they are to retain it. Encourage students to think actively about how new information relates to them personally. Indeed, people demonstrate higher levels of recall when they generate their own cues for later recall than when someone else generates the cues for them (Greenwald & Banaji, 1989).

*i*MPLICATIONS FOR TEACHING

- **Use the ideas of priming and spreading activation to help students learn.** For example, a teacher may review subtraction and multiplication as a way of priming students before teaching division.
- **Help students encode information at the deepest level possible.** Expert teachers know that making ideas meaningful for students is the best way to help the students learn.



Retrieving Information

The standard memory model and the alternatives to it presented in this chapter focus primarily on encoding and storing information. Once you have stored information, what happens when you try to retrieve it? Sometimes it is very easy to retrieve a fact or procedure from long-term memory. At other times, try as you might, retrieval seems impossible. Retrieval is critical in school. Indeed, teachers generally base their evaluations of how well students have learned on students' demonstrations of retrieval, such as their performance on exams (Greeno, Collins, & Resnick, 1996). In this section, we discuss what makes information easier to retrieve. We also examine what makes information more difficult to retrieve. First, however, we consider the different ways in which teachers assess their students' memories.

TASKS USED TO ASSESS STUDENTS' MEMORIES

There are two basic types of memory tasks you will undoubtedly use when you evaluate students' learning: tasks that measure recall and tasks that measure recognition memory.

■ **RECALL TASKS** Perhaps the most common way to assess learning and memory is through a **recall task.** In a recall task, a person is asked to produce information from memory. The information might take different forms. Examples are a single word, fact, or picture, or a string of words, facts, pictures, or perhaps other symbols. Recall can be measured in various ways.

In a **free recall** task, students are presented with a list of items. The students then must recite back the items, in any order they prefer. For example, a teacher might ask students to list the names of important historical figures. Or students might have to recall the names of the world's oceans, or a list of important prepositions. In these cases, the teacher does not care about the order in which the items are listed. Rather, she cares how many items are correctly listed.

In a **serial recall** task, students are presented with a list of items. Their job is to repeat the items back in the order in which they were presented. Serial recall is used as a subtest on a number of tests of intelligence. An example would be when people are asked to repeat back (in forward or sometimes reverse order) a list of digits. Serial recall is sometimes used in school as well. For example, when students learn to recite a poem, they need to learn the words in order. Just repeating back all the words of the poem in random order will not do! Similarly, learning lines of a play means learning them in order. Individuals cannot just randomly order the words that need to be said.

THINKING CREATIVELY

How can you measure free recall in the context of measuring learning of a science lesson? As an example, consider a science lesson about different animals or plants that live in the rain forest, or use an actual science lesson you have used or heard about.

SUGGESTION: You can have the students recall the names of the animals or plants.

In a **paired-associates recall** task, students are presented with items in pairs. When they are tested, students are given the first item of each pair. They then must repeat back the item with which the first item was paired. For example, in vocabulary tests you present a word and ask students to define it (as in Bill Norton's vocabulary test). These types of examinations are paired-associates tests. Similarly, suppose you give your geography students the name of a state, and ask them to write down the capital of that state. You are testing their paired-associates recall. If you teach chemistry, you may ask students what element has an atomic number of 16. You are also giving a paired-associates test.

In schools, many learning and memory tasks require a combination of the various kinds of memory demands. For example, suppose you ask your students to write an essay. Their task is to recount the main events leading up to Abraham Lincoln's Gettysburg Address or to the beginning of the French Revolution. In such a case, you are requiring students to use some combination of free and serial recall, as well as other higher-order thinking processes (described in Chapter 9). On the one hand, you have not prescribed a fixed order of recall. On the other hand, you presumably expect students to know something of the chronology of events. You would not be satisfied if they simply listed events in a random order.

■ **RECOGNITION TASKS** Another kind of task used to assess memory is a **recognition task.** In a recognition task, students have to select or identify something that they learned previously. Suppose Bill Norton tested vocabulary through a multiple-choice test. He would present a definition, and ask students which word corresponds to the definition. He might also present a word, and give alternative definitions. The students must recognize the correct answer from among the choices Bill presented.

Of course, recognition can be measured in other ways. For example, consider a matching test, in which you give the names of countries. The student has to match them with their appropriate continents. Here, you are testing recognition as well.

Many multiple-choice tests and related tests measure more than straight recognition memory. Such tests often involve an element of reasoning as well (discussed in Chapter 9). Indeed, few teacher-made or standardized tests are pure measures of any one kind of memory.

Performances on the various kinds of memory tasks are not very highly related (Underwood, Boruch, & Mulmi, 1978). In other words, someone who does well on one kind of memory test does not necessarily do well on another. For this reason, expert teachers vary their forms of assessment. They thereby allow students with different kinds of memory and other skills to show what they know.

THINKING ANALYTICALLY

Describe a recent example from your own experience as a student of the difference between recall and recognition memory.

SUGGESTION: Recall is primarily involved in short-answer and fill-in-the blank tests. Recognition is primarily involved in multiple-choice tests.

FACILITATING STUDENTS' RETRIEVAL

Psychologists studying retrieval distinguish between the availability and the accessibility of memories. *Availability* refers to whether information is actually stored in long-term memory. *Accessibility* refers to how easily stored information can be retrieved. One study tested people's memory for names and photographs of their high school classmates (Bahrick, Bahrick, & Wittlinger, 1975). Even after 25 years, the research participants had surprisingly good memory for the names and faces. Moreover, at times when participants seemed not to remember, further prompting enabled them to remember things they thought they had forgotten. The information about their classmates, in other words, was available; it was there in long-term memory. The difficulty was in retrieving it, or making it accessible. Similar findings have emerged from studies assessing people's memory for what they learned of a foreign language many years earlier (Bahrick, 1984; Bahrick, Bahrick, Bahrick, & Bahrick, 1993). But what makes some information more accessible and other information less accessible?

■ **RETRIEVAL CUES** One of the best ways to make information easier to get out of mental storage is through retrieval cues. **Retrieval cues** are clues or reminders that can enhance the ability to retrieve stored information from memory.

Endel Tulving and Zena Pearlstone (1966) asked participants in an experiment to memorize lists of categorized words. For example, the participants might hear the category "articles of clothing." This category would be followed by the words *shirt, socks, pants*, and *belt.*

Scott Cunningham/Merrill

An elementary school child uses a map to visualize geographical terms she must learn and later retrieve from her memory. Retrieval is critical to school performance, particularly on exams.

Participants were later tested for their recall in one of two ways. In a free recall condition, participants were asked to recall as many words as they could in any order they could. In a cued recall condition, participants were tested category by category. They were given each category label as a cue. They were then asked to recall as many words as they could from that category. The critical result of this research was that cued recall was far better, on average, than free recall.

Suppose, however, that these experimenters had tested the participants only via free recall. They might then have concluded that the participants had learned far fewer words than they had actually learned. In other words, difficulties in the free recall condition were due not to availability difficulties, or lack of words stored. Rather, they arose because of accessibility difficulties in retrieving the words. Once participants were given cues, they were better able to retrieve the memorized words.

THINKING PRACTICALLY

How might you use the findings of Tulving to help children learn and later retrieve information about various kinds of rocks in a science class?

SUGGESTION: Have the students learn the identities of the rocks by categories (igneous, sedimentary, metamorphic), and then encourage the students during testing to retrieve the rocks by categories.

This research suggests that teachers can greatly enhance students' learning of and subsequent memory for information. They should provide some way for the students to organize the information in advance. This way of organizing information is sometimes called an **advance organizer.** For example, adding a title to the quoted passage earlier in this chapter of "Washing Clothes" would serve as an advance organizer. Other examples of advance organizers can be found throughout this book. The title and outline of each chapter—as well as the lists of objectives—are designed to help you organize in advance the information in the chapter to make this information easier for you to learn.

The settings in which students learn information can also function as retrieval cues. According to the principle of **encoding specificity** (Tulving & Thomson, 1973), what is recalled depends on the context in which it is encoded. You recall best if the circumstances of recall match the circumstances of encoding. Even seemingly irrelevant aspects of the learning environment can be encoded along with class information and can later function as retrieval cues.

In one study, 16 underwater divers were asked to learn a list of 40 unrelated words. At the time, the divers were either on shore or 20 feet beneath the surface (Godden & Baddeley, 1975). Later, the divers were asked to recall the words either in the underwater environment or on shore. Their retrieval was better if the retrieval environment was the same as the encoding environment at the time of learning. Divers who learned while underwater had better recall when tested underwater. In contrast, divers who learned while ashore remembered better when tested ashore.

Even people's moods can provide retrieval cues for later recall. That is, those things we encode during a particular mood are more easily retrieved if they are recalled when we are in the same mood (Bower, 1981). For example, suppose students learn things when they are happy. They often will retrieve that information better during a time when they are happy than a time when they are sad. Expert teachers are aware of the effect of context on their students' learning. They make it a point to pay attention not only to the material the students are to learn, but also to the context in which the students are to learn it.

THINKING PRACTICALLY

Two ways of learning new vocabulary, whether words in general or a particular technical vocabulary, are (1) through memorization of terms and their definitions and (2) through learning of words from context (whereby the new word is presented in a sentence or series of sentences in which it is used). What are the implications of encoding specificity for performance in various kinds of testing situations when words are learned in these two different ways?

SUGGESTION: Words learned in context usually will be better recalled in the same or similar contexts. Words learned in isolation usually will be better recalled in isolation.

■ **MNEMONISTS AND MNEMONIC DEVICES** A mnemonist is a person who uses memory-enhancing techniques for greatly improving his or her memory or who has a distinctive sensory or cognitive ability to remember information, particularly information that is highly concrete or can be visualized readily. The mnemonist's ability shows us what we might long to have, especially when, as students, we wish we had photographic memories for material we need to remember when taking exams.

Perhaps the most famous mnemonist was a man called "S.," who was described by Alexander Luria, a celebrated Russian psychologist. Luria (1968) reported that one day a man

employed as a newspaper reporter appeared in his laboratory and asked to have his memory tested. Luria tested him and discovered that the man's memory appeared to have virtually no limits. S. could reproduce series of words of any length whatsoever, regardless of how long ago the words had been presented to him. Luria studied S. over a period of 30 years and found that even when his retention was measured 15 or 16 years after a session in which S. had learned words, S. could still reproduce the words.

What was S.'s trick? How did he remember so much? Apparently, he relied heavily on the mnemonic of visual imagery. That is, he converted material that he needed to remember into visual images. For example, when asked to remember the word *green*, S. visualized a green flowerpot; when asked to remember the word *red*, he would visualize a man in a red shirt coming toward him. Even numbers called up images. For example, *1* was a proud, well-built man, and so on. S.'s heavy reliance on imagery created difficulty for him when he tried to understand abstract concepts, such as *infinity* or *nothing*, which did not lend themselves well to visual images.

His excellent memory also caused S. other problems. He could not forget things even when he wanted to forget them. At times, images would come into his consciousness and interfere with his ability to concentrate and even carry on a conversation. Eventually, S. became a professional entertainer, dazzling audiences with his memory feats, not so much because he wanted to entertain, but because he found himself unable to succeed in other pursuits.

The story of S. is a good example of how memory and all other cognitive functions represent an evolutionary compromise. Often, as we improve in one function, other functioning may suffer as a result. For example, S.'s superior memory interfered with his ability to adapt in other spheres of life. Similarly, in the physical domain, someone who builds up an extraordinarily muscular frame may lose agility. In eons past, such a person might have been at an advantage in some forms of hand-to-hand combat, but might have had some difficulty in making a quick escape in the face of overwhelming odds against a stronger, possibly nonhuman predator. Thus, when we complain about being forgetful or even less strong than we might like to be, we should remember that our minds and physiques represent evolutionary compromises that may not be optimized for any one function, but rather may be optimized (or something close to it) as a delicate balance of functions.

Another mnemonist, S. F., remembered long strings of numbers by segmenting them into groups of three or four digits each, and encoding those chunks as running times for different races (Ericsson, Chase, & Faloon, 1980). An experienced long-distance runner himself, S. F. was familiar with the times that would be plausible for different races. He did not enter the laboratory as a mnemonist; rather, he was selected to represent the average college student in terms of intelligence and memory ability. S. F.'s original memory for a string of numbers was about seven digits, average for a college student. After 200 practice sessions distributed over a period of two years, S. F. had increased his memory for digits more than tenfold and could recall approximately 80 digits. His memory was only average, however, when the experimenters purposely gave him sequences of digits that could not be translated into running times. The work with S. F. by Ericsson and his colleagues suggests that a person with a fairly typical level of memory ability can be converted into one with quite an extraordinary memory, at least in some domains, with a great amount of concerted practice.

These kinds of exceptional mnemonists offer some insight into the processes of memory. For example, mnemonists generally recode arbitrary, abstract, meaningless information into more meaningful or sensorially concrete information, which subsequently aids in that information's recall from long-term memory, as we saw earlier. We can use the same kinds of **mnemonic devices,** or specific techniques for improving learning and memory, to improve our own memory abilities. These devices rely on similar kinds of recodings that add meaning to otherwise meaningless information. Although most people will never perform at the level of these extraordinary mnemonists, we can all improve our memories by using mnemonics.

It was once thought that people with extraordinary memories were people who had "photographic memories." In fact, some people do: They can visualize, for example, a page of text in their heads. Such imagery is sometimes referred to as *eidetic*. Nevertheless, the large majority of people with extraordinary memories are experts who exhibit the same kinds of expertise as other experts have. There is nothing magical about any of their memories. Instead,

ACRONYMS. Form a word or expression whose letters each signify some other word or concept. Acronyms are very common as abbreviations. For example, O.R. can stand for "operations research." Acronyms can also be used for learning concepts. For example, suppose you want to remember each of the mnemonics in this section. You might create the acronym, I AM PACK. Here, each letter stands for the first letter of one of the mnemonics (Interactive images, Acronyms, Method of loci, Pegwords, Acrostics, Categories, and Keywords). Both the acronym and the acrostic methods, described next, make use of levels of processing deeper than those required for rote learning, to generate the mnemonic devices.

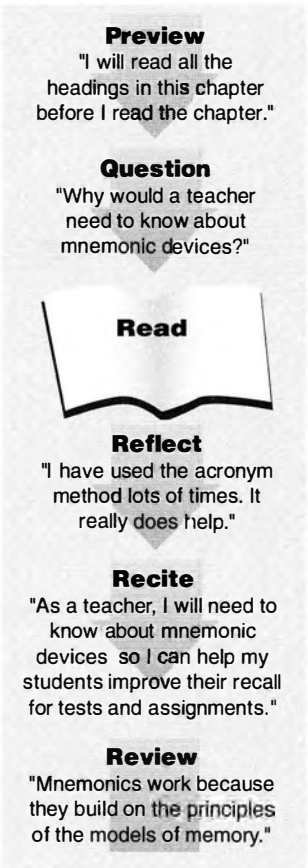
ACROSTICS. Form a sentence in which the first letter of each word of the sentence is the first letter of one of the words to be remembered. For example, "Every Good Boy Does Fine" is an acrostic frequently used to memorize the notes on lines of the treble clef in music. "Can A Woman Dance?" might be used to remember the four products mentioned earlier—cheese, automobiles, wine, and designer dresses. "Mother Very Easily Makes Jelly Sandwiches Using No Peanut butter" can be used to remember the names of the planets in the order of their distance from the sun.

KEYWORDS. Form an interactive image that links the sound and meaning of a foreign word with the sound and meaning of a familiar word. For example, suppose you want to remember that the French word for butter is *beurre*. You might observe that the French word sounds like "bear." So now associate the keyword "bear" with butter in an image or sentence. For example, you might imagine a bear eating a stick of butter. Later, the image of a bear will provide a retrieval cue for *beurre*.

Other general mnemonic devices can be used as well. One of the most well known is called **PQ4R,** which stands for "Preview, Question, Read, Reflect, Recite, and Review" (Thomas & Robinson, 1972). The PQ4R technique is designed to help you remember what you read (see Figure 8.7). To use this strategy, you first *preview* the material to be read. You do so by skimming the main chapter headings, summaries, and any other organizing information the authors included. Next, write *questions* about each section of the material that relate the material to your reason for reading it. An example would be, "Why does a teacher need to know about PQ4R?" Then, *read* the material. Be sure to pay attention to details. While you are reading, *reflect* on the material. Try to build your understanding by drawing conclusions from it. Next, *recite* to yourself the contents of what you just read. Answer the questions you wrote without looking back at the text. Finally, *review* what you read previously to build on it with the new information you have just read. This step is part of an ongoing, cumulative process.

Indeed, a whole host of strategies can help students become expert learners. Some of these strategies were described in Chapter 1, where we discussed how to become an expert student.

FIGURE 8.7 Using PQ4R



CONSTRUCTING YOUR OWN LEARNING

Read "The War of the Ghosts," which follows.

One night two young men from Egulac went down to the river to hunt seals. While they were there, it became foggy and calm. Then they heard war cries, and they thought, "Maybe this is a war party." They escaped to the shore, and hid behind a log. Now canoes came up, and they heard the noise of paddles, and saw one canoe coming up to them. There were five men in the canoe, and they said, "What do you think? We wish to take you along. We are going up the river to make war on the people."

One of the young men said, "I have no arrows."

"Arrows are in the canoe," they said.

"I will not go along. I might be killed. My relatives do not know where I have gone. But you," he said, turning to the other, "may go with them."

So one of the young men went, but the other returned home. And the warriors went on up the river to a town on the other side of Kalama. The people came down to the water, and they began to fight, and many were killed. But presently the young man heard one of the warriors

say, "Quick, let us go home; that Indian has been hit." Now he thought, "Oh, they are ghosts." He did not feel sick, but they said he had been shot.

So the canoes went back to Egulac, and the young man went ashore to his house, and made a fire. And he told everybody and said, "Behold I accompanied the ghosts, and we went to fight. Many of our fellows were killed, and many of those who attacked us were killed. They said I was hit, and I did not feel sick."

He told it all, and then he became quiet. When the sun rose, he fell down. Something black came out of his mouth. His face became contorted. The people jumped up and cried.

He was dead.

After reading the story, do something else for 15 minutes. Then try to recall as much of the story as possible. What kinds of errors in recall did you make?

If you are currently working in a practicum, you might also ask some of the students you are working with to try this same test, or a similar one with a story that you select. (Be sure to discuss this first with your cooperating teacher.)

Most people tend to commit errors that help make incomprehensible aspects of the text comprehensible to them. The reason is that the text is unfamiliar and difficult. More generally, when students read material that is difficult for them, they may distort what they read. These distortions are ways they use to help make the story consistent with their existing knowledge base. Giving students an advance organizer to help them understand what they are about to read may reduce or eliminate such distortion. Can you think of any other ways to reduce distortion?

Source: Excerpt from "The War of the Ghosts" from *Remembering* by F.C. Bartlett. Cambridge, UK: Cambridge University Press, 1932. Reprinted with permission of the publisher.

■ **FLASHBULB MEMORIES** An interesting example of retrieval is the flashbulb memory, a recollection of an event that is so emotionally powerful that the recollection is highly vivid and richly detailed. It is as if the memory were indelibly preserved on film (Brown & Kulik, 1977). Memories of the assassination of President John F. Kennedy, of the destruction of the World Trade Center in New York on September 11, 2001, and of the explosion of the Space Shuttle Columbia in February 2003 have all been cited as examples of common flashbulb memories. Flashbulb memories may be preferentially recalled because their recall is mediated by the hormones that are released in response to arousal.

Clearly, the experiencing of strong emotion when viewing important events may enhance later recall of these events. People feel certain of their memories of the events, and the vividness and detailed texture of their memories seem to support their accuracy. It turns out, however, that these remembered events are often recalled inaccurately (Romeu, 2006; Schacter, 1996; Talarico & Rubin, 2007).

RETRIEVAL FAILURE

Of course, many attempts at retrieval fail. We often use the term "forgetting" to describe our failure to retrieve information from memory. Why do we forget information, whether from long-term memory or from short-term memory?

The two most well-known theories of forgetting from the short-term store are decay theory and interference theory. **Decay theory** posits that information is forgotten because of the gradual disappearance over time of an unusual memory trace. Although there is some evidence of decay (Reitman, 1971, 1974), it appears that decay plays relatively little role, if any, in forgetting.

Interference theory asserts that we forget because competing information renders inaccessible (and possibly unavailable) the information we want to remember. There are two main kinds of interference: retroactive and proactive.

Retroactive interference (also called **retroactive inhibition**) is forgetting caused by activity following the time something is learned, but before we need to recall that thing (Sternberg, 1999b). Thus new learning interferes with old learning. In other words, you learn

something you will need to recall. Then you learn something else. Finally, you are tested on the to-be-recalled material.

Consider an example of retroactive interference. A student studies for a world history test to take place the next day. Afterward, she completes her American history homework. The information in the American history homework can retroactively interfere with her ability to remember what she studied for the world history test. Or consider the native Chinese speaker who has completed an advanced English class. He is now studying French. He may have difficulty speaking English. Retroactive interference may occur from what he is learning about French grammar and vocabulary to what he is learning about English.

In contrast, **proactive interference** (also called **proactive inhibition**) is forgetting what occurs when the interfering material precedes the to-be-remembered material (Sternberg, 1999b). Here, old learning interferes with new learning. In other words, you learn something not related to what you will later need to recall. Then you learn what you will need to recall. Finally, you are tested on the to-be-recalled material.

Consider an example of proactive interference. A student completes her American history homework. She then studies for the world history test the next day. The American history information may proactively interfere with her ability to learn and recall the world history material. Or, after completing an advanced English class, a student who is a native Chinese speaker and is now taking a French class may have difficulty in French class. Proactive interference from what he has learned previously about English grammar and vocabulary may interfere with his learning French.

Sometimes you learn a number of items at once and then later have to retrieve them. You are likely to be able to recall some items more easily than others. In particular, you will tend better to remember items near the beginning and near the end of the list than you remember items from the middle of the list. For example, suppose you are asked to recall the numbers 4-8-6-1-9-8-2-7-3-5. You are more likely to recall well the first few and last few numbers, and to be less able to remember those in the middle. Better recall of items near the beginning of a list is sometimes referred to as a primacy effect. Better recall of items near the end of the list is sometimes referred to as a recency effect. The combination of the primacy and recency effects is referred to as the **serial-position curve.** It is shown in idealized form in Figure 8.8.

Why do you recall more items at the two ends? One interpretation is that items at the beginning of a list are subject only to retroactive interference. Items at the end of a list, in contrast, are subject only to proactive interference. Items in the middle of the list, however, are subject to both retroactive and proactive interference.

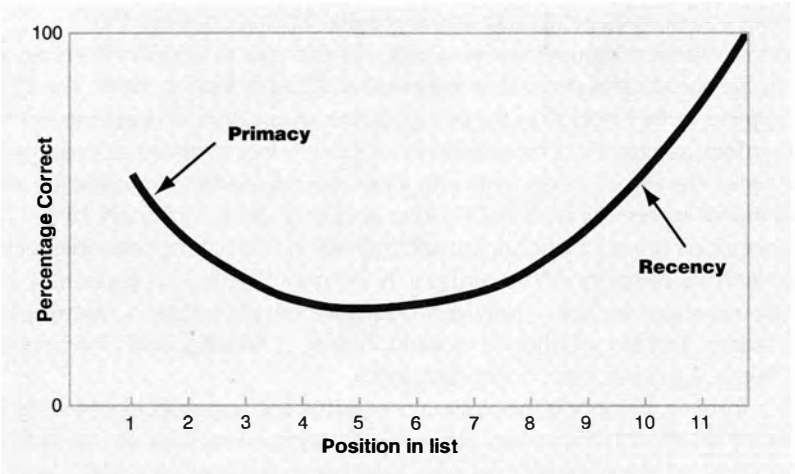
The serial-position curve has a practical implication for those who wish to become expert teachers. Suppose you have a lot of material to teach. Naturally, you do not expect students to remember every single thing you have taught. Because material at the two extremes is most likely

THINKING ANALYTICALLY

Give an example of how you might experience proactive interference if you are taking two foreign language courses, one in French and one in Spanish. *Hint:* What if your French course meets at 9 A.M. and your Spanish course meets at 11 A.M.?

SUGGESTION: Your learning in the French class may proactively interfere with your learning in the later Spanish course.

FIGURE 8.8 The Serial-Position Curve



THINKING PRACTICALLY

If you plan to go job hunting, why might you want to be interviewed either at the beginning or at the end of the series of interviews of job applicants?

SUGGESTION: You might be more memorable to the interviewer.

to be remembered, you decide to place the most important material either at the beginning or at the end of the lesson. As you can see, the context in which you learn things makes a large difference in how well you can retrieve those things. Moreover, competing contexts can interfere with later retrieval. In the next section we consider the effects of context in more detail.

iMPLICATIONS FOR TEACHING

- **Be aware of the effect of context on your students' learning.** Pay attention to not only the material the students are to learn, but also the context in which the students are to learn it. For example, suppose posters were used as visual aids when the target information was presented. An expert teacher might decide not to remove these posters completely during the testing time. Instead, the teacher might cover parts of the posters that revealed too much information. Alternatively, the teacher might simply turn the posters away from the students. The mere presence of the posters contributes to the contextual similarity between the information as presented and the information as tested. This similarity could result in better performance for some students.
- **Make use of mnemonic devices to help your students study.** For example, have a group of students learn a list of unrelated words---dwelling, underwear, cavalier, kinetic, warble, ambush, larvae, and kilowatt—by using the acronym DUCK WALK.

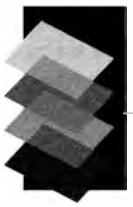
BIOLOGY OF MEMORY

Psychologists have been able to locate many cerebral structures involved in memory, such as the hippocampus and other nearby structures (Achim & Lepage, 2005; Montalidi, Spencer, Roberts, & Mayes, 2006; Piekema, Kessels, Mars, Petersson, & Fernández, 2006; Squire, 1987; Thompson, 2000). A great deal of information about the brain structures involved in memory has come from the study of people who have sustained some sort of brain damage. Memory is volatile: It may be disturbed by a blow to the head, a change in consciousness, or any number of other injuries to, or pathologies of, the brain. Studies of brain-injured patients are informative because they offer distinctive insights not previously observed in people with normal brain function, such as the insights into declarative versus procedural knowledge gained through the study of individuals with amnesia. In addition, although studies of brain-injured people do not necessarily provide conclusive evidence regarding localization of function, they may indicate that a particular structure at least participates in a given function (Kosslyn & Koenig, 1995).

Some studies show preliminary findings regarding the specific structures involved in various kinds of memory, such as procedural versus declarative memory. In particular, procedural memory seems to depend on the basal ganglia (Mishkin & Petri, 1984).

In contrast, the hippocampus seems to play a crucial role in complex learning, and particularly in the encoding of declarative information (Zola & Squire, 2000). The hippocampus also appears to be involved in the consolidation of encoded information in long-term memory, perhaps as a means of cross-referencing information stored in different parts of the brain. Likewise, the amygdala seems to play a key role in memory consolidation, especially where emotional experience is involved (LaBar & Cabeza, 2006; McGaugh, 1999). The cerebral cortex appears to play a smaller, but still important role in long-term memory, particularly declarative memory (Zola-Morgan & Squire, 1990). The prefrontal cortex is particularly important for tasks involving working memory (De Pisapia, Slomski, & Braver, 2007; Marklund, Fransson, Cabeza, Petersson, Ingvar, & Nyberg, 2007; Narayanan, Prabhakaran, Bunge, Christoff, Fine, & Gabrieli, 2005).

Another form of memory is the classically conditioned response, in which the cerebellum is heavily involved (Thompson, 1987). For example, when dogs are classically conditioned to salivate at the sight of those who bring them food, we can expect activation in the cerebellum.



Constructivist Approaches

We mentioned at the outset of this chapter that learning is more than just loading down students with memories, in much the same manner that you would fill a computer disk with data. **Constructivist approaches** to learning and memory are based on the idea that children are not like a computer disk or an empty container. That is, students do not wait passively to be filled up with knowledge (Cobb, 2000). Rather, children actively build, or construct, their own knowledge. Although teachers cannot entirely control their students' learning, expert teachers can do much to facilitate students' own active learning processes.

CONSTRUCTIVIST APPROACHES TO MEMORY

A constructivist approach to memory recognizes that prior experience and context affect how we encode memories, how we recall things, and what we actually recall (Alexander, 1996; Greeno et al., 1996). In this sense, memory is constructive—it is something we build. Memory is not merely reproductive, or something we extract from our knowledge base. New knowledge is built on the memory foundation of prior experiences.

What do we mean when we say that memory is affected by prior experience and context? Consider the case of Bubbles P. He was a 33-year-old professional gambler, card dealer, and crap shooter, who also worked part-time in a liquor store. Bubbles was studied extensively by Stephen Ceci and his associates (Ceci, DeSimone, & Johnson, 1992). Bubbles was known for his exceptional memory for cards. He could memorize the exact order of 52 cards in a deck in only 6 minutes! It took Bubbles only 9 minutes to memorize 50 numbers in order. When it came to memorizing colors, faces, or words, however, Bubbles's memory was only average (as was his IQ of 103). For example, he could memorize only 8 colors.

The key to his performance was that Bubbles's memory was affected by context. What Bubbles did for a living affected his motivation and his memory. He had trained his memory to count cards and remember numbers. Memory is not an entity or thing that exists independent of the person. Rather, memory depends on a person's knowledge, experiences, and motivations.

■ **SCHEMAS** An early constructivist, Frederick Bartlett (1932), asked British university students to learn what must have seemed to them to be a strange and only poorly comprehensible North American Indian legend, "The War of the Ghosts" (see page 293). Bartlett found that people tended to distort their recall in an attempt to render the story more comprehensible. For example, the British university students who participated in Bartlett's study often recalled two young men going on a fishing trip, rather than seal hunting. Or they recalled that the war party used a rowboat instead of a canoe. In other words, their prior knowledge, as well as the expectations they had based on this prior knowledge, had a large effect on how they recalled the text.

Few players at blackjack tables share Bubbles's extraordinary ability to memorize the order of a deck of cards.

Index Open

Bartlett suggested that people bring into a memory task **schemas,** or cognitive frameworks for organizing associated concepts. These schemas are based on previous experience, and they affect how we learn and remember. Recall from Chapter 2 that Jean Piaget also suggested the existence of cognitive schemas. Piaget's theory, however, emphasized the ways that schemas change as children develop and must assimilate or accommodate new information. Bartlett's research suggests that not only does information change children's schemas, but those schemas may also affect the information the children learn. Students' prior knowledge

and expectations may cause them to remember information in a distorted way that fits into their existing cognitive frameworks. Recall that, during his review session, Bill Norton asked several students to state their own definitions of the vocabulary words. Through this exercise, he could determine whether the students had interpreted the words in ways that fit with their own cognitive frameworks, but were distortions of the actual meanings.

■ **AUTOBIOGRAPHICAL MEMORY** Students' images of themselves and their views of who they are often shaped in large part by their memories of their own past. *Autobiographical memory* is what we remember of our own history. Autobiographical memory is constructive—that is, you do not remember exactly what happened, but instead form your own reconstruction of what happened. Our autobiographical memories are usually quite good. They can be distorted, however. They are differentially good for different periods of life. Middle-aged adults, for example, often remember events from their youthful and early-adult periods better than they remember events from their more recent past (Rubin, 1982, 1996).

One way of studying autobiographical memory is through diary studies. In such studies, individuals, often researchers, keep detailed autobiographies (e.g., Linton, 1982; Wagenaar, 1986). Linton, for example, kept a diary for a six-year period, recording at least two experiences per day on index cards. Then, each month, she chose two cards at random and tried to recall the events on the cards as well as their dates. She further rated each memory for its salience and its emotional content. Surprisingly, her rate of forgetting events was linear, not curvilinear as is usually the case. In other words, a typical memory curve shows substantial forgetting over short time intervals, followed by a slowing in the rate of forgetting over longer time intervals. Linton's forgetting curve, however, did not show any such pattern. Her rate of forgetting was about the same over the entire six-year period. She also found little relationship between her ratings of the salience and emotionality of memories, on the one hand, and their memorability, on the other hand. In short, she surprised herself in what she did and did not remember.

In another study of autobiographical memory, Sehulster (1989) attempted to recall information about performances he attended at the Metropolitan Opera over a period of 25 years. A total of 284 performances were the data for the study. Sehulster's results were more in line with traditional expectations. His memory was best for operas seen near the beginning and end of the 25-year period (serial-position effect). He also recalled important performances better than less important ones.

■ **MEMORY DISTORTIONS** People sometimes find that their memories are distorted (Ayers & Reder, 1998; Balota et al., 1999; Heaps & Nash, 1999; Johnson & Raye, 1998; Roediger & McDermott, 2000; Schacter & Curran, 2000). For example, just saying something has happened to you makes you more likely to think it really happened, whether it did or not (Ackil & Zaragoza, 1998; Arbuthnott, 2005; Pezdek, Blandon-Gitlin, & Gabby, 2006). According to Schacter (2001), distortions tend to occur in seven specific ways (which Schacter refers to as the "seven sins of memory"). Here are Schacter's "seven sins" and some examples of them from Schacter's work and elsewhere:

1. *Transience.* Memory fades quickly. For example, although many people know that actress Winona Ryder was convicted of felony theft for shoplifting clothing, they do not remember exactly where they found it out. At one time they could have said, but now they no longer can. Students generally do not remember *where* they learned *what* they learned.
2. *Absent-mindedness.* People sometimes brush their teeth after already having brushed them, or they enter a room looking for something, only to discover that they have forgotten what they were seeking. Students sometimes forget assignments because the work just "slips their minds."
3. *Blocking.* People have something that they know they should remember—but they can't. It's as though the information is on the tip of their tongue, but they cannot retrieve it. For example, people may see someone they know but the person's name escapes them. Or they may try to think of a synonym for a word, knowing there is an obvious synonym but being unable to recall it.

4. *Misattribution.* People often cannot remember where they heard what they heard or read something. Sometimes people also think they see things they do not see or hear things they do not hear. For example, eyewitness testimony is sometimes clouded by what we think makes sense that we should have seen, rather than what we actually saw.
5. *Suggestibility.* People are susceptible to suggestion. If it is suggested to them that they saw something, they may think they remember seeing it. For example, in the Netherlands, when researchers asked people whether they had seen a television film of a plane crashing into an apartment building, many individuals said they had seen it. In fact, there was no such film. Students often believe whatever they read on the Internet, for example, despite the low credibility of some of the information to be found.
6. *Bias.* People are often biased in their recall. For example, people who are currently experiencing chronic pain are more likely to remember pain in their past, whether or not they actually experienced it. People who are not experiencing such pain are less likely to recall pain in the past, again with little regard to their actual past experience. Students may be biased against certain groups and recall more negative things about them than they recall about other groups toward which they have a more positive disposition.
7. *Persistence.* People sometimes remember as consequential things that, in a broad context, are inconsequential. For example, someone with many successes but one notable failure may remember the single failure better than the many successes. Likewise, some students remember their failures, but their successes elude them. They just cannot retrieve these memories.

These distortions can affect many forms of memory, including eyewitness testimony.

■ **EYEWITNESS TESTIMONY** Teachers primarily think about memory in terms of its relevance for students' learning of course material. But there are other circumstances in educational settings where memory is important. One such issue in which memory plays a key role is behavior management. Sometimes children misbehave outside the range of a teacher's vision and the teacher is called upon to try to figure out what happened. The teacher may ask children what happened, only to find that one student has one account, while another tells a different story. Sometimes children spontaneously come to teachers to offer their accounts of events, usually unfortunate ones. Obviously, children may, in such cases, have ulterior motives for presenting a biased account of events. But what if they merely try to report on what really did happen? What does the research show with regard to such eyewitness testimony?

Research on eyewitness testimony (Douglass & Steblay, 2006; Loftus, 1975, 1977; Loftus & Ketcham, 1991; Loftus, Miller, & Burns, 1978, 1987; Loftus & Pickerall, 1995; Thompson, Herrmann, Read, Bruce, Payne, & Toglia, 1998) suggests that people can be led to distort their memories. In particular, they tend to use cognitive schemas to build—rather than merely take out—knowledge when they try to recall what they have learned.

To see how this works, consider the following example. When Mary is asked about her memory of the past Memorial Day, she remembers how much she enjoyed going to the beach. Yet a week after she was first questioned, Mary discovers (through a false report) that the past Memorial Day had broken the state's hot weather records. Now when asked, Mary remembers her time at the beach as less fun than she did at first. In particular, she begins to remember how hot the sand had been. Mary's memory of the past Memorial Day was shaped by the new information she learned. But this information wasn't true: Memorial Day wasn't any hotter than usual. Yet because Mary believed the new information, she incorporated it into her memory. This input then changed her memories of the event in question.

Expert teachers are careful to look for distorted perceptions and memories on the part of students. Asking students to relate what they know about a subject may help teachers clear up distorted perceptions before these perceptions become problematic.

In one study, people saw a series of 30 slides (Loftus et al., 1978). In them, someone drove a red car down a street, stopped at a stop sign, turned right, and then knocked down a pedestrian crossing at a crosswalk. As soon as the people finished seeing the slides, they had to answer a series of 20 questions about the accident. One of the questions contained information

that was either consistent or inconsistent with what they had been shown. Half of the research participants were asked, "Did another car pass the red car while it was stopped at the stop sign?" The other half of the participants received the same question, except with the word *yield* replacing the word *stop*. In other words, the information in the question given this second group was inconsistent with what the people had seen.

Later, after an unrelated activity, all people were shown two slides and asked which they had seen. One had a stop sign, the other a yield sign. Accuracy on this task was 34 percent better for people who had received the consistent question (stop sign question) than for people who had received the inconsistent question (yield sign question). Although this distortion may be due to phenomena other than just constructive memory, it does show that we can easily be led to construct a memory that differs from what really happened.

Loftus (e.g., Loftus & Ketcham, 1991) has been instrumental in pointing out the potential problems of wrongful conviction when eyewitness testimony is used as the sole evidence or even the primary basis for convicting accused persons of crimes. She has also noted that eyewitness testimony is often a powerful determinant of whether a jury will convict an accused person. The effect is particularly pronounced if eyewitnesses appear highly confident of their testimony, even if the eyewitnesses can provide few perceptual details or offer apparently conflicting responses. People sometimes even think they remember things simply because they have imagined or thought about them. Indeed, having people repeatedly imagine doing something increases their confidence that they actually have done what they only have imagined doing (Goff & Roediger, 1998). Students may even remember having done an assignment they did not do, if they thought enough about it. In the legal context, it has been estimated that as many as 10,000 people per year may be convicted wrongfully on the basis of mistaken eyewitness testimony (Cutler & Penrod, 1995; Loftus & Ketcham, 1991).

Eyewitness identification is particularly weak when the task is identifying persons of a race other than the race of the witness (Bothwell, Brigham, & Malpass, 1989; Brigham & Malpass, 1985; Meissner, Brigham, & Butz, 2005; Shapiro & Penrod, 1986; Walker & Hewstone, 2006). Astonishingly, even infants seem to be influenced by post-event information when recalling an experience, as shown through their behavior in operant-conditioning experiments (Rovee-Collier, Borza, Adler, & Boller, 1993).

Not everyone views eyewitness testimony with such skepticism, however (e.g., see McKenna, Treadway, & McCloskey, 1992; Zaragoza, McCloskey, & Jamis, 1987). The issue regarding the validity of such testimony is still an open one.

Consider an example of how easy it is for people to manufacture memories. In one study, people were asked to memorize lists of words that were very closely associated with target words, such as *sleep* (Roediger & McDermott, 1995). Words like *dream* and *bed* would appear on the list to be memorized—but the word *sleep* would never appear on the list. To the researchers' surprise, people were as likely to remember having heard the nonpresented word (*sleep*) as they were to remember words actually present on the list! As this study demonstrates, people can believe they have heard something they have not heard with the same confidence they remember something they have heard. This result has been replicated multiple times (McDermott, 1996; Schacter, Verfaellie, & Pradere, 1996; Sugrue & Hayne, 2006). In a classroom setting, for example, children may actually believe they have heard a teacher say something the teacher did not say. The source of this error is not always inattention. Perhaps what the teacher says triggers an association for a student. The student may then believe she has heard what, in fact, is the product only of an association in her own memory.

Why are people so weak in distinguishing what they have heard from what they have not heard? One possibility is a *source-monitoring error*, which occurs when a person attributes a memory derived from one source to another source. People frequently have difficulties in *source monitoring*, or figuring out the origins of a memory (Johnson, 1996; Johnson, Hashtroudi, & Lindsay, 1993). They may believe they read an article in a prestigious newspaper, such as *The New York Times*, when they actually saw it in a tabloid on a supermarket shelf while waiting to check out. Likewise, when people hear a list of words not containing a word that is highly associated with the other words, they may believe that their recall of the central word comes from the list rather than from their minds.

In an age in which students are increasingly bombarded by information, such as from television and the Internet, teachers need to realize that students may remember the information long after they remember its source. As a result, they may believe information to be credible that, in fact, has little or no credibility at all.

■ **CHILDREN'S MEMORIES** Children's recollections are particularly susceptible to distortion, especially when the children are asked leading questions, as in a courtroom setting. Consider what is known about children's memories (Ceci & Bruck, 1993, 1995).

First, the younger the child is, the less reliable the testimony of that child can be expected to be. In particular, children of preschool age are much more susceptible to suggestive questioning that tries to steer them to a certain response than are children of school age or adults.

Second, when a questioner is coercive or even just seems to want a particular answer, children can be quite susceptible to providing the adult what he or she seems to want to hear. Given the pressures involved in court cases, such forms of questioning may be unfortunately prevalent.

Third, children may believe that they recall observing things that others have said they observed. Suppose, for example, they hear a story about something that took place. They then believe that they have observed what allegedly took place.

For all these reasons, the testimony of children must be interpreted with great caution—perhaps even more so than eyewitness testimony from adults. In short, the younger the child, the more a teacher must be skeptical of the child's eyewitness accounts of behavior and misbehavior.

■ **SCRIPTS** Roger Schank and Robert Abelson (1977) took the concept of schemas one step further. They suggested that people develop organized **scripts,** or stereotypical story outlines for how events typically proceed. A script for a typical test-taking session, for example, can include the following actions:

- Learn material.
- Participate or take notes in review session.
- Practice material the night before the exam.
- Walk into the classroom; take a seat.
- Teacher hands out exam papers.
- Answer questions that are easy.
- Check test time remaining.
- Return to hard questions; try to answer.
- Finish all the questions.
- Hand in exam to teacher.

We have similar scripts for activities such as going to a restaurant or going out on a date. Evidence indicates that scripts have psychological reality (Bower, Black, & Turner, 1979). Of course, they are only one of many representations we use for complex sets of information. Scripts are useful for stereotyped sets of actions, such as going to a doctor's office. In contrast, they appear to be less useful in novel kinds of situations.

Children have scripts that can affect their recall of events (Hudson, 1990; Hudson & Nelson, 1986). In other words, children tend to recall an event as though it corresponds with the script they have for the event. In one study, children who went regularly to a creative-movement workshop developed a script that included initial stretching and then certain exercises and activities. One day, the teacher omitted one typical event—for example, the stretching. Later, when the children were asked to recall what they did at the workshop that day, they reported having performed the omitted activity. For example, they said they had done the stretches that day. The children were script dependent: They truly believed the way the event had happened on a given day must have corresponded to their script.

As a teacher, you will see examples of students' scripts for events. Examples include how class activities should proceed, how tests should be written and graded, and how book reports and projects should be completed. Expert teachers need to exercise patience if they wish students to do things differently from the way their script dictates. Scripts have a significant

influence on students. It can be a challenge for students to violate their scripts. Initially, students may not be enthusiastic about a teacher's desire to change the way things are done!

CONSTRUCTIVIST APPROACHES TO LEARNING

Constructivist approaches to education are built on the same key ideas as constructivist approaches to memory. Learners must build their own knowledge—it cannot be given to them. New knowledge also builds on current knowledge. Constructivist approaches to education are based, in part, on the theories of Lev Vygotsky (Karpov & Bransford, 1995). For example, as described in Chapter 2, Vygotsky (1978) believed that children internalize what they see in their surroundings (i.e., their contexts). They build up their knowledge from what they observe around them. Vygotsky also recognized the essentially social nature of learning. Constructivists believe other people are a part of every learning situation—indeed, every context. Thus you can meaningfully study learning only by taking into account the social situation in which the learning occurs.

Many educational approaches based on constructivist views emphasize the social contexts of learning. For example, highly meaningful learning can occur through cognitive apprenticeships, or partnerships between novice students and experts, such as teachers or more experienced students. In such collaborations, the expert acts as a facilitator, advising and helping the novice student when he or she encounters problems while trying to master a task or concept (Collins, Brown, & Newman, 1989; Farnham-Diggory, 1992; Greeno, Collins, & Resnick, 1996; Rogoff, 1990). In Vygotsky's terms, the expert provides the novice student with scaffolding, or gradually decreasing levels of support, as the novice internalizes the task. For example, a math or science teacher asks students to figure out how much water three different containers hold. The teacher does not directly teach students the formula for determining the volume of a container. Instead, he meets with groups of students. He uses the meeting to help them plan a strategy for solving the problem. He then makes himself available for questions or offers hints as students try to develop the formula on their own.

These kinds of group projects increase the chances that students will learn from one another, as well as from the teacher. Thus group projects are an important part of many constructivist educational approaches.

Constructivist views have become increasingly important in schools. They have been used as the basis for the standards of teaching developed by education groups. Examples include the National Council of Teachers of Mathematics' Curriculum and Evaluation Standards for School Mathematics (NCTM, 1989) and the American Association for the Advancement of Science's Benchmarks for Science Literacy (AAAS, 1993).

Group projects in school increase the chances that students will learn from one another, as well as from the teacher; thus, they are an important aspect of constructivist educational approaches.

Some investigators have gone beyond mere constructivism to argue for a view of learning sometimes referred to as **situated learning.** According to the situated-learning perspective, social factors and specific learning environments form an important part of the context responsible for how well people learn (e.g., Brown, Collins, & Duguid, 1989; Derry & Lesgold, 1996; Greeno, 1989, 1998; Greeno, Moore, & Smith, 1993; Lave & Wenger, 1991; Rogoff, 1990). Knowledge does not exist independently (Greeno, Collins, & Resnick, 1996). Rather, learning occurs as people engage in activities. People learn the meanings and significance of objects and information in the situation in which they are working from their roles and activities in the situation (Greeno, Moore, & Smith, 1993, p. 100). Thus a child who learns multiplication while building a set of bookshelves with a parent has one kind of knowledge. A child who learns multiplication by working through numerical problems at school has another kind of knowledge. Bill Norton's students have a different understanding of the vocabulary words than they would if they had learned the words from watching public television.

Laima Druskis/PH College

The key idea of situated learning, then, is that knowledge is embedded in the contexts in which it is learned. This idea suggests that a major part of learning

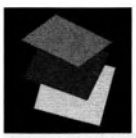
information is achieved through "learning the situation" in a culturally relative context, or **enculturation.** When people learn the rules of a situation, they are becoming enculturated to that situation and building their knowledge (see Alexander, 1996). Examples are learning to use jargon or show certain behavior. Children who attend a baseball game, for instance, may at first not know the meaning of the term "infield fly." At the game, they may observe the times the other fans use the term and their reactions when the infield fly is called by the umpire. These observations help them build their store of baseball knowledge.

A number of investigators question whether learning truly is highly situated (e.g., Anderson, Reder, & Simon, 1996). They believe that much of what people learn about can be transferred. It thus can be applied fairly readily outside the context in which it is learned. For example, much—although not all—of what people learn from reading one text can be applied to another. Many driving skills can also be applied across contexts. Thus it appears that learning may vary as to how situated it is. Some learning transfers more readily than other learning.

School is another kind of culture. Students who find it easier to become enculturated at school may also find it easier to build their knowledge of the subjects taught in school. A program called Practical Intelligence for School (PIFS; see Williams, Blythe, White, Li, Sternberg, & Gardner, 1996) was developed with the aim of helping students learn to succeed in the culture of school. It emphasizes the understanding and control of one's cognition, or metacognition (Hiebert & Raphael, 1996; Sternberg, 1985). Students using this program improved achievement more than those in a control condition (Williams, Blythe, White, Gardner, & Sternberg, 2002).

PIFS has five key components (Williams et al., 1996, p. ix):

- **Knowing Why.** Students need to learn the relevance of school, and of particular school tasks, to their lives. People may need to use algebra and geometry, for example, when they design the house of their dreams.



THE FLEXIBLE EXPERT

TEACHING AND LEARNING ABOUT CONSTRUCTIVIST APPROACHES

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Roz plans to begin a unit on the digestive system by first asking her eighth-grade students to tell her what they already know about digestion. She hopes to tie new information to what the students say they already know, as well as to correct misunderstandings about digestive processes.

THE CREATIVE TEACHER: Roz creates a game in which groups of students are assigned to be different foods and the groups must race to be the first to "pass" through the entire digestive tract. Each group must figure out—on its own, with Roz acting only as an expert guide to resources—the answers to three questions about each important digestive process before they are allowed to go to the next process.

THE PRACTICAL TEACHER: Roz wants students to relate the unit on digestion to their own eating habits. She assigns each student to perform an analysis of how much nutrition was absorbed from the food he or she actually ate on a single day.

THE ANALYTICAL STUDENT: When Marty's geography teacher mentions that the class will be studying central African nations, Marty makes a list of some of what he already knows about Africa so he can find out how the new information will relate to what he has learned before.

THE CREATIVE STUDENT: Marty works with a group of classmates to research and put together a performance of American music and dance that reflects origins or influences from Africa.

THE PRACTICAL STUDENT: Marty hopes to travel to Kenya for a summer study program; thus, of all the facts he learns in geography class, he tries hard to remember those he believes will be most useful if he actually is able to go to Kenya.

EXPERT TEACHER INTERVIEW

FOCUS ON: AUTHENTIC LEARNING EXPERIENCES

RON FORESO: PARSIPPANY HIGH SCHOOL, PARSIPPANY, NEW JERSEY—GRADES 9–12, SOCIAL STUDIES

In December 1991, as an alternative to their usual winter music program of Christmas and Hanukkah songs, the students of Parsippany High School performed a multimedia event commemorating the fiftieth anniversary of the United States' entry into World War II. Students at every grade and academic level, representing nearly every department in the high school, performed this tribute to the local veterans of World War II and their families.

Why did you choose World War II as the theme for this project?

The purpose of the program was not to celebrate a devastating war, but to honor those who fought in defense of our freedom. More than 292,000 young Americans died in combat, and nearly 300,000 factory workers were killed in accidents on the homefront. We shouldn't forget their sacrifice. "Those who don't remember are doomed to repeat it." We must also remember that out of the war experience came advancements in science, medicine, education, and technology that greatly improve our lives today.

How did this program address the students' different learning styles?

This program addressed the needs of many learning styles. There was an opportunity for diverse kids to shine, and to show their expertise. A powerful reason for entering into these programs is that they allow the students to excel at what they are good at, whether it's history, music, English, or art. Some students are not good test-takers, but they are excellent public speakers. These kids were the narrators for the evening's event. Some students are good musicians but not great in history or math. Their brilliance is in their music. Band students researched authentic music from the war years. They dug through libraries, grandmothers' attics. They went about this with a great sense of purpose. Art classes painted banners; social studies classes researched war history; stagecraft students constructed realistic backdrops. For the performance, students wore World War II uniforms and clothing. The history and English classes researched and wrote the narrative material that was performed. The audio/visual and stagecraft students presented a slide show depicting the war.

Describe the night of the performance.

The night of the performance there were more than 500 people in the audience. Nearly half were World War II veterans. The last part of the program was a medley of armed services songs played and sung by our band and choir. The veterans of each branch of the service were invited to stand to be acknowledged. As the Navy veterans stood for "Anchors Aweigh," one of the veterans near the front of the

- **Knowing Self.** Students with practical intelligence have a clear understanding of their personal strengths, weaknesses, habits, and interests. Knowing themselves lets students capitalize on their strengths and compensate for weaknesses.
- **Knowing Differences.** Practical intelligence includes conditional knowledge, the knowledge of when to apply different skills or to use knowledge that has been stored in memory. Students need to see the similarities and differences between different school subjects and activities. Examples of school activities that enhance this knowledge include reading, writing, doing homework, or taking tests, which allow students to learn when to apply different skills.
- **Knowing Process.** Practical intelligence includes knowing the steps needed to reach a goal effectively. For example, students need to learn the process of effectively studying for an exam. They also need to know the steps of writing a good paper.
- **Reworking.** Although checking test answers or rewriting first drafts of papers may not seem worth the time, students with practical intelligence know that reworking pays off. Reworking a project can only add to a student's knowledge. An expert teacher should emphasize to students that reworking is not a sign of failure, but rather a sign of growth.

An important implication of the situated-learning view is that learning should take place in the same context in which knowledge is expected to be used (Cunningham, 1991; Young, 1993). Many constructivists argue that learning in schools is overly abstract. They suggest that teachers should develop authentic learning tasks whenever possible (Brown, Collins, &

auditorium began to cry. His granddaughter, a choir member, saw him and began to cry. Soon, much of the choir and many in the audience were in tears. This event touched all of us on a deeper level than any typical classroom experience.

What did the students learn?

This authentic learning experience involved all areas of the curriculum. In addition, the students were emotionally involved with the learning experience.

Students put human faces to something they usually only read about in a history book or see in a film. A reception preceded the event. The students provided name tags for the veterans and offered refreshments. It was an epiphany for the kids to see that these were real people, who had participated in the making of history, standing right in front of them. Kids made the connection. Spontaneously, several veterans came up to the stage at the end of the concert and had photos taken with the students.

Our students were truly satisfied by the result of their efforts. They received great feedback from the community. One student commented, "I learned more from preparing for this concert than in any history class I've ever taken."

Were the students graded for their participation in this event?

The choir and band classes were graded on their performance that night, as part of their normal grading procedure. They also wrote an essay critiquing the performance. The contributions of English, social studies, art, and stagecraft classes were all graded by their teachers in those subjects.

What is your advice to novice teachers who are planning authentic and multidisciplinary projects?

I told the music teachers at my school not to hide in their department but to go out and teach across the curriculum. Make contact with people in other areas. Get involved with each other's subjects. Students don't learn in a vacuum, and neither do teachers.

I urge young teachers to be innovative, to create learning opportunities that engage your students' interest. Don't be afraid to try new things. Do your homework beforehand, but don't let this inhibit you. You have to dream as well as act. You need to have big ideas. We need leaders of inspired enthusiasm. If you allow yourself to think small, you won't create the educational opportunities kids need. Kids love spectaculars!

I urge young teachers to be innovative, to create learning opportunities that engage your students' interest. Don't be afraid to try new things.

Duguid, 1989; Cunningham, 1991; Needels & Knapp, 1994). For example, the PIFS program stresses the importance of life skills that relate intelligence to the real world in which the student must function, both inside and outside school. The PIFS authors argue that students must know how school tasks are relevant to their lives now. They also must know how they can use what they learn in school to improve their lives later.

Incorporating elements of situated learning into traditional course content is not necessarily difficult. For example, elementary-school students who are taught map skills are generally taught such skills as identifying map symbols and calculating distances between map points. Yet they are almost never asked to plan and travel a route from one place to another (Griffin, 1995). In one study, one group of students learned map skills in lessons that included planning and then traveling a short walking trip. When compared with students who had been taught map skills the traditional way, the students who experienced situated map learning were better able to plan and walk a real route (Griffin, 1995). The Flexible Expert feature, "Teaching and Learning About Constructivist Approaches," shows some other ways that expert teachers and students use constructivist approaches.

The situated-learning approach is more readily suited for some subjects than for others (Griffin, 1995). Even so, teachers can create more realistic tasks in many subjects. For example, math teachers could ask students to calculate percentages using sports statistics or sales tax. Science teachers have the opportunity to involve students in many real-life scientific experiments. These experiments can be done by students working in groups, allowing students to share in the construction of knowledge. Foreign language teachers can invite a native speaker of the language to converse with the class.

TABLE 8.4 Kinds of Memory

Kind of Memory	Definition
Episodic	Encoding, storage, and retreival of events or episodes that the rememberer experienced personally at a particular point in time
Semantic	Encoding, storage, and retrieval of facts that do not describe the unique experiences of the individual recalling the facts, and that are not characterized by any particular temporal context in which the individual acquired the facts
Declarative	A recognition and understanding of factual information ("knowing that")
Procedural	A recognition and awareness of how to perform particular tasks, skills, or procedures ("knowing how")
Recall	A process of memory often used in memory tasks, in which the individual is asked to produce (not just to recognize as correct) a fact, word, or another item from memory
Recognition	A process of memory often used in memory tasks, in which the individual is asked just to recognize as correct (not to produce) a fact, a word, or another item from memory

Not all cognitive psychologists accept the situationist view. Many argue that general principles of learning apply in a variety of situations (e.g., Banaji & Crowder, 1989), although how they apply varies somewhat from one situation to another. We discuss this idea of transfer of knowledge in detail in Chapter 9. The situated-learning view is important for educators, however. It points out that how well children will learn in the classroom depends not only on the teacher's specific instruction, but also on the general environment for learning and the role that the teacher takes in the classroom.

A number of different kinds of memory have been discussed in this chapter. For your convenience, they are summarized in Table 8.4.

SUMMING IT UP

WHY UNDERSTANDING COGNITIVE APPROACHES TO LEARNING IS IMPORTANT TO TEACHERS

- This chapter discussed a cognitive approach to learning. Much of the chapter was devoted to describing the workings of memory, the mechanisms of which allow us to retain and retrieve information.

THE STANDARD MEMORY MODEL

- Three basic operations of memory are encoding of information, storage of information, and retrieval of information. According to the standard model of memory, information first enters a sensory register, then moves to short-term memory, and finally moves to long-term memory.
- Information can be moved into or held in short-term memory if there is rehearsal, a metamemory skill that can be learned. Information must be encoded if it is to move into long-term memory. The total-time hypothesis suggests that spending a longer amount of time studying information in a single session increases the chances of that information being remembered. Distributed learning, via several learning sessions spaced out over time, is more effective for long-term memory than is massed learning, or cramming.
- Another way to encode information for long-term storage is to elaborate on it, or associate it with something already known. Elaborative rehearsal is more effective than maintenance rehearsal, which consists of simply repeating new information.
- Long-term memory can be divided into declarative knowledge ("knowing that") and procedural knowledge ("knowing how"). Conditional knowledge is "knowing when" to use information stored in long-term memory. Declarative knowledge can be divided into two types: semantic (our general knowledge of the world) and episodic (personally experienced events or episodes).
- Information is mentally represented in memory in several different ways. Declarative knowledge can be stored in analogical representations, such as mental imagery, or in symbolic representations, such as propositions. Propositions may be organized into propositional networks, consisting of a web of interlinked nodes.

ALTERNATIVE MODELS OF MEMORY

- A variety of alternatives to the standard model of memory have been proposed. For example, connectionist models integrate much of what we know about memory. They rely heavily on the idea of networks of stored information and the idea that activating one part of a network will lead to a spreading activation of related information. Another alternative model of memory emphasizes working memory, which is a temporarily activated part of long-term memory. A third model focuses on levels of processing; it proposes continuous levels rather than discrete stores for holding information.

RETRIEVING INFORMATION

- Tasks used to assess students' memories generally can be divided into two groups: recall or recognition. Recall tasks, which require a person to produce information from memory, include free recall, serial recall, and paired-associates recall. Recognition tasks require that the person select or identify something he or she has learned.
- Retrieval cues can enhance accessibility of stored information. Advance organizers provide one form of retrieval cue. The context in which something is encoded substantially affects how well that something is later retrieved. According to the encoding-specificity principle, what is encoded determines in large part what is later retrieved. Mnemonic techniques that students or teachers can use to improve their learning and memory include categorical clustering, interactive images, pegwords, the method of loci, acronyms, acrostics, and keywords. Mnemonic devices, such as PQ4R, also can be used during studying.
- Although decay may play some role in forgetting, interference appears to be more important. The two main kinds of interference are proactive and retroactive interference.

CONSTRUCTIVIST APPROACHES

- Constructivist approaches suggest that memory is largely constructive, or built on prior experience and context, rather than being merely reproductive. People often use existing cognitive frameworks, or schemas, to construct organizations for new information. Mental scripts, or stereotypical sequences of events, also can affect students' expectations and memories.
- Proponents of the situated-learning perspective suggest that social factors form an important part of the context responsible for how well people learn, and that learning must be studied and understood in the context in which it takes place. Learning takes place in and is relevant to a cultural context called enculturation. An important aspect of situated learning is people's metacognition, or the way they understand and control their own thinking.

KEY TERMS AND DEFINITIONS

- **Advance organizer** Way of organizing information to be learned to enhance learning. Page 290
- **Analogical representations** Declarative memories that preserve many aspects of the original stimulus. Page 278
- **Chunking** Grouping items of information so as to expand the amount of information that can be stored in short-term memory. Page 274
- **Cognitive approaches** Theories that emphasize the mental mechanisms underlying the processing and representation of information during learning. Page 270
- **Conditional knowledge** Knowledge of when and how to apply the declarative and procedural knowledge you have. Page 281
- **Constructivist approach** Approach to learning based on the idea that children actively build their own knowledge. It suggests that prior experience and the context of learning affect how we encode memories, how we recall, and what we recall. Page 297
- **Context** Environment in which learning takes place. Page 270
- **Decay theory** Theory of memory suggesting that information is forgotten because of the gradual disappearance over time of an unused memory trace. Page 294
- **Declarative knowledge** Knowledge of facts stored in semantic or episodic memory. It is sometimes described as "knowing that." Page 277
- **Distributed learning** Learning done over several sessions spaced out over time. Page 276
- **Elaborate** To learn by thinking carefully about information and associating it with other known information. Page 274
- **Elaborative rehearsal** Learning strategy in which the person thinks carefully about new information, associating it with information already learned or associating various items of the to-be-learned information. Page 274
- **Encoding specificity** Principle of memory suggesting that the context in which something is encoded substantially affects how well that something is later retrieved. Page 290
- **Enculturation** Principle of situated learning suggesting that much of learning is achieved through "learning the situation" in a culturally relative context. Page 303
- **Episodic memory** Long-term memories holding personally experienced events or episodes. Page 277
- **Free recall** Type of memory test in which a person must recite back a list of learned items, in any order. Page 288
- **Implicit memory** A type of memory in which an individual recalls or recognizes information without consciously being aware of doing so. Page 282
- **Interference theory** Theory suggesting that forgetting is caused by competing information that renders the sought-after information inaccessible. Page 294

- **Levels-of-processing model** Model of memory in which storage is seen as varying along a continuous dimension in terms of depth of encoding. It suggests that the deeper the level at which an item is processed, the higher the probability that the item will be retrieved later. Page 286
- **Long-term memory** According to the standard model of memory, the third store of memory, which has a very large, possibly unlimited capacity; it is capable of storing information for very long periods of time, possibly indefinitely. Page 272
- **Maintenance rehearsal (rote learning)** Learning strategy that involves learning and memorizing new information by simply repeating it. Page 274
- **Massed learning** Learning that is crammed, occurring all at one time. Page 276
- **Memory** Active mental mechanisms that enable people to retain and retrieve information about past experience. Page 270
- **Mental representations** Ways in which knowledge is stored in memory. Page 276
- **Metacognition** Understanding and control of one's own cognition. Page 276
- **Metamemory** Knowledge and control of one's own memory. Page 273
- **Mnemonic devices** Specific techniques for improving learning and memory. Page 291
- **Paired-associates recall** Type of memory procedure in which a person learns pairs of words. When one word in the pair is presented, the person must respond with the correct matching word. Page 289
- **Parallel distributed processing (PDP) model (connectionist model)** Model of memory that focuses on the ways declarative and procedural knowledge are combined via series of connections among elements. Page 283
- **PQ4R** Mnemonic device for the steps in a study method: Preview, Question, Read, Reflect, Recite, and Review. Page 293
- **Proactive interference (proactive inhibition)** Forgetting caused by activity that occurs before something is learned. Page 295
- **Procedural knowledge** Knowledge of how to do certain things; "knowing how." Page 279
- **Productions (condition–action sequences)** Way of storing procedural knowledge in memory as condition–action sequences that tell us, "If this, then do that." Page 280
- **Propositional network** Schematic integration of interrelated propositions. Page 278
- **Recall task** Memory task that requires a person to produce information from memory. Page 288
- **Recognition task** Memory test that requires a person to select or identify something he or she has learned previously. Page 289
- **Rehearsal** Repeated recitation of an item. Page 273
- **Retrieval** Gaining access to information stored in memory; one of three basic memory operations. Page 271
- **Retrieval cues** Clues or reminders that can enhance the ability to retrieve stored information from memory. Page 289
- **Retroactive interference (retroactive inhibition)** Forgetting caused by activity that occurs after something is learned. Page 294
- **Rote learning** Learning by repetition with little or no attempt to add to or find meaning in the information. Page 274
- **Schemas** Cognitive frameworks for organizing associated concepts. Page 297
- **Script** Stereotypical story outline for how events typically proceed. Page 301
- **Self-reference effect** Effect whereby people show very high levels of recall when asked to relate words meaningfully to themselves by determining whether the words describe themselves. Page 287
- **Semantic memory** Long-term memory store holding general knowledge of the world. Page 277
- **Sensory register** According to the standard model of memory, where much information is first stored when it is sensed. It is capable of holding relatively small amounts of information for brief moments of time. Page 272
- **Serial-position curve** Combination of phenomena in which items near the beginning of a list and near the end of a list are remembered well. Page 295
- **Serial recall** Type of memory procedure in which a person must recite back a list of learned items, in the same order that the items were originally presented. Page 288
- **Short-term memory** According to the standard model of memory, the second store of memory, which is capable of holding relatively limited amounts of information for a matter of seconds, and, in some instances, up to two minutes. Page 272
- **Situated learning** View suggesting that social factors and specific learning environments form an important part of the context responsible for how well people learn. Page 302
- **Spreading activation** According to the connectionist model of memory, a phenomenon whereby activation of one node may prompt activation of another, connected node. Page 283
- **Symbolic representations** Declarative memories that rely on arbitrary symbols that may bear no obvious relation to whatever it is being represented. Page 278
- **Total-time hypothesis** Principle of learning suggesting that how much you learn studying in a single session depends on how much time you spend studying. Page 274
- **Working memory** According to the working model of memory, an active part of long-term memory that also includes temporary, or short-term memory. Page 285

QUESTIONS AND PROBLEMS

Apply the concepts introduced in this chapter to the following problems of teaching practice.

IN ELEMENTARY SCHOOL

1. How could you teach kindergartners to use elaborative rehearsal to remember the letters of the alphabet?
2. How would you prime second graders before teaching them subtraction? In other words, what previous knowledge do you think second graders would have on which to build an understanding of subtraction?
3. How would you create an authentic learning situation for a sixth-grade social studies unit on Japan?
4. What kind of assignment would you give your fifth graders to assess both their recognition and their recall of the names of countries in Africa?
5. How might you develop a lesson, based on the ideas of the working-memory model, to clear up first graders' misconceptions about the nature of electricity?

IN MIDDLE SCHOOL

1. What would you say to convince your eighth-grade Spanish students that rote memorization may not be the most effective way to learn Spanish?
2. How would you encourage your seventh-grade science students to process the names of the plant phyla at deeper, rather than surface, levels?
3. What are some mnemonic devices you could use to help students in your health class remember the names of vitamins that are important to include in their diets?
4. Which kinds of advance organizers would you use to help sixth graders learn and remember the key points of a unit on structuring paragraphs?
5. How would you set up a unit on geometry that would let students work in groups, with you serving only as an expert resource, to discover the way to find the sizes of the angles in a triangle?

IN HIGH SCHOOL

1. How would you incorporate students' metamemory skills in your Chemistry I class curriculum?
2. What could you do to help students in your last-period English class avoid forgetting what you teach them, due to proactive interference from the information learned in all their previous classes on the same day?
3. How could you incorporate some of the principles of constructivist learning (student-constructed knowledge, building on previous knowledge, cognitive apprenticeships, group learning, and authentic learning situations) into first-semester algebra classes?
4. What are some ways you could get tenth-grade students today to elaborate via self-reference—that is, to think about their own resemblance and connection to—Shakespeare's Macbeth?
5. How would you prime the memories of the students in your world history class before beginning a unit on the Crusades?

9 Thinking

CONCEPT FORMATION, REASONING, AND PROBLEM SOLVING

Why Understanding Thinking Is Important to Teachers

Concept Formation

Defining Features of Concepts

Characteristic Features of Concepts

Reasoning

Deductive and Inductive Reasoning

Developing Reasoning Skills

Problem Solving

The Problem-Solving Cycle

Types of Problems

Strategies for Problem Solving

Impediments to Problem Solving

Expertise in Problem Solving

Transfer

Types of Transfer

Teaching for Transfer

Decision Making

Satisficing

Teaching for Thinking

Use Role Playing

Use Groups

Model and Explicitly Teach Thinking Skills

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this chapter:

- How do students learn and organize their knowledge about concepts? What are the main approaches to understanding what concepts are and how they are used?
- What are the main kinds of reasoning? Which kinds of errors in reasoning do students make, and how can they avoid these errors?
- Which kinds of problems do students confront? Which techniques can students use to improve their solving of problems inside and outside school? What makes a student an expert problem solver?
- How can you help students transfer knowledge and skills gained from solving one type of problem to other types of problems?
- Which steps can you take to promote effective thinking, inside and outside the classroom? How can you help students develop insightful solutions to problems?

Joan Gracek took a continuing education seminar over the summer on teaching for thinking. As a result of what she learned, she decided to change the emphasis of instruction in her tenth-grade biology classes this fall. In the past, Joan had stressed a combination of memorizing basic concepts about plants and animals. She also emphasized learning to write good essays about biological principles such as evolution. This year, however, she decided to give students a more active role. Now she expects them to examine, interpret, and judge critically several different theories about the natural world. Joan believed this new approach would help students become more active learners. As a result, they would better know how to solve problems in biology. They also would reason more effectively with biological concepts.

The plan sounded great—that is, until the students heard it! They were not pleased. Joan had a reputation for being an easy teacher who gave mostly A's. The students were expecting to slide through her course with little more than the basic textbook for support. The first test, on plant species, showed that the students were basically memorizers. They had a long way to go before they would be able to think like scientists.

Joan realized that teaching the next unit, on animals, would require more effort on her part. She decided to change her approach to teaching concepts. She started by having students learn about groups of animals. They would judge, based on a number of examples of animals both within and outside of the group, the name and characteristics of a group. For example, they might have to guess the characteristics of mammals or birds.

Next, Joan gave the class a "mystery animal" game to play. Her students pretended to be biologists exploring an unknown island who came across an undiscovered animal. They could draw clues about the animal, or about various animal groups, from a special deck of clue cards that Joan had prepared. For example, Lin drew a card that read, "Most mammals give birth to live young. Some reptiles and amphibians give birth to live young. This animal gives birth to live young." The students combined a number of such clues. The idea was to classify and name the newly discovered animal. With such practice during the animal unit, the students were able to do much better when faced with similar problems on their second test.

Joan Gracek, like many teachers, has come to believe that the teaching of thinking skills should be a central and vital task in education. The overall goal of education is to help students gain knowledge they can use to help them succeed. Moreover, they need to succeed not only in their schoolwork, but also throughout their lives. Knowledge that cannot be used or applied is often called inert knowledge. Thinking, by contrast, is skill in making active, reflective use of knowledge.

More formally defined, thinking involves the representation and processing of information in the mind. Thinking skills can and should be taught. Later in this chapter we cover the main methods for doing so. Most important, teachers need to establish a culture of thinking in the classroom. In such a culture, students learn that critical thinking and inquisitiveness are an integral part of all classroom activities, rather than being add-ons that apply only on special occasions.

One important part of thinking is the formation of concepts, which are organizations or groupings of ideas in the mind (Barsalou, 2000; Hampton, 1997, 1999; Quinn, 2004). Teachers can have a great influence on their students' abilities to form concepts effectively. Another thinking skill that is important both in and out of school is skill in reasoning. Reasoning is the thinking involved in drawing conclusions from evidence (Leighton, 2004a, 2004b; Leighton & Sternberg, 2004). In this chapter we discuss the two major types of reasoning. We then describe some common flaws in people's reasoning. Finally, we discuss some ways you and your students can avoid these fallacies.

Teachers are interested in more than just how students think, or process information in their minds. They also want to help students apply their thinking skills to problems they encounter, both inside and outside school. This chapter describes effective strategies for solving problems that you can teach to your students. It also provides some key guidelines for teaching your students how to transfer their knowledge. Transfer refers to applying what one has learned in new settings.

Why Understanding Thinking Is Important to Teachers

Do students really need to be taught to think? Perhaps not. Raymond Nickerson (1987, p. 28) has pointed out that "with or without special training, everyone thinks." What, then, should people be taught? Perhaps it is "how to think more effectively—more critically, more coherently, more creatively, more deeply—than we often, perhaps typically, do" (Nickerson, 1987, p. 28). But "many students, at all levels of formal education, are unable to do the kind of thinking and problem solving that their schoolwork requires" (Nickerson, 1994, p. 411; see also Grotzer & Perkins, 2000; Nickerson, 2004; Perkins & Grotzer, 1997). For example, some students may superficially understand material they retrieve from the Internet, yet not be able to evaluate the credibility of the source of that material adequately.

What is an effective thinker? Numerous activities are included under the broad definition of thinking (Reed, 2000a). For example, students must be able to classify ideas or objects, place them in various orders, make estimates, and extrapolate from limited data. They also need to be able to weigh evidence and draw conclusions, and to use analogies appropriately. Effective thinking is not only analytical, of course: It also involves creative and practical modes.

One distinction often made in education is that between critical thinking and mindlessness. Educators are particularly interested in encouraging critical thinking. In **critical thinking,** students consciously and purposefully direct their thoughts to find a solution to a problem (Halpern, 1998). In contrast, most teachers work hard to help their students avoid mindless thinking. People think mindlessly when they routinely and automatically follow a customary thought pattern without consciously directing their thoughts (Langer, 1993, 1997). For example, it may be useful to memorize a list of pollutants and their sources in a local river—but it may be even more useful to work together in groups to develop a plan to reduce the level of one of the pollutants.

Why is effective thinking so important? Nickerson (1994) suggests three key reasons. First, effective thinking is becoming increasingly important for success in school. Second, independent thinking and problem solving are becoming job requirements for careers that students may pursue after they leave school. Third, a thoughtful populace is better able to solve the complex problems facing society at all levels. These levels range from neighborhoods and towns, to nations, and even to the world community. The Flexible Expert feature, "Teaching and Learning About Thinking," provides examples of teachers and students who think effectively in analytical, creative, and practical modes.

Many students face the immediate need to develop effective thinking skills so that they can succeed in school. In 1991, for example, the U.S. Department of Education's National Educational Goals Panel (1991) set the following goal related to thinking skills: to demonstrate substantial improvement in the critical thinking and problem-solving skills of college graduates by the year 2000. As part of the effort to develop the thinking skills of today's students, many test programs increasingly require students not only to remember material, but also to analyze and evaluate it (Ennis, 1987).

Students need to understand thoroughly what they are taught. To do so, they must learn to think deeply about material presented to them. They also need to understand their own thinking and the kinds of errors they are likely to make. Thus metacognition—the understanding and control of one's cognitive processing—is as important to thinking as it is to learning and memory (Moses & Baird, 2000). But what is involved in this type of thinking? And how can students be taught to think more effectively? These are the major questions we address in this chapter.

THINKING PRACTICALLY

Critics of particular schools or teachers sometimes complain that students are forced to engage in mindless activities. What do you see as an example of a mindless activity that students pursue in some classrooms? Drawing on your own experience and imagination, can you identify an example of another activity students might pursue that will help them be more mindful?

SUGGESTION: Worksheets with many repetitive examples of the same kind of activity can become mind-numbing. A better alternative or, at least, supplement is practice with simulations of real-world problems requiring the same operations.

Concept Formation

Let us begin by considering how students form concepts. **Concepts** are mental abstractions or categories of similar objects, people, events, or ideas (Hampton,

THE FLEXIBLE EXPERT

TEACHING AND LEARNING ABOUT THINKING

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Pat studies the thinking processes that lead to insightful problem solving and then brainstorms how he can apply these to his own teaching.

THE CREATIVE TEACHER: Pat creates a mystery story in which his students must use creative thinking skills to solve the mystery.

THE PRACTICAL TEACHER: Pat suddenly realizes that students' low scores on math tests with word problems may be due to their inability to decide which information is relevant to the problem, rather than an inability to perform the calculations. Pat hands out a checklist of steps for solving word problems, and he works through the steps with students when presenting new word problems in class.

THE ANALYTICAL STUDENT: Chris can point out fallacies in the reasoning of a character in a novel that led to the character's tragic demise.

THE CREATIVE STUDENT: Chris writes a story about what happens to a person who wrongly reasons that, because "everyone is doing drugs," she will not be harmed if she experiments with dangerous drugs.

THE PRACTICAL STUDENT: Whenever she thinks they are reasoning fallaciously, Chris asks her friends questions so they clarify their arguments.

2000, 2007; Murphy, 2004). A key goal of teaching is conveying to students the nature of various concepts. Examples of concepts are odd numbers, longitude, tragedy, plural, and mass, to name just a few. At first, the topic of how concepts are formed may seem obvious to you. After all, you learned many concepts when you first learned language as a child. But matters are actually a bit more complicated: Research on how people learn concepts suggests that not all concepts are learned in the same way (Keil, 1999b; Ross, 2000). Thus expert teachers must know different methods for teaching concepts. In this way, they can reach more students with more effective instruction.

DEFINING FEATURES OF CONCEPTS

How do you know that *two* is an even number and *three* is an odd number? Probably because sometime ago you learned that an even number is defined as any integer that is divisible by two without a remainder. An odd number is a number that is not evenly divisible by two. Other concepts can also be systematically defined. For example, a bachelor is an unmarried adult male.

Concepts such as that of an even number or a bachelor are easily understood in terms of defining features. **Defining features** are necessary and sufficient for defining a concept (see Katz, 1972; Katz & Fodor, 1963; Medin, Proffitt, & Schwartz, 2000). But what does it mean for a feature to be necessary and sufficient?

Consider an example. If an integer is evenly divisible by two, this feature is a necessary characteristic of an even number. You cannot find an even number without this property. Being divisible by two is also enough to guarantee that the integer is an even number. In other words, divisibility by two is sufficient for evenness of a number.

When students learn about concepts, it is useful for them to think about which features are necessary and which features are sufficient. In this way, they better learn the exact nature of the concept. For example, they might learn that there are three defining features of a widow. First, she is a woman (a necessary but not sufficient feature, as not all women are widows, but all widows are women). Second, she has previously been married (a necessary but not sufficient feature—the woman might be divorced). Third, her husband has died (a necessary and sufficient feature). As another example, consider the concept of a pair. It always involves two of something. Two of anything is always a pair, we can say that "twoness" is a necessary and sufficient feature of a pair. Similarly, uranium has an atomic number of 92.

Any element with an atomic number of 92 is uranium. Thus the atomic number 92 is a necessary and sufficient feature of uranium.

CHARACTERISTIC FEATURES OF CONCEPTS

Defining a concept in terms of necessary and sufficient features works well for some but not for all concepts. For example, try listing the necessary or sufficient features of a bird. Most birds fly—but not all of them do. For instance, an ostrich is a bird, but it does not fly. And what are the necessary or sufficient features of a game (Wittgenstein, 1953)? Most games are enjoyable, but not all are. Most games are played by several people, but solitaire certainly is not. Thus some concepts do not seem to be well described in terms of necessary and sufficient features. As a result, psychologists also think in terms of a second kind of feature. It is referred to as a characteristic feature.

A **characteristic feature** (Medin et al., 2000; Rosch & Mervis, 1975) is a property typical of something represented in a concept, but not always associated with it. For example, the ability to fly is a characteristic rather than a defining feature of a bird. Having multiple players is a characteristic feature of games, but it is not a defining feature. Numbers are characteristic of mathematics problems, but they do not constitute defining features.

Students should learn to understand the difference between characteristic and defining features. For example, in history class, students need to distinguish between two kinds of features of a king. Being the titular head of a kingdom is a defining characteristic of being a king of a country. Inheriting the throne, however, is only a characteristic feature. In some countries, kings have come to power through other means, such as rebellion.

Obviously, some concepts have many characteristic features, while others have only a few. For example, a robin seems to have a lot of the characteristic features of a bird. An ostrich does not. Similarly, a cow is quite typical of a mammal. Bats and whales are not. The most representative instance of a given concept is referred to as a **prototype** (Hampton, 1995; Medin et

THINKING ANALYTICALLY

Are there any defining features of a teacher? In other words, do any attributions uniquely define someone as a teacher?

SUGGESTION: Imparting of knowledge to one or more students is a defining feature. (Note that to be a teacher, one need not be a professional. Parents are teachers, regardless of whether or not they are paid to teach.)

THINKING ANALYTICALLY

What are the characteristic features of a school?

SUGGESTION: Examples of characteristic features are the presence of classrooms, books, and students.

Anthony Magnacca/Merrill

Bob Daemmrich Photography, Inc.

Lori Whitley/Merrill

Although each of these three schools is distinctive in its look, all share certain typical features. It is important that students have a full understanding of a concept—here, the meaning of "school."

al., 2000; Rosch, 1973; see also Smith & Medin, 1981). For most North American readers of this book, a robin would come close to being a prototype of a bird.

How do we actually represent concepts in our minds? Some concepts, such as that of an "odd number," seem to be organized primarily in terms of defining features. Others, such as "game," are organized primarily in terms of characteristic features. Still other concepts, such as "bird," seem to be organized in terms of both defining and characteristic features. We have described the characteristic features of a bird. But birds also have defining features, such as their warm-bloodedness. Thus teaching students about the meanings of concepts can involve teaching them in any of three ways. Teaching may focus on only defining features, only characteristic features, or both defining and characteristic features.

Not everyone agrees that concepts described primarily in terms of characteristic features are mentally represented in terms of prototypes. It is difficult, for example, to think of just what the prototype for a dog would be. Might it be a German shepherd, perhaps? A cocker spaniel? For many people, no one kind of dog seems quite as typical of dogs as a robin does of birds. Some researchers have suggested instead that what people store are good exemplars of such concepts. **Exemplars** are highly typical instances (see Barsalou, 1990, 2000; Medin et al., 2000). In the case of a dog, a person might compare a new animal to exemplars such as a collie, a poodle, or other typical dogs. He or she then would decide whether the new animal is a dog by determining whether it closely resembles any of these good exemplars (Ross & Spalding, 1994; see also Komatsu, 1992). When teaching new concepts, expert teachers start with highly typical exemplars. They then move on to ones that are less typical. At the same time, they help students see the more and less typical features.

FIGURE 9.1 Example of a Concept Map

Mentioning a larger category may activate students' memories of related information, thereby helping them fit the new concept into their schemas (Murphy & Allopena, 1994). Teachers can also draw a **concept map,** a picture or diagram. An example would be the hypothetical map of one student's concept of sports in Figure 9.1, which illustrates the relationships among the various concepts (Novak & Musonda, 1991).

iMPLICATIONS FOR TEACHING

Expert teachers use several different ways to teach concepts effectively:

- **Use a lot of examples.** Examples help clarify the boundaries of a concept. Here are three general rules to keep in mind when presenting examples of concepts (Tennyson & Park, 1980, p. 59):

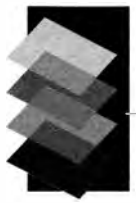
  Rule 1: Present the examples in order from easiest to most difficult. Highly typical exemplars are likely to be the easiest for students to understand. A science teacher presenting examples of stars might discuss the North Star before mentioning that our sun is also a star.

  Rule 2: Select examples that are different from one another. The science teacher presenting the stars could include examples of both new and old stars.

  Rule 3: Compare and contrast examples and nonexamples. Examples of objects in space that are not stars include planets, our moon, and meteors.

- **Combine examples with definitions to encourage full understanding of a concept** (Joyce & Weil, 1996). Joan Gracek taught her biology students about animal groups by discussing examples before presenting definitions of the concept (Tennyson & Cocchiarella, 1986). Another method is to present the definition first. For example, one might start by defining alliteration as the repetition of initial consonant sounds in two or more neighboring words. One then might offer examples such as "partridge in a pear tree" and "two turtle doves." A synthesis of the two approaches would involve several steps. First, one would present the definition. Next, one would follow it with examples. Finally, one would reinforce the definition.

- **Distinguish between defining and characteristic features.** Some concepts are easily described by their defining features. With other concepts, however, teachers may need to define them by citing their characteristic features. Discussion should focus on whether features are necessary, sufficient, or both. For instance, a teacher might point out that the characteristic of flight is neither necessary nor sufficient to identify an animal as a bird. Consider as examples bats and insects, on the one hand, and penguins, on the other hand.
- **Help students link new concepts to what they already know.** For example, the teacher introducing alliteration might mention that it belongs to a larger group of word sounds. These sounds also include rhyming and assonance.



Reasoning

Reasoning is the process of drawing conclusions from evidence (Sternberg, 2000; Sternberg & Ben-Zeev, 2001; Wason & Johnson-Laird, 1972). By reasoning, students make sense of what they read and hear in class. Reasoning is a basic part of deep and thoughtful learning. Expert teachers encourage students to reason with concepts, rather than simply to memorize these concepts. Philosophers and psychologists alike typically divide reasoning into two basic kinds—deductive and inductive (Heit & Rotello, 2005).

DEDUCTIVE AND INDUCTIVE REASONING

Deductive reasoning is the process of drawing specific, logically valid conclusions from one or more general premises. In other words, it is a process of going from the general to the specific (Johnson-Laird, 2000; Goel, 2007; Rips, 1999; Sternberg, 2000). By its nature, deductive reasoning leads to conclusions that are logically certain.

Some of the material students learn in school is presented first in terms of general concepts. The same material is then presented in terms of specific points and conclusions that follow from these concepts. Examples are easy to find in science classes. A teacher explains that every liquid has a distinctive boiling point. When its temperature reaches this point, it turns into gaseous form. The teacher asks students to identify several different clear liquids based on their boiling points. The name of the liquid follows logically here from knowledge of the boiling point (assuming each liquid has a unique boiling point). In formal terms, we say, for example, "If a liquid boils at 212 °F, it is water. This liquid boils at 212 °F. Therefore, it is water."

Similarly, in the story at the beginning of the chapter, Joan Gracek had students deduce from several general clues the group to which an unidentified animal might belong. If there is only one possible kind of animal it can be, the reasoning involved is deductive reasoning. The logical form might be: "If an animal is warm-blooded and feeds with milk secreted by the mammary glands of a female, then it is a mammal. This rabbit is warm-blooded and feeds with milk secreted by the mammary glands of the female. Therefore, it is a mammal."

Most real-world arguments do not involve the kind of certainty possible in deduction. In real life, we are not usually told the overarching rule that explains what will happen and why. Often, there is no such rule. Instead, most real-world arguments involve the process of making plausible inferences. For example, suppose a young child notices that every adult that he or she has ever met, talks. The child might reasonably conclude that all adults talk. But this inference is incorrect: Eventually the child is likely to encounter a person who is mute. The inference is thereby falsified not by logic, but rather by experience.

Inductive reasoning is the process of drawing reasonable general conclusions from specific facts or observations. In other words, it is a process of going from the specific to the general (Johnson-Laird, 2000; Thagard, 1999). In induction, it is not possible to have logical certainty (Hild, 2006). There is always the chance that the next observation you make will disconfirm what all the previous observations have confirmed. For example, an adult who is

EXPERT TEACHER INTERVIEW

FOCUS ON: TEACHING CONCEPTS

JOANN LEONARD: CRESCENT ELEMENTARY SCHOOL, WALDWICK, NEW JERSEY—GRADE 1

JoAnn Leonard has been teaching for 22 years. She introduces concepts to her first graders by accessing their prior knowledge, or she asks her students to relate the concept to a personal experience.

Which concepts do you encourage your first-grade students to learn?

Teaching first grade is the best! Children enter this level with little or no knowledge of reading, writing, and math skills, and leave with a good basis to build on for their future schooling.

The students learn many new concepts in each subject. More specifically, in the area of mathematics, first graders are exposed to the concepts of addition, subtraction, time, money, simple geometry, and number sense, as dictated by the district curriculum.

How do you approach teaching these concepts to first-grade students?

It is important to begin the teaching of these concepts by accessing the prior knowledge of the students. Once a personal connection has been made, it is the role of the teacher to provide ways for students to comprehend and apply the subject matter. This is Vygotsky's zone of proximal development. For example, in the kindergarten, students are introduced to the concept of time only to the hour. In first grade, I build on that knowledge by introducing the concept of the half hour. In second grade, students learn time to the quarter hour, building further on the same concept.

When I present the concept of money, students' experiences will vary greatly. Some first graders haven't touched money because their parents are afraid they will swallow it. Other kids have much experience handling the coins. At Back-to-School Night, I ask the parents to let their child handle money so that as first graders they can begin to understand the concept. I further enhance these concepts by letting students use various manipulatives in the classroom.

Addition and subtraction are the primary concepts in the math curriculum. It is wonderful if they can add in their heads, but many students must use a number line or counters. Each student gets these concepts at different times. By the end of the school year, however, I want them to be less dependent on the concrete; I encourage them to add without the counter or number line. To reinforce this, we

mute will disconfirm the inference that all adults talk. Similarly, a dog missing a leg might disconfirm the inference that all dogs have four legs.

Expert teachers look for ways to challenge conclusions that students reach on the basis of inductive reasoning. Working in this manner, teachers help students understand how alternative conclusions often can be drawn from the same set of facts. In addition, teachers may discuss how inductive reasoning in scientific research is problematic. As soon as one part of a scientific theory is disconfirmed, scientists are forced to search for a different solution.

DEVELOPING REASONING SKILLS

Effective reasoning is not just necessary in school; it is something students will depend on for the rest of their lives. Reasoning is an important thinking skill, in and of itself. But it is also the foundation for several other thinking skills. These skills include problem solving and making judgments, both of which are discussed in the next section. Expert teachers use many methods to help their students learn to reason. In addition, evidence suggests that superior processing speed and working memory enhance reasoning skills (Kail, 2007). Thus strategies to increase both processing speed and working memory will have benefits for reasoning.

■ **USING SYLLOGISMS** When children argue, they often play "fast and loose" in monitoring the validity of their arguments. The same applies to adults. An argument is deductively valid only when its conclusions follow logically (with certainty) from its premises (Johnson-Laird & Byrne, 1991). One of the best ways to practice deductive arguments is to use syllogism. A **syllogism** is a deductive argument that permits a conclusion from a series of two statements or premises (Braine & O'Brien, 1998; Marrero & Gamez, 2004; Polk & Newell, 1995; Rips, 1994). Each of these two premises contains two terms, and one term is

play "hot pencils." The students add numbers on paper, and when I say "hot pencils" they must drop their pencils. I give them enough time to add in their heads, but not to use counters or the number line. There is a prize at the end of the game—a shiny new pencil!

How do you know when students have mastered a concept?

There is so much growth at this age. When the light bulb goes on for these children, it is dynamic and rewarding!

Students who have mastered a math concept often complete their work without reaching for the manipulative. They can verbalize the skill they are completing, and they can complete their assignments without much teacher direction or assistance. In addition, when a student can use the concept and apply it to a different skill, it is apparent that the child has acquired the main idea.

How do you approach problem solving with your students?

In first grade, problem solving is primarily about social issues—for example, feeling accepted, following rules, tattle-taling, and making new friends. I often use books or videos to point out social issues as they are occurring in our classroom. After reading the books or watching the video, the class discusses the content and makes comparisons to activities surrounding them. The students are often aware that a certain issue is present in our classroom, although sometimes they cannot relate to it.

In first grade, problem solving is primarily about social issues—for example, feeling accepted, following rules, tattle-taling, and making new friends.

What advice would you give to new teachers?

Never assume that a child has experience in a skill. Always begin with the concrete and work toward the concept. Have manipulatives readily available for those students who need them longer than others do.

To experience teaching, you must be in the classroom. Theory assists you, but just like the students, you need hands-on, concrete time to experience what teaching is all about!

common to both premises. Many of the "clue cards" that Joan Gracek prepared for her biology students contained syllogisms.

Three general kinds of syllogism are distinguished: linear, categorical, and conditional (Sternberg & Ben-Zeev, 2001). Linear syllogisms relate terms to one another over a successive (linear) sequence. The terms are expressed in a series of statements called premises. An example of a linear syllogism follows:

Premise A: You are taller than your best friend.

Premise B: Your best friend is taller than your sister.

Who is the tallest?

The logically consistent conclusion is that you are the tallest of the three. The linear syllogism makes apparent the fact that you are the tallest, because of the comparisons and rank ordering the syllogism presents. Note that linear syllogisms are valid only when the premises represent transitive relations. In other words, the fact that A exceeds B on some dimension and B exceeds C on that dimension guarantees that A exceeds C. As many tennis players have learned, not all linear relations are transitive. John might win over Sandy, and Sandy might win over Jason. But Jason might then win over John because John finds himself powerless against Jason's powerful serve.

Young children (younger than approximately age 8) often have difficulty with transitive reasoning. Specifically, they have trouble holding all the terms of the problem in their working memory (see Bryant & Trabasso, 1971). By the time that the question "Who is the tallest?" is asked, six-year-old Jessica probably has forgotten that she is taller than her best friend (premise A). By this time, all that Jessica may remember is that her best friend is taller than her sister (premise B). Working-memory function is thus an important component of reasoning (Buehner, Krumm, & Pick, 2005; De Neys, Schaeken, & d'Y'dewalle, 2005; Gilhooly,

2004; Kail, 2007; Süß, Oberauer, Wittmann, Wilhelm, & Schulze, 2002). Young children may not perform as well on reasoning tasks because they have not yet developed control of their working memories and other aspects of the reasoning process (Markovits, 2004). Moreover, individual differences in these processes result in differences in levels of reasoning skills among individuals of the same age (Stanovich, Sá, & West, 2004).

Categorical syllogisms typically involve relations in which members of one category belong to another category as well. For example, the premises of a categorical syllogism might be "All robins are birds" and "All birds are animals." Questions that help students reason with a categorical syllogism such as this one might include "Are all birds animals?" and "Are some animals not birds?" Teachers might also encourage students to draw or represent the relationships in a categorical syllogism visually. When they have access to these kinds of visual aids, students are more likely to make logically valid deductions. Invalid categorical syllogistic reasoning can hurt students in school. Suppose a student learns that some educational psychology tests are easy and that some easy tests do not require much studying. The student cannot conclude that some educational psychology tests do not require the student to study much.

Conditional syllogisms involve determining the validity of a deduction based on conditions given in the premises of the syllogism. An example of a conditional syllogism might be "If an animal is a robin, then it is a bird. This animal is a robin. Is it a bird?" A good conditional syllogism for students to understand is this one: "If students work very hard, they almost always succeed in school. X is a student who works very hard. Therefore X will almost always succeed in school." Children's reasoning along these lines tends to improve with age (Sternberg & Ben-Zeev, 2001).

Students commonly make two errors in conditional reasoning. The first type of error is called affirming the consequent. Here we assume that if the conditional is true, the "if" and "then" statements can be reversed and the conditional will still remain true. However, this assumption is incorrect. For example, it is true that if an animal is a robin, then it is a bird. Conversely, it is not true that if an animal is a bird, then it is a robin (affirming the consequent). The second type of error is denying the antecedent. Here one assumes that if a conditional is true, it is also true with its antecedent negated. But this is not correct. It is not logically valid to conclude that "If an animal is a robin, then it is a bird" implies the validity of "If an animal is not a robin, then it is not a bird" (denying the antecedent). A pigeon, for example, is not a robin. But a pigeon is a bird.

Deductive validity applies only to whether a conclusion follows logically from its premises. It does not deal with the question of whether the premises—and, therefore, the conclusion—are actually true. Sometimes people do not understand this point, and think that the problem deals with whether the conclusion is true, rather than whether it is logical (Girotto, 2004). They also may let their prior beliefs interfere with their reasoning (Evans & Feeney, 2004). Consider the following deductive argument: "All lawyers are professionals. All professionals work hard. Therefore, all lawyers work hard." This argument is deductively valid—but it is factually incorrect. In the argument, the second premise (all professionals work hard) is false. Thus the argument is deductively valid, but the conclusion is not empirically true. In teaching your students to evaluate arguments, urge them to take into account not only whether the conclusions follow from the premises, but also whether all of the premises are true. If any of the premises is not false, then any conclusion that follows may well be factually wrong, albeit logically valid.

People solve syllogisms through mentally imagining the elements in the problems—forming so-called mental models (Johnson-Laird, 2004)—through rules (Oberlander et al., 1999), or through a combination of both (see also Copeland, 2006). Mental models draw more on spatial visualization skills, rules, on propositions. Both require large amounts of working memory, because one must hold either or both representations in mind as one solves the problems.

A different approach to deductive reasoning suggests an important role for evolutionary factors in deductive reasoning (Cosmides, 1989; Cosmides & Tooby, 1987, 1992; Cummins, 2004). According to Cosmides (1989), psychologists should take an evolutionary view of cognition. In other words, they should consider which kinds of thinking skills would provide a naturally

selective advantage for humans in adapting to our environment across evolutionary time. To gain insight into human cognition, we should study which kinds of adaptations would have been most useful to hunters and gatherers during the millions of years before the relatively recent development of agriculture and the very recent development of industrialized societies.

Cosmides has suggested that one distinctive adaptation of hunters and gatherers occurred in the area of social exchange, when the idea of barter or sale was developed. Two kinds of inferences that people should be well equipped to make are those related to cost–benefit relationships and those related to the detection of cheating. You will reason better if a problem involves detecting that you are being cheated than if it involves, say, a procedure for washing clothes. The idea emphasized here is that people in earlier times who were not skilled in assessing the costs and benefits of a deal or in determining when they were being cheated would have been at a disadvantage in adaptation. Owing to this disadvantage, they would have been less likely to have descendants.

Over a series of nine experiments, Cosmides (1989) found that the predictions of her social-exchange theory better fit the data from people's performance on deductive-reasoning tasks than did the predictions of other models that failed to take into account evolutionary theory.

Deductive reasoning with abstract kinds of terms is practiced and rewarded in some cultures but not in others. As a consequence, individuals in some cultures may find such problems confusing and rather pointless (Cole, Gay, Glick, & Sharp, 1971; Luria, 1976).

THINKING PRACTICALLY

Consider a hasty generalization you have made in your own past. What was the error, and how did you correct it? How might you help students correct their own hasty generalizations?

SUGGESTION: Each student will provide his or her own example. However, you can help students correct such errors by encouraging them to identify the errors and to think reflectively of alternative courses of action.

■ **ENCOURAGING INDUCTIVE REASONING** Students need to be taught that it is important to make inductive inferences. At the same time, it is important to be constantly on the lookout for disconfirmations of these inferences (Popper, 1959; Sternberg & Grigorenko, 2000b). In other words, student need to realize that inductions are only as good as the experience on which they are based.

Not only is inductive reasoning a natural way to learn, but it is also a way in which students can sharpen their reasoning skills in everyday life (Gigerenzer, Todd, & ABC Group, 1999). For example, students may come to believe that a subject is dull because they have studied it before and didn't find it interesting. This induction represents an error in thinking called a hasty generalization. In fact, a new approach to teaching or learning in that subject may make interesting a subject that previously was uninteresting. In much the same way, stereotypes often result when students hastily generalize about a group of people based on a small number of people they have met who belong to the given group.

By examining inductive inferences, we can become much better thinkers and avoid making fallacies. An expert teacher actively works to challenge the hasty generalizations of his or her students. For example, one way to discredit negative hasty generalizations about race or sex might be to create racially and sex-mixed study groups. These groups could then work together to reach a common academic goal.

Having students work in racially and sex-mixed study groups will help them avoid making hasty generalizations about their peers.

■ **REPAIRING FALLACIOUS REASONING AND DECISION MAKING** Expert teachers are quick to point out underlying errors in students' arguments. More importantly, they help students recognize their own errors. By doing so, these teachers help students improve their reasoning skills in ways that will be useful well beyond the immediate situation.

Anthony Magnacca/Merrill

Although people can reason fallaciously in a large number of ways (see, e.g., Levy, 1997; Sternberg, 1986, for lists of common fallacies), certain fallacies tend to be particularly common. Fallacies tend to result from the incorrect application of heuristics. **Heuristics** are informal, intuitive, and often speculative shortcuts in thinking that may solve a problem but are not guaranteed to do so (Korf, 1999; Roberts, 2004; Simon, 1999).

One of the most common fallacies is misuse of the **availability heuristic** (Tversky & Kahneman, 1973). People relying on this shortcut in thinking make judg-

THINKING PRACTICALLY

Give an example from your own life of your use of the availability heuristic, and explain how it led you to an incorrect conclusion. What were the consequences at the time? What did you learn from the experience?

SUGGESTION: Each student must answer for himself or herself.

ments on the basis of how easily they are able to call to mind what they perceive as relevant instances of a phenomenon. Sometimes this heuristic works appropriately. At other times, it leads people astray.

Most of us at least occasionally use the availability heuristic (Tversky & Kahneman, 1973). For example, consider the letter R. Are there more words in the English language that begin with the letter R or that have R as their third letter? Most respondents say there are more words beginning with the letter R (Tversky & Kahneman, 1973). Why? Because it is easier to generate words beginning with the letter R than it is to generate words having R as the third letter. In fact, there are more English language words with R as their third letter. The same happens to be true of some other letters as well, such as K, L, N, and V (Sternberg, 2008). It is important to teach students about errors in reasoning such as the availability heuristic. In this way, they become less likely to draw inappropriate conclusions simply on the basis of whatever information quickly comes to mind. Students must learn that just because a practice is common, and thus "available," it is not necessarily desirable.

Teachers also can fall prey to the availability heuristic. For example, teaching in a way that emphasizes rote memory of concepts may be a strategy that is highly available to many teachers. Its easy availability does not make it the best strategy in all circumstances, however.

Another common fallacy is misuse of the **representativeness heuristic**. When people use this heuristic, they judge the probability that a particular event or object belongs to a certain category by how obviously it resembles or represents the population from which it comes (Kahneman & Tversky, 1971). Consider an example. For much of history, the notion that diseases are caused by microbes eluded laypeople and even medical practitioners. This lack of understanding had many roots, but one almost certainly was that microbes seem nothing at all like the diseases they cause. In other words, microbes seem not to be representative of diseases. Rather, many people considered evil spirits as somehow more akin to the diseases they allegedly caused. Students need to realize that causes (e.g., microbes) often bear no resemblance to their effects (e.g., symptoms of diseases).

Most people believe that if a coin is tossed six times, a sequence of HTHHTH (with H representing heads and T standing for tails) is more likely than a sequence of HHHHTH. In fact, each sequence is equally likely to be generated by a random process. For many people, however, the first sequence somehow seems to "represent" a random coin-tossing process better than the second sequence.

THINKING PRACTICALLY

When have you used the representativeness heuristic to reach a false conclusion? Describe the situation and the consequences.

SUGGESTION: Each student must answer for himself or herself.

Students and teachers alike misuse the representativeness heuristic when they rely on stereotypes or group memberships to judge individuals. For example, a teacher may wrongly assume that a student who is a member of a street gang has little motivation for school. Why? Because other gang members do not seem to be motivated by school. Other people may take it for granted that a well-disciplined classroom is one in which learning is taking place. They falsely assume that good discipline adequately represents the quality of learning taking place! Teachers also may falsely assume that because the students are having fun in the classroom, the students are learning.

A third common heuristic is **overconfidence,** an overestimate of the likelihood of the correctness of a judgment. Try a little test: Do you believe that absinthe is (a) a liqueur or (b) a precious stone? In one study, 200 people received two alternative statements such as this one (Fischhoff, Slovic, & Lichtenstein, 1977). The investigators found that people were strangely overconfident in their responses. In fact, when people were 100 percent confident of their answers, they were right in those answers only 80 percent of the time!

Overconfidence may explain why students are so reluctant to check their work, proofread their papers, and think before they talk. They overestimate the quality of what they have done. By warning students of the overconfidence heuristic, you can help them realize the importance of checking over (in particular, monitoring and evaluating) what they do. If possible, use strong past work to show a student how well he might have done, had he taken the time to go over his work. When the student realizes that small errors can reduce the quality of the grade on a well-thought-out project, he may begin to place more importance on doing a final check of his work.

Of course, equally unsuccessful is relying on the heuristic of underconfidence. **Underconfidence** is a thought pattern in which people believe they are less likely to be cor-

rect than they actually are. As we discussed in Chapter 4, underconfidence seems to be more common among girls than among boys (Phillips & Zimmerman, 1990). Underconfidence can impair a person's willingness to undertake challenges that he or she is fully capable of meeting. It can also make students less willing to ask a teacher or peer for help when they face daunting challenges. Teachers need to be sensitive to both overconfidence and underconfidence, as both are erroneous thought patterns.

Another common error in thinking is the *gambler's fallacy*, the false belief that when a sequence of coincidental events occur in a particular pattern, subsequent events are more likely to deviate from the pattern than to continue in it. Actually, the probability of each event continues to be exactly the same at each occurrence. For example, the gambler who loses in five successive bets may believe that a win is more likely the sixth time. In truth, the gambler is no more likely to win on the sixth bet than on the first—or on the 1001st!

Another common error in judgment is the *sunk-cost fallacy* (Dupuy, 1998, 1999; Friedman, Pommerenke, Lukose, Milam, & Huberman, 2007), which is the decision to continue to invest in something simply because one has already invested in it and hopes to recover the investment. Suppose you put a lot of work into preparing a lesson. You deliver the lesson to your class, but it does not work. You feel badly because of the vast amount of time you put into the lession's development. Instead of discarding the lesson, you try to improve it the next year. Again it fails. Your best bet may well be to start all over with a new lesson rather than to try to improve the existing lesson. You then would look at the time you put into it as a "sunk cost." Similarly, suppose you go on a vacation, which you intend to last two weeks. You are having a miserable time. Should you go home a week early? You decide against it, so as to justify the investment you already have made in the vacation. By doing so, you have committed the sunk-cost fallacy. Instead of viewing the money simply as lost to an unfortunate decision, you have decided to justify the expense by continuing the vacation without any hope that it will get better.

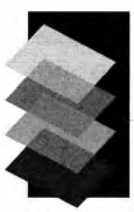
Much of the research on judgment and decision making has focused on the errors people make. Of course, people do act rationally in many instances (Harman, 1995). Moreover, heuristics do not always lead us astray. Sometimes they are amazingly simple ways of drawing sound conclusions. For example, a simple heuristic, *take the best,* can be amazingly effective in decision situations (Bergert & Nosofsky, 2007; Gigerenzer & Goldstein, 1996; Gigerenzer et al., 1999; Hogarth & Karelaia, 2006; Marsh, Todd, & Gigerenzer, 2004). The rule is simple: Identify the single most important criterion to you when making a decision. For example, in choosing a new automobile, the most important factor might be good gas mileage, safety, or appearance. Gigerenzer and his colleagues have shown that this heuristic, which may seem on the surface to be inadequate, often leads to very good decisions—even better decisions, in many cases, than far more complicated heuristics.

Thus heuristics can be used for both good and bad decision making. Indeed, when we take people's goals into account, heuristics often are amazingly effective (Evans & Over, 1996).

THINKING CREATIVELY

Describe an activity you can do with students in which they use their own work to become aware of the prevalence and the danger of overconfidence.

SUGGESTION: An example might be rock climbing, where a person may have confidence in oneself despite lack of training.



Problem Solving

Students use concepts and reasoning to solve problems. Through this process, they learn about and make sense of the world. **Problem solving** is the process of moving from a situation in need of resolution to a solution, overcoming any obstacles along the way (Davidson & Sternberg, 2003; Reed, 2000a; Sternberg, 1997a). Here we consider several aspects of problem solving. First we consider how students go about solving problems. The expert teacher needs to understand this problem-solving cycle to teach students how to use effective problem-solving techniques.

THE PROBLEM-SOLVING CYCLE

Numerous models have been proposed for the exact set of steps used in solving problems (e.g., Bransford & Stein, 1993; Gick, 1986; Spear-Swerling & Sternberg, 1996; Sternberg, 1986;

THINKING CREATIVELY

Give an example of a problem that teachers face in which the solution to the one problem can serve as the basis for a new problem.

SUGGESTION: Using harsh discipline may temporarily suppress bad behavior, but it may result in other kinds of problems, such as displaced aggression and low self-esteem.

Sternberg & Grigorenko, 2000a; Sternberg, Kaufman, & Grigorenko, 2008). In contemplating any set of steps, you should recognize that they represent a problem-solving cycle, rather than a linear progression (Pretz, Naples, & Sternberg, 2003). Also, when people use these steps, they almost never follow them in the strict order presented here. Rather, they do some of the steps, then they cycle back and do some of them over again. Even when a problem is solved, the solution to one problem often becomes the basis for the next problem. Suppose you have earned an A in this course. Your achievement—that is, your solution to the immediate problem of taking this course—may mean you are ready for a more advanced course next semester! Thus the problem-solving cycle starts anew when you take the next course.

The set of steps that follows is useful for characterizing problem solving (Sternberg & Grigorenko, 2001).

■ **STEP 1. IDENTIFY THE EXISTENCE OF A PROBLEM** We cannot overemphasize the importance of this step. Students need to recognize, for example, when they do not understand the material being taught. Without such understanding, they cannot seek help when they need it. Teachers also need to identify students who are in trouble, whether academically or personally. For example, some students who appear attentive and well behaved may still be missing the point in class. Perhaps they are daydreaming while scribbling down mindless notes. Expert teachers recognize the existence of such a problem before it becomes a serious issue.

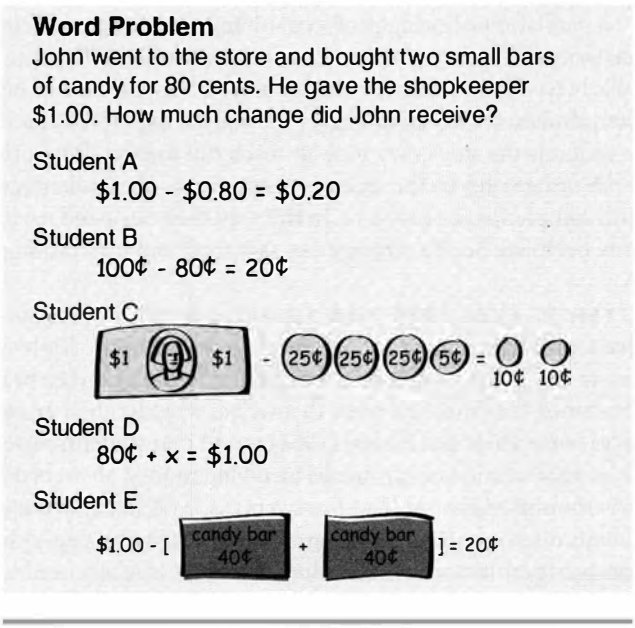
■ **STEP 2. DEFINE THE PROBLEM** It is one thing to know you have a problem. It is another thing to figure out what the problem is. For example, students may recognize that they do not understand something, such as fractions. But they may not be sure of exactly what it is that they do not understand ("some funny-looking numbers written one on top of another!"). Or students may identify a task, such as the need to write a paper on "World War I." Each student, however, must still define a particular issue to write about. Many students have trouble defining problems or topic issues for themselves. A teacher can assist by providing questions that help define the problem. In this case, the teacher might ask students some defining questions: "What do you think led to World War I?" or "What would have happened if some of the countries involved had been aligned on different sides?"

Problem definition is important to teachers as well. A novice teacher might consider a student's low score on a math test to be a way to identify the existence of a problem. By comparison, the expert teacher will go beyond this identification step and pinpoint exactly what the student does not understand in the math lesson that has been taught. Teachers also must define problems in their own teaching. If a teacher realizes he or she is not holding students' attention, then that teacher has identified the existence of a problem. However, the teacher still needs to define what the problem is: Why is he or she not holding students' attention?

■ **STEP 3. REPRESENT AND ORGANIZE INFORMATION ABOUT A PROBLEM** How people represent information about a problem often determines whether they will solve it—or at least solve it correctly (Hunt, 1994; Von Eckardt, 1999). For example, students often solve math problems more easily if they construct a diagram or other kind of sketch. There are often many different ways to represent the information in a math problem, as illustrated in Figure 9.2. Representing and organizing information is important in problem solving in every domain. For example, some students find it easier to organize their writing of a paper if they first organize their thinking with an outline.

■ **STEP 4. CREATE OR SELECT A STRATEGY FOR PROBLEM SOLVING** Students are far better problem solvers when they think strategically and plan for problem solving. Indeed, research shows that better student problem solvers spend more time in planning for problem solving up front. In contrast, poorer problem solvers often jump right in. Later, if they discover that they are following a dead end, they then have to start anew (Sternberg, 1981b; see also Bloom & Broder, 1950; Larkin, McDermott, Simon, & Simon, 1980). Likewise, good readers decide before they start to read how to read in a way that is appropriate for the material and the strategic goals they have set out. For example, compare read-

FIGURE 9.2 **Five Students Represent the Same Mathematics Problem in Their Own Way, with Each Way Yielding a Correct Solution**



ing a novel for pleasure versus reading a textbook to prepare for a multiple-choice test. Good readers pursue different strategies in the two kinds of situations. In contrast, average and poor readers read almost everything in roughly the same way (Wagner & Sternberg, 1987). In summary, strategic planning pays off for students in their schoolwork.

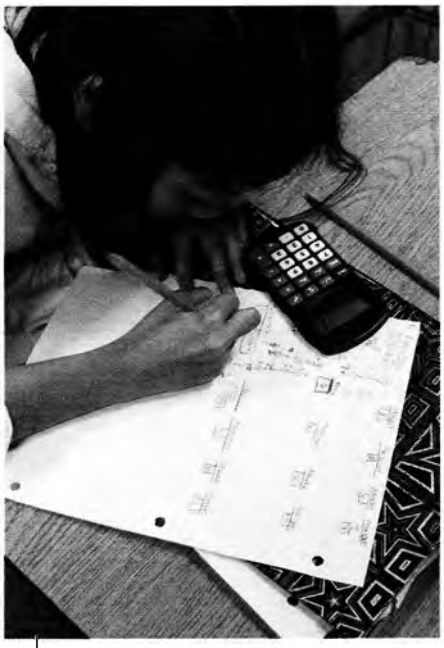
Strategic planning is also important for teachers (Sternberg & Grigorenko, 2000b). The well-planned lesson is almost always more successful than one that is delivered in an impromptu manner. Teachers who have thought carefully about potential student reactions to, comments on, and questions about material find that anticipating these responses pays off. Of course, we can become paralyzed by overplanning, trying to predict every possible contingency. The expert teacher learns to plan—but she also recognizes the limits of planning.

■ **STEP 5. ALLOCATE RESOURCES FOR PROBLEM SOLVING** Because neither teachers nor students have unlimited time for getting their work done, they need to budget their time effectively. The good problem solver decides how much time a problem is worth. He or she then works within that time frame. On standardized tests, in particular, students who devote too much or too little time to problems often do worse than those who allocate their time more effectively, independent of their actual knowledge about or understanding of the material being tested (Sternberg, 1981). Of course, people also have to be flexible. Sometimes, they may need to reassess the time they plan to devote to the problem when they discover they initially have allocated too little (or too much) of it.

Time is only one of many resources on which students and teachers need to draw. A second resource is effort. How hard should one work before giving up, or seeking help? Able students not only understand things quickly or well, but also recognize when they should seek help from the teacher. Less able students often seek help immediately, without trying sufficiently hard to solve the problem by themselves. Alternatively they may not seek help even when their efforts clearly are getting them nowhere.

Of course, students and teachers alike have many other resources at their disposal—money, space, equipment, and materials. Wise allocation of these resources in the school creates an effective environment for learning and allows for flexibility.

■ **STEP 6. MONITOR PROBLEM SOLVING** As people are solving a problem, they must keep track of their problem solving. For example, students sometimes choose a research



Bob Daemmrich Photography, Inc.

A student carefully checks her answers to a homework assignment—an important problem-solving technique. Students often compromise their grades by not bothering to do even perfunctory proofreading of papers or tests.

paper topic, only to find out not enough past research has been done on the topic to justify a review of that research. In such cases, they are better off quickly moving on to another topic.

As part of monitoring problem solving, encourage students to clarify and even write out each step they take to solve a problem. This strategy works particularly well in mathematics. Of course, it may be used in other classes, too. When students reach an incorrect answer, the expert teacher may review with the students the steps they took to reach this answer. When the wrong step is found—preferably by the students themselves—the students can correct it and finish completing the problem. In this way, they can avoid having to rework the entire problem. Such a strategy can save time and frustration.

■ **STEP 7. EVALUATE THE SOLUTION TO A PROBLEM** After you solve a problem, you need to evaluate your solution. Students, for example, need to check their work on a test. Similarly, they need to proofread a paper. Sometimes, they must even ask themselves whether their answer to a problem makes sense. Paige and Simon (1966) found that students were willing to present, as final solutions to problems involving money, answers that involved negative amounts of change. These answers made no sense. In our own experience, students often compromise the grades they receive on papers by not bothering to do even perfunctory proofreading. Similarly, teachers need to ask themselves questions such as whether a lesson has gone well. If not, they need to think about what they can do the next time to improve it.

Several models for solving problems have been proposed (Hayes, 1989; Simon, 1999). One model includes most of the steps described here, although those steps are labeled with somewhat different names (Bransford & Stein, 1993). This model can easily be remembered by its handy acronym, IDEAL: Identify problems and opportunities, Define goals and represent the problem, Explore possible strategies, Anticipate the outcomes and Act, and Look back and Learn. No matter which problem-solving method you or your students choose, you can apply the steps of the problem-solving cycle to many different types of problems. However, as we shall see, the type of problem does affect the ease or difficulty of reaching a solution.

TYPES OF PROBLEMS

No two problems are exactly alike. Even so, many problems do share common characteristics. One dimension in which problems can vary is their structure. Problems can be either well structured or ill structured. Another characteristic of many problems is the type of thinking required to solve them. We look in depth at one type of problem, the insight problem. Insight problems require the problem solver to think in novel types of ways (Davidson, 2003; Gilhooly & Murphy, 2005).

■ **WELL-STRUCTURED AND ILL-STRUCTURED PROBLEMS** Many problems that students encounter in school are **well-structured problems**—that is, problems with clear paths to their solutions (Sternberg, 1981). For example, suppose a student is asked to subtract one number from another and to provide an answer. Alternatively, the student may have to choose among several answer options on a vocabulary test, or even to solve a fairly difficult physics problem. These problems are considered well structured. The student can use a well-defined path to reach a solution.

Standing in contrast to well-structured problems are ill-structured problems. **Ill-structured problems** have no clear paths to a solution (Sternberg, 2008). Note that the term *ill structured* does not refer to something being wrong or amiss with the problems. Rather, the term implies that the problems have no other obvious paths to solution. For example, suppose students are asked to write a term paper on a topic of their choice. In this case, they are being given an ill-structured problem. No one obvious, correct, clear path will help them choose a good topic, research the topic, and actually write the paper. Similarly, planning an

effective class presentation is to a large extent an ill-structured problem: There is no set of steps teachers can follow to guarantee a successful lesson.

Knowing the distinction between the two kinds of problems is useful for both students and teachers. In this way, they will know whether they can expect a clear path to solving a given problem. For example, when students learn how to do scientific research, they often have the unrealistic expectation that research proceeds in close accord with the idealized scientific method they may have learned earlier. According to the scientific method, first the scientist formulates an hypothesis. Then the scientist tests the hypothesis, and so on. In real life, research is typically much less organized than the idealized scientific method implies. Indeed, research presents an ill-structured rather than a well-structured problem.

Teachers also need to learn when problems are well structured and when they are ill structured. For example, some teachers attend in-service workshops with the unrealistic hope that the workshop leader will provide them with a step-by-step recipe they can follow that will guarantee success in teaching. They are then disappointed when they learn that, whether the workshop leader admits it or not, no surefire recipe exists. Expert teachers know that becoming a successful teacher is an ill-structured problem. There is no single clear path to success.

■ **INSIGHT PROBLEMS** Many, but not all, ill-structured problems are called **insight problems** (Sternberg, 2008). These problems require the problem solver to think in novel ways that are not obvious from the way in which the problem is presented (Davidson, 2003; Davidson & Sternberg, 2003; Sternberg & Davidson, 1995). For example, suppose students are asked, "If you have blue socks and brown socks in a drawer, mixed in a ratio of 4 to 5, how many socks do you have to take out of the drawer to be assured of having a match?" (see Sternberg & Davidson, 1982). The students may try complicated reasoning using the 4:5 ratio. Or they may realize that, at worst, the first two socks they pull out of the drawer will be of different colors—so they need to pull out only one more sock to make a match. Here, as with many insight problems, the first path to solution that occurs to you is often the wrong path.

Do you remember the step of the problem-solving cycle called "defining the nature of the problem"? Insight problems typically require the problem solver to redefine the problem. Sometimes the problem has to be redefined many times. In other words, these problems require successive alternative definitions until a useful definition is found. Because of the need to redefine these problems, it is not surprising that verbal short-term memory capacity plays a significant role in solving insight problems (Fleck, 2008).

Consider an example. A junior high school student who was doing splendid work early in the term is suddenly doing work well below average. What has happened? A teacher who treats this situation as an insight problem may be able to help. Perhaps the student's work is below average for a straightforward reason: The student worked hard early in the term, but then simply decided to slack off later in the term. There could, however, be less obvious reasons. For example, the student may be having trouble with his parents. Or he may have a substance abuse problem, may be trying to do too much, or may have become friends with other students who discourage hard work. Seeing the problem as an insight problem open to alternative definitions is the most useful approach in this case, because it may result in the teacher's being able to help the student in a way that otherwise would not be possible.

Three processes are key in insightful thinking (Davidson & Sternberg, 1984a, 1984b; see also Davidson, 1995; Sternberg, 1985). These processes can help you or your students crack problems that require nonobvious insights. They can also be used for problems that do not require such insights.

The first process is called selective encoding. It is used to distinguish relevant from irrelevant information. For example, a student listening to a lecture needs to recognize the important information worth noting. That same student writing a paper has to decide which information is worth including.

The second process is called selective combination. It is used to put together information that is sometimes related in nonobvious ways. For example, a student listening to a lecture may see how to combine various points the teacher has made to go beyond what the teacher is saying. In a mathematics problem, the same student not only needs to recognize which information is relevant, but also needs to decide how to combine that information to yield a solution.

THINKING CREATIVELY

Give an example of a problem that requires selective encoding for its solution.

SUGGESTION: A minister in a certain town married nine women within a three-month period. He never divorced but broke no laws. How was this possible?

The third process is called selective comparison. It is used to relate new information to old information already stored in memory. Selective comparison is essentially analogy formation. It involves seeing the relationship between two things or among a group of things. For example, a student might see a relationship between something now being learned in physics and something that was learned earlier in math. Alternatively, the student might connect something learned in European history with something learned in American history.

Table 9.1 gives some well-known examples of insight problems. Each problem requires the use of selective encoding, selective combination, or selective comparison. You can use problems such as these in class to help your students develop their ability to think productively.

TABLE 9.1 Insight Problem

Insightful Thought Process Required	Selective Encoding	Selective Combination	Selective Comparison
Problem	A teacher had 23 pupils in class. All but 7 of them went on a museum trip and thus were away for the day. How many of them remained in class that day?	There were 100 politicians at a meeting. Each politician was either honest or dishonest. We know the following two facts: First at least one of the politicians was honest; second, for any two politicians at least one of the two was dishonest. How many of the politicians were honest and how many were dishonest, and what were the respective numbers of each?	Create a novel analogy by altering the normal state of something in the world: If villains are lovable, then *hero* is to *admiration* as *villain* is to: a. contempt b. affection c. cruel d. kind
Solution	Insightful problem solvers must realize that the number of students in the class, 23, is actually irrelevant in this problem. Instead they should notice the number of students who did not go on the trip, and therefore stayed in class: 7.	Problem solvers know there is at least one honest politician. That leaves 99 possibly dishonest politicians. Also, they know that, if you take any two politicians, one of them is guaranteed to be dishonest (and maybe both are). Insightful problem solvers must combine the two clues. If the honest politician is paired with any of the 99 other politicians, at least one of the pair must be dishonest. The insightful problem solver concludes there is one honest politician and there are 99 dishonest ones.	(Answer: b. affection) There are two processes at work. First, the problem solver must avoid being confused by the normal definition of a villain. Second, the problem solver must see the relationship between the two other terms in the analogy (heroes receive admiration) and choose the word that creates a similar relationship with the newly defined term, *villain*.
Other examples	An airplane crashes on the U.S.–Canadian border. In which country are the survivors buried? (Answer: Survivors are not buried at all.) Fifteen percent of the people in a certain town have unlisted telephone numbers. You select 200 names at random from the local phone book. How many of these people can be expected to have unlisted telephone numbers? (Answer: None. If they are in the phone book, their numbers are listed.)	I bought one share of stock in the Sure-Fire Corporation for $70. I sold that share for $80. I bought back the share for $90, but later sold it for $100. How much money did I make? (Answer: Combine the two purchase prices ($70 + $90) and combine the two selling prices ($80 + $100). Subtract total purchase price from total selling price ($180 - $160) = $20 profit.	If lakes are dry, then *trail* is to *hike* as *lake* is to: a. swim b. dust c. water d. walk (Answer: d. walk) If broomsticks are flying machines, then *jet* is to *pilot* as *broomstick* is to: a. house b. hermit c. witch d. garden (Answer: c. witch)

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STRATEGIES FOR PROBLEM SOLVING

By learning effective strategies for solving the problems that you face, you will become better able to teach these strategies to your students. Bright students often are unable to begin a problem because they do not know a relevant strategy to help them get started. Sometimes they may not know how to organize their thinking and to apply their knowledge. Today, more and more students come from homes in which parents do not teach children basic learning and problem-solving strategies. It often is up to teachers to fill in these gaps in students' knowledge.

Students need to be able to develop strategies for exploring multiple ways of answering questions and solving problems. One of the first strategies is to read the problem carefully, because errors often arise because of inadequate understanding of what is being asked (Whitten & Graesser, 2003). A second strategy is to motivate yourself to solve the problem (Zimmerman & Campillo, 2003)—people sometimes give up simply because they do not have the motivation to complete problem solution. A third strategy is to use your intuition as a basis for helping you get a handle on the problem you face (Schwarz & Skurnik, 2003). A fourth is to look for analogies for the problem you are solving at the time among problems you have solved in the past (Bassok, 2003).

■ **ALGORITHMS AND HEURISTICS** We can use two basic approaches to solve problems (Korf, 1999; Newell & Simon, 1972; Stanovich, 2003). The first is to follow a clear and fixed set of steps that guarantees a solution to a problem, called an **algorithm.** Given the problem of multiplying 26 by 12, for example, you might use the following algorithm:

- Multiply the rightmost digits (6×2) to get their product.
- Write down the ones digit (2) in the ones column and carry the tens digit (1).
- Multiply the rightmost digit of the second factor by the leftmost digit of the first factor (2×2).
- Add the carried number (1) to the product, and so on.

Eventually, if you follow the steps correctly, you are guaranteed to get the correct solution to the problem. By using an algorithm, you buy security—a guarantee of a correct solution. Unfortunately, this certainty often comes at the expense of efficiency. A fairly substantial portion of many teachers' time is spent teaching students how to choose and use algorithms. This is especially true in subjects such as math or science.

Some problems, however, do not lend themselves to algorithms. Suppose, for example, you want to locate a friend. You know where she lives. You also know something about the kinds of places where she is likely to be. You could specify an algorithm for solving this problem that would involve carefully searching every possible place in the world where she might be. Of course, such an algorithm would be impractical, so you need some other way to solve the problem. You are more likely to use a *heuristic*, an informal, intuitive, and often speculative strategy that might solve a problem but is not guaranteed to do so (Korf, 1999). For example, a heuristic for finding your friend is to start by asking her other friends where she is. You are not guaranteed to find her, but this plan is definitely more practical than searching everywhere in the world! Heuristics yield efficiency, but they do so at the expense of the security that you will definitely find the correct solution.

Psychologists have found that certain heuristics tend to be used again and again for a variety of problems. These heuristics can be taught to students as general means to aid them in their problem solving. People are most likely to rely on these domain-general strategies when they do not have domain-specific strategies available, or when the domain-specific strategies they have fail to work (Alexander, 1996; Perkins & Salomon, 1989). Here are four of the most common heuristics (Newell & Simon, 1972; see also Lesgold, 1988), and examples illustrating them:

1. **Means-ends analysis.** The problem solver analyzes the problem by viewing the goal. He then tries to decrease the distance between the current state and the goal. Consider a student who breaks down a problem, such as completing a complex term

THINKING ANALYTICALLY

Specify an algorithm for checking whether you have a certain textbook on your bookshelf. How does the algorithm guarantee that you will find the book if it is really on your shelf?

SUGGESTION: You can go through every book on the shelf until you encounter the book that you seek.

THINKING CREATIVELY

Suggest a problem a teacher is likely to encounter that is best solved by a heuristic. Describe the heuristic as well as the problem.

SUGGESTION: At the beginning of a lesson, you can ask students some questions to get a sense of their current level of understanding for what you are about to teach.

paper, into smaller problems or subgoals. Such a breakdown often decreases working-memory load, because at a given time, the problem solver has to keep only part of the problem in working memory (Hambrick & Engle, 2003). He then works in turn on each subgoal (Schunk, 1996a, 1996b). In this way, the problem solver uses means-ends analysis to achieve a solution (Korf, 1999; Newell & Simon, 1972).

2. **Working forward.** The problem solver begins with an analysis of the current state. She then tries to solve the problem from start to finish. The student who makes a list of all steps needed to complete the term paper, before she begins it, is working forward.
3. **Working backward.** The problem solver starts at the end, or goal. He tries to work backward from there. Consider a student who knows a final deadline for a complicated project. He writes reminders in his or her calendar about when to start each step so that he can complete the entire project on time. He is working backward.
4. **Generate and test** (also known as **trial and error**). The problem solver generates alternative courses of action, albeit necessarily in a systematic way. She then considers whether each course of action works. A student using this heuristic might sit down and write the introduction of the term paper, before realizing that she needs to do research. This heuristic is generally regarded as ineffective. In a completely new situation, it is sometimes better to use it to gather data that will let you move to a more methodical heuristic.

■ **PROBLEM ISOMORPHS** Sometimes a problem may stump students, even though they already know exactly how to solve the problem when it is represented in a somewhat different form. For an example, consider the "monk problem":

A monk decides to pursue study, contemplation, and prayer in a place where he will not be disturbed. He decides that the best place to go is an isolated monastery at the top of a high mountain (as shown in Figure 9.3). The monk starts climbing the mountain at 8 A.M. He arrives at the top of the mountain at 4 P.M. of the same day. He varies his speed, of course, depending on just how steep a given part of the mountain is. He also stops for lunch. The next week, the monk, feeling spiritually refreshed, decides to return. He starts his descent at 8 A.M. Feeling relaxed and peaceful, he descends the mountain slowly. He does not arrive at the bottom of the mountain until 4 P.M. Must there be a point on the mountain that the monk passes at exactly the same time of day on the two different days of his ascent and subsequent descent? Why or why not?

FIGURE 9.3 The Monk-on-the-Mountain Problem

Even children in grade school know the answer to the monk problem when it is expressed in a slightly different form! The monk problem is a difficult one. When the problem is described as it is here, very few people are able both to give the correct answer and to specify why that answer is correct. Yet the solution to the problem can be made relatively straightforward. One need simply change the terms of the problem slightly. In this changed form, you no longer imagine the same monk going both up and down the mountain on the separate days. Instead, you imagine two separate monks. One ascends the mountain and the other descends the mountain on the same day (see Sternberg, 1986). If one monk goes up and the other simultaneously goes down, clearly the two monks will have to pass each other at some time of the day. This situation is shown in Figure 9.4.

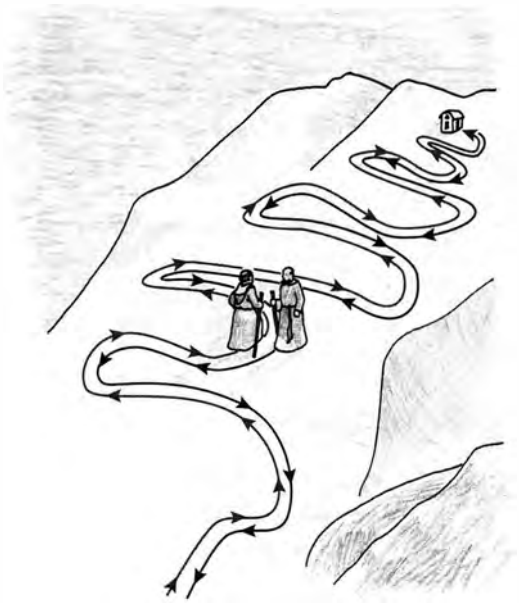
The two forms of the problem have somewhat different verbal and even pictorial expressions. But they are exactly the same in terms of the constraints of the problem. They are **problem isomorphs**—problems that have the same formal structure, but different ways of expressing this structure (Hayes & Simon, 1974; Kotovsky, Hayes, & Simon, 1985).

The two problems described here have the same formal structure. Simply imagine the second monk walking down the mountain path exactly one week later. The second monk now becomes (formally speaking) the first monk. Thus the correct answer is that there must be a point the monk crosses at the same time on the two separate days. Here, as elsewhere, we cannot easily see that two forms of a problem are isomorphic.

The concept of problem isomorphism is important for teachers to understand. A given mathematics problem often can be represented (1) verbally, (2) algebraically, and (3) geometrically. In such a case, the problem is the same; only the representation is different. Similarly, the grammar of a sentence can be represented verbally or diagrammatically. Students respond differently to different representations of information, however. By showing a student how to represent a problem in different isomorphic ways, you can help that student find a representation that works well. Instructions for tests and homework sometimes confuse students. Expert teachers often express the instructions in different isomorphic ways. In this way, they help students better understand the tasks they must do. The ability to express a given idea in various ways is a sign that a teacher or a student thoroughly understands the idea.

Teach students to consider looking for a problem isomorph when they find the original form in which a problem is presented to be very difficult. The problem need not be a formal

FIGURE 9.4 Isomorph of the Monk Problem, Showing Two Monks, One Going Up the Mountain and the Other Simultaneously Going Down the Mountain



one, like the problems described earlier. The point is to make the solving of a given problem as easy as you possibly can. For example, when two elementary school students argue over the use of the classroom paper cutter, a teacher might point out the usefulness of having a problem isomorph: "This is a lot like the story we read the other day. What did the two children in the story decide to do when they both wanted the same thing?"

■ **INCUBATION** Sometimes we try and try to solve a problem requiring insight. Unfortunately, no matter how hard we try, we don't succeed. At such times, a practice called incubation may help. **Incubation** involves temporarily ceasing to work actively on a problem (Wallas, 1926). Psychologists have found that incubating on a problem often helps us solve it. When we are incubating, we don't seem to be working on the problem (Anderson, 1985; Segal, 2004; Sio & Rudowicz, 2007; Smith, 1995). Thus, if you are baffled by a problem, putting it aside for a while may be the best thing you can do.

Hard-working students who become frustrated in their problem-solving efforts may believe that incubation means giving up. Teachers should help these students understand that incubation can be an important part of the problem-solving process that helps complete this process.

How can you best benefit from incubation? Invest enough time in the problem initially, so you have thought about it as fully as you can. Then allow sufficient incubation time to have an insight (Kaplan & Davidson, 1989).

THINKING PRACTICALLY

Have you ever used incubation to help come up with an insight? If so, under what circumstances, and how well did it work? How might you make this problem-solving strategy work better for you?

SUGGESTION: Incubation helps most after careful reflection on a problem.

IMPEDIMENTS TO PROBLEM SOLVING

Sometimes people do not solve problems or have insights because they are blocked. Fortunately, by becoming aware of the reasons we sometimes get blocked during the problem-solving process, we can consciously overcome maladaptive thought processes and reach a solution.

That a person has a predisposition to think about a problem in a particular way is referred to as having a **mental set** (Luchins, 1942). Often, students have a mental set for how to complete a book report that involves a boring set of steps that ultimately yields a dull report. When they are shown more creative ways to approach the task—such as writing and acting out skits containing the book's characters, or designing costumes that might have been worn by the characters—these same students may approach the next book report assignment very differently.

THINKING PRACTICALLY

Describe a mental set you have that may block you from becoming the best teacher you might possibly be.

SUGGESTION: Although each student will answer for himself or herself, an example is the belief that you can teach off the cuff without careful preparation.

Teachers can also acquire mental sets. For example, years ago, many teachers were trained to teach almost exclusively by rote memorization. In fact, some are still trained this way. Consequently, these teachers often form a mental set that blocks them from teaching in new and more effective ways. Such a block may occur even if the teachers are told that students will soon be tested in a new way that requires skills beyond memorization. These teachers have had to work hard to overcome these mental sets. Under many circumstances, most students learn better—even in regard to memorizing for facts—when they think to learn rather than merely memorize by rote (Sternberg, Torff, & Grigorenko, 1998).

Sometimes people get stuck on a particular use for an object. **Functional fixedness** is a particular kind of mental set in which a person is unable to invent a specific new use for something because the person is so used to seeing a conventional use for that thing (Duncker, 1945). For example, coat hangers are typically used for hanging coats and credit cards for charging purchases. However, if you become locked out, you can also use a coat hanger to open a car and a credit card to enter a locked door.

EXPERTISE IN PROBLEM SOLVING

Some people are expert problem solvers in a given field of endeavor. We discussed at length in Chapter 1 the characteristics of an expert teacher and an expert student. This topic is particularly relevant in our current discussion of expert problem solving. What is it that distinguishes experts from novices at problem solving?

Consider the game of chess. Chess experts have better memory for chess pieces than novices, but only when the chess pieces are placed on the chessboard in a sensible configuration for the

game of chess (Chase & Simon, 1973a, 1973b). If the pieces are arranged randomly on the board, experts cannot recall their positions any better than novices could. Chase and Simon (1973a, 1973b) interpreted these results as suggesting that what distinguishes experts from novices is the storage in their long-term memories of many thousands of configurations of pieces in actual chess games. The experts can draw on this past knowledge in the memory task—but only when they are shown sensible configurations of pieces. Since Chase and Simon's original study of chess players was conducted, many other investigators have replicated this type of finding across a wide variety of fields of endeavor, including other games, physics, radiology, mathematics, chemistry, and sociology (see Chi, Glaser, & Farr, 1988; Ericsson, 1996a, 1996b, 1999, 2003; Sternberg & Frensch, 1991).

The same observations that have been made with adult experts have been made with child experts. For example, one study showed that fourth-grade children who were experts in soccer learned and remembered more new soccer terms than nonexpert children. This result occurred even though the children were considered equal in general learning and memory abilities (Schneider & Bjorklund, 1992).

A study of the advantages experts have over novices concludes they have five primary advantages (Chi et al., 1988; see also Chapter 1):

1. Experts perceive large, meaningful patterns of information more readily than novices. In other words, they see the whole picture more easily than do novices. By contrast, novices may become fixated on details.
2. Experts perform tasks more quickly and with fewer errors than novices.
3. Experts deal with problems at a deeper level than novices. Therefore, they deal with the underlying meanings of problems, not just with the way the problems look or sound.
4. Experts' memory for information in their domain is superior to that of novices. This difference reflects experts' ability to draw on more and better-organized prior knowledge about their domain of expertise.
5. Experts take more time to analyze a problem before undertaking its solution. In this way, they end up solving the problem more efficiently than novices.

Experience buys experts **automaticity** in their solution of domain-relevant problems. Experts gain automaticity from having procedures they can execute with hardly any effort or even conscious awareness of what they are doing. In general, they are more "intelligent" problem solvers (Wenke & Frensch, 2003). Nevertheless, they may or may not be more creative than novices (Lubart & Mouchiroud, 2003) owing to the potential costs of expertise.

Yes, there can be costs to expertise (Castel, McCabe, Roediger, & Heitman, 2007; Frensch & Sternberg, 1989; see also Sternberg & Lubart, 1995, 1996). On the one hand, being an expert can facilitate problem solving through automaticity. On the other hand, expert problem solvers can become entrenched. In other words, they can become so used to seeing problems in one way that they have difficulty seeing them from another perspective (Adelson, 1984).

As a teacher, you will need to be vigilant about your own expertise. Recognize that the same expertise that can make you a better teacher also can hinder your learning about and implementing new ways of teaching. You may encounter teachers who claim, "I've been doing the same thing for 30 years, so I can be sure I know what I'm doing." Expert teachers avoid this way of thinking. They know they need to be lifelong learners, constantly improving their own expertise.

THINKING PRACTICALLY

What are some steps you can take to avoid becoming entrenched in your teaching?

SUGGESTION: Attending in-services and professional meetings can help.

IMPLICATIONS FOR TEACHING

In addition to furthering their own expertise in problem solving, expert teachers help their students learn effective reasoning and problem-solving strategies. Some ways teachers can develop their students' reasoning and problem-solving skills are suggested here (see also Nickerson, 2004).

- **Define problems.** Teachers can practice defining problems using the content of lessons or naturally occurring opportunities. For example, an elementary school teacher

might assemble the class to discuss a problem the teacher has identified: The room is not being cleaned up before students go to recess. Students need to know which kind of problem they face before they plan a solution strategy.

- **Teach strategies for insightful problem solving.** In mathematics problems, a selective-encoding insight may be involved in distinguishing relevant from irrelevant information. For example, in the socks problem mentioned earlier, an insight needed to solve the problem is that the ratio information (socks mixed in a ratio of 4:5) is irrelevant. Expert teachers can develop creative curricula through selective combination of students' interests, materials, and assignments. For example, in preparing to work with twelfth-grade remedial English students who previously failed the class, a teacher might have the students read a newspaper article on an issue of interest (such as gun control), learn vocabulary based on the article, and write a letter to the editor about the issue. The teacher's selective-combination insight is the basis for a solution to the problem of how to motivate and reach a challenging group of students. Expert teachers may initially develop analogies to help their students solve problems. They then gradually require the students to suggest analogies of their own.
- **Look for isomorphs.** Consider an isomorph of a geometry problem that requires finding the perimeter of a rectangle. It might involve asking students to imagine walking the length and width of the school soccer field.
- **Help students overcome impediments to problem solving.** Help students practice flexible thinking, by occasionally doing things in a slightly different way. For example, an elementary school teacher might read books that reverse common stories, such as *The Three Little Wolves and the Big Bad Pig.* In a physics lesson, a teacher might ask students to invent novel uses of a blank piece of notebook paper—for example, as a blindfold for a demonstration of the importance of the sense of sight.

Transfer

Students can become very effective at solving problems in school. Sometimes, however, they may not be able to use their knowledge when they encounter problems outside school. That is, they cannot transfer their knowledge to a new situation. **Transfer** means carrying over knowledge from one problem or situation to a new problem (see Detterman & Sternberg, 1993, for alternative views of transfer). As we will see, transfer of knowledge gained from earlier problems can either help solve new problems or hinder their solution. Researchers have identified several different types of transfer, based on the ways transfer is achieved or planned.

TYPES OF TRANSFER

THINKING CREATIVELY

Give one example of positive transfer and another of negative transfer in the context of applying what students learn in school to the performance of work on the job.

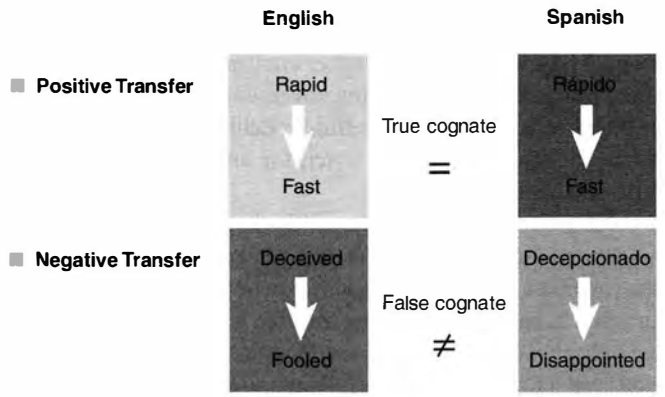
SUGGESTION: An example of positive transfer is applying mathematics to shopping at a supermarket. An example of negative transfer is paying attention only to price and not quality.

Transfer can have either welcome or unwelcome effects (Mayer & Wittrock, 1996). **Positive transfer** occurs when the solution of an earlier-encountered problem facilitates the solution of a later-encountered problem. **Negative transfer** occurs when the solution of an earlier-encountered problem impedes solution of a later-encountered problem.

Suppose, for example, that you teach grade school children the basic notion of decimals. You also teach them how to do basic arithmetic operations with decimals. You are now ready to teach your students the basic concepts and operations involving percentages. Percentages, of course, are conceptually similar to decimals. Thus you would hope to attain positive transfer.

Often, the same prior learning that leads to positive transfer in some respects can lead to negative transfer in others. For example, having just learned decimals, some students may believe that 1 percent is written as .01 percent. Similarly, knowing one language often helps you learn a second language. Even so, you may find yourself using the grammar or words from the first language to construct sentences in the second language, even though they are inappropriate in the second language. In such cases, both positive and negative transfer occur

FIGURE 9.5 Positive and Negative Transfer as They Apply to the Learning of Vocabulary and Grammar of One Language as It Is Transferred to the Learning of Vocabulary and Grammar of Another Language



simultaneously. Figure 9.5 shows examples of positive and negative transfer as they apply to learning two different foreign languages.

Psychologists have studied the conditions under which transfer takes place. Their research reveals that it is surprisingly hard to achieve positive transfer. As discussed in Chapter 8, learning that is situated, or closely linked to a particular situation, is difficult to transfer. Positive transfer is more likely to occur if people are given more prior examples of how something works and if they are explicitly told to transfer what they learn (Gick & Holyoak, 1980, 1983). If you are teaching mathematics, for example, you can increase the probability of transfer from one lesson to another. Give a lot of practice with different kinds of problems on a concept. Tell students explicitly that they should look for instances of that concept in problems they will be solving.

Sometimes transfer is not symmetrical. In other words, transfer may not work equally well in both directions. For example, transfer of principles from math to physics is greater than transfer of principles from physics to math—perhaps because people learn math with the expectation of having to transfer it to other courses, but do not learn physics with the same mental set (Bassok & Holyoak, 1993).

One can distinguish between low-road transfer and high-road transfer (Salomon & Perkins, 1989). These two types of transfer occur in different kinds of situations.

Low-road transfer is spontaneous and automatic. It occurs when a highly practiced skill is carried over from one situation to another, with little or no reflective thinking. For example, suppose you know how to ride a ten-speed bike, or to drive an automatic car, or to use a computer. You are likely to be able to transfer these skills relatively easily from one bike, car, or computer to another.

Low-road transfer is most likely to occur when the skills have been well practiced and used under diverse circumstances. Thus, the more you have driven and the more cars you have driven, the more likely you are to transfer driving skills easily from one car to another. Low-road transfer will be impeded, however, as the difference between situations increases. Thus, if you have learned how to drive using only an automatic shift, you are likely to get far less transfer to another car if it has a standard transmission rather than an automatic shift. Similarly, the student who has done lots of multiplication problems may not be able to solve a problem as quickly if it requires division.

High-road transfer occurs when you consciously apply abstract knowledge you have learned in one situation to another situation. For example, suppose you take a behind-the-wheel driver education course and use a school automobile. Your goal will be to transfer what you learn about driving in the school car to your own car. Or suppose you are an education or psychology student and you learn statistics. You usually take such a course with the explicit intention of applying the knowledge it provides to your work.

To achieve high-road transfer, you need a meaningful abstraction of whatever principles need to be transferred. In other words, you need a good understanding of the concept at an

abstract level. You thereby can apply it later in another situation. For example, suppose a teacher wants her students to recognize the relevance of events that led to the Vietnam War as applied to the possible involvement of the United States in another war. She wants the students to transfer what they have learned about the Vietnam War appropriately to the other war. To do so, they must have a good abstract idea of the circumstances leading up to that war that may (or may not) be applicable under other circumstances.

Mindless drilling practice leads to little improvement in anything. For a practice or drill of any kind to be effective, it should be mindful, or deliberate. Individuals should be attentive to what they are doing. They should watch for and correct errors and work toward improvement (Ericsson, 1996a, 1996b).

We can make yet another distinction between the kinds of transfer. In **forward-reaching transfer,** you intend the transfer to occur at the time you are learning whatever you are learning. For example, when you take a statistics course, you may be purposely taking it to apply statistical techniques in your work. In **backward-reaching transfer,** you realize the applicability of what you learned in the past only after it becomes relevant. Perhaps you took the statistics course just for fun, long before you even started studying psychology and education. Now, later on, you find you can use the statistics in your work. You are engaging in backward-reaching transfer.

TEACHING FOR TRANSFER

How often do students actually transfer what they learn? Investigators have diverse viewpoints on this issue (see Detterman & Sternberg, 1993; Greeno, Moore, & Smith 1993; Mayer & Wittrock, 1996). The consensus, however, is that teachers can help students achieve meaningful transfer. To do so, teachers should conscientiously follow principles such as those described here. The important thing from the teacher's point of view is not just to hope that students will transfer. Instead, the teacher should follow procedures such as those described here to actively promote the transfer. Let us consider some of the ways teachers can promote students' transfer of knowledge and training.

■ **MEANINGFULNESS** The teacher emphasizes tying whatever is being taught to whatever knowledge students already have and use a lot. Students are more likely to learn about the concept of transfer if they see how it can be a key to their own success in school or in life outside school.

■ **ENCODING SPECIFICITY** As we discussed in Chapter 8, the ability to retrieve information can be helped or hindered by a number of circumstances. For example, students may tend to transfer learning only in conditions similar to those in which the original learning took place. Expert teachers help students overcome this tendency known as **encoding specificity** (Tulving & Thomson, 1973). They teach new information in a way that will help students retrieve the information more flexibly later on (Ceci & Howe, 1978). They explicitly show students how to apply information in various contexts. They also give students opportunities to practice doing so.

Expert teachers regularly ask students to suggest their own ideas regarding new contexts in which they can apply information (Mayer & Wittrock, 1996). For example, a social studies teacher is presenting a series of lessons on colonial American life. Suppose she lectures about "the way things were in colonial America." The teacher does not link this information to later cultural and political trends, nor does she make any comparisons to life before and after the period under study. In this case, the students may be left with knowledge they will have trouble applying to contexts other than colonial America. Now suppose instead that the teacher begins the lessons by talking about how life in colonial America influenced later trends in American society. She continues to make these kinds of connections throughout the lessons. The students will then see the relevance of what they are learning to other contexts. They will be able to retrieve the information more flexibly in the future.

■ **ORGANIZATION** The likelihood that students will be able to transfer information from one situation to another can sometimes be affected by the way the information is

organized when it is first learned (Bower, Clark, Lesgold, & Winzenz, 1969). For example, it would be much more difficult for students to learn the correct use of commas in writing by memorizing hundreds of sentences in which commas are correctly placed than for them to learn a relatively small set of rules for correct placement of commas.

To help students overcome the limitations of the way they organize information, expert teachers present new information within a coherent, well-organized framework. They emphasize the big idea that underlies a lesson. They further clarify to students how the various concepts taught relate to that big idea. Each individual lesson is internally well organized. Each lesson also fits into an overarching scheme of information. Expert teachers also help students see how new information relates to old information students already know. They explicitly state the connections and encourage students to suggest their own ideas regarding relevant connections.

For example, a science teacher intends to spend three months focusing on the characteristics of different types of animals. Suppose he or she presents the material in the format: "The first animal we will discuss is called a kangaroo. It lives in Australia. It is a marsupial. It eats leaves. Its young are born in a highly undeveloped state. . .," and so on, into a discussion of the habits of kangaroos. The next day, the teacher presents the characteristics of another animal. In this case, the students will create a mental organization of knowledge in the form "animal—country of origin—biological name—diet—reproductive habits—et cetera." They will know many different types of animals by the end of the year, and they will have memorized details about the habits of each. Unfortunately, the students may be limited by the way this information is organized.

To overcome this problem, the teacher can instead begin the series of lessons with an overview of the world's biological habitats and major types of animals. He may focus on types of diets (carnivores, herbivores, omnivores), types of animals (mammals, amphibians, reptiles), modes of reproduction (egg laying, live birthing), and so on. Through this teaching approach, the students develop a more flexibly organized base of knowledge. This flexibility, in turn, enables them to retrieve information in more ways and for more uses in the future. The beneficial effects of a highly organized knowledge base have been demonstrated repeatedly in empirical research (Ceci, 1980; Sternberg, 2008).

■ **DISCRIMINATION** Students also need to learn when information previously learned does not apply to a new situation. This skill, known as **discrimination,** helps students recognize more readily when old information is *not* relevant in new situations. The teachers may accomplish this goal by stating outright the types of situations to which new information does and does not apply. Also, teachers can ask students to speculate about situations in which new information is and is not relevant.

For example, the science teacher might tell students that mammals are a group of animals distinguished in three ways: They are warm-blooded, are furry, and nurse their young with milk. The teacher also notes that the vast majority of mammals give birth to live young. However, he states that giving birth to live young does not necessarily mean a creature is a mammal. Duck-billed platypi are mammals that lay eggs. Numerous species of amphibians and reptiles give birth to live young. By making these distinctions for students and by explaining what the new information about mammals does and does not apply to, the teacher helps students develop the power to discriminate appropriately among different contexts and situations. Note the relevance of the discussion earlier in the chapter regarding necessary versus characteristic features: Giving birth to live young is a characteristic but not a necessary feature of a mammal.

Decision Making

The earliest models of decision making assumed that decision makers operate in ideal circumstances and make optimal decisions. Although we now consider these assumptions unrealistic, a great deal of economic research has been and still is based

on this model. Subsequent models of decision making have recognized that we may not face ideal circumstances but that we nevertheless strive to make optimal decisions.

According to *utility-maximization theory*, the goal of human action is to maximize pleasure (*positive utility*) and to minimize pain (*negative utility*). Utility-maximization theorists suggest that we can predict what people will do by assuming that they will seek the highest possible utility. In other words, individuals make decisions that maximize pleasure and minimize pain. Suppose that you are deciding whether to buy a desktop computer. You do not like the fact that this model is not portable—a factor that can be viewed as a negative utility. At the same time, you like the large screen and the rapid processing speed—factors that can be viewed as positive utilities. Whether you buy the desktop computer will depend on whether the positive utilities outweigh the negative ones in your mind.

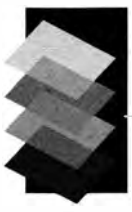
It is certainly appealing to come up with objective, mathematical models for decision making. In practice, however, it is very difficult to assign objective utilities to decisions. Models based on such assignments are likely to produce inaccurate representations of reality. To counteract this drawback of utility-maximization theory, cognitive psychologists interested in decision theory introduced *subjective-utility theory*. This theory acknowledges that each individual may have a distinct understanding of the various utilities for a given action, based on the idiosyncratic hopes, fears, and other subjective motivations of the individual. For example, being turned down for a date may be extremely negative for one person but only slightly negative for another.

SATISFICING

Principles of economics are often based on the notion that decision makers have unlimited rationality and use it in making their decisions. According to this theory, decision makers decide which criteria to maximize or minimize and then they make the optimal decision for doing so. Even in the 1950s, however, some psychologists began to recognize that we do not always make ideal decisions. Rather, we are usually influenced by subjective considerations. As a consequence, people do not act entirely rationally when making decisions.

The best-known challenge to the rational-decision theory came from Herbert Simon (1957), who went on to win the Nobel Prize in economics. Simon did not suggest that people are irrational. Rather, he suggested, we exhibit *bounded rationality*, the limits within which humans demonstrate reasoned behavior. Simon proposed one of the decision-making strategies most commonly used by people: satisficing. In **satisficing,** the decision maker considers options one by one, immediately selecting the first option that appears to be satisfactory. This option is just good enough. In other words, humans do not consider all of the possible options and then carefully compute which of the entire universe of options will maximize gains and minimize losses. Instead, we consider the minimum number of options needed to arrive at a decision that we believe will satisfy our minimum requirements. A student may use satisficing when she considers topics for a term paper. Of the countless possible topics, she may think about only a few. She then settles on the first satisfactory or even pretty good topic she thinks of, without continuing her exploration.

The progression from fully rational models of decision making to models of bounded rationality involved the increasing recognition that people are not perfect decision makers. We make decisions in less than ideal circumstances, given inadequate or incomplete information. We use limited objectivity and rationality. Often we are even willing to settle for the first acceptable option that becomes available, fully aware that other choices may be better.



Teaching for Thinking

Now you have learned about concept formation, reasoning, and problem solving. At this point, we are ready to consider the important issue of how teachers can teach students to think more effectively. In Chapter 4, we discussed issues related to teaching to increase intelligence. Here, we consider some issues not presented in that chapter.

You can take two basic approaches to teach students how to think. One approach is to teach thinking via a stand-alone program. In a **stand-alone program,** thinking is taught as a separate unit or even as a separate course. A number of such stand-alone programs have been used with some success (for examples, see Baron & Sternberg, 1987; Costa, 1985; for evaluations, see Perkins & Grotzer, 1997; Nickerson, Perkins, & Smith, 1985; Sternberg & Bhana, 1986; Sternberg & Spear-Swerling, 1996). Examples of stand-alone programs include Reuven Feuerstein's (1980) Instrumental Enrichment, Matthew Lipman's Philosophy for Children (Lipman, Sharp, & Oscanyan, 1980), and the Odyssey program (M. J. Adams, 1986). In these programs, students learn and practice specific thinking skills. Examples are classifying items, forming different orders of items, or making comparisons between ideas or things; and reasoning skills such as making inferences.

The second, more commonly used approach for teaching thinking is infused instruction. In **infused instruction,** teaching how to think is an integral part of a curriculum. Thus the teacher teaches thinking in the course of teaching other subjects, such as history, mathematics, English literature, or science. We examine the relative merits of stand-alone and infused instruction in the Forum feature, "What Is the Best Way to Teach Thinking?"

FORUM

WHAT IS THE BEST WAY TO TEACH THINKING?

Which is better, a separate program for teaching thinking or one infused into regular instruction?

FIRST VIEW: Thinking is best taught as a separate topic. The advantage of separate instruction is that it tends to be more intensive. Sometimes, because of the press of other things teachers need to do, infused programs disintegrate gradually over time. The best intentions go awry as teachers find they just do not have the time or perhaps the know-how to succeed with an infusion approach. Separate programs also increase the likelihood that the thinking skills will be taught in a systematic, logical manner, with one skill building on another. Most of these programs have been used in a large number of sites. As a consequence, they have the benefit of having been developed and refined over of a number of years.

SECOND VIEW: Thinking skills are best developed in concert with other skills as part of the standard curriculum. The danger of separate programs to teach thinking is that what the student learns in them will not be transferred to other classes. In essence, a stand-alone program could result in stand-alone thinking. Students may come to believe that thinking is something they do only in thinking class. They then leave those techniques behind when they leave the class. For example, one team of researchers (Mayer & Wittrock, 1996) found that people often neglect to apply mathematical thinking skills learned in school to real-world situations such as grocery shopping. Moreover, when thinking is taught in a stand-alone way, the connections with other subject matter are often not obvious. In infused programs, by contrast, the connection is made directly. In this way, students can see how to apply thinking skills when and as they need them.

THIRD VIEW: A SYNTHESIS. Separate thinking courses or programs allow students to see the links between different steps and thought processes. They can be delivered by teachers who are well trained and experienced in teaching students thinking skills. However, teachers in other courses must reinforce what is taught in the course on thinking. Regular classroom teachers may not be experts in teaching thinking. Nevertheless, they must have training in this area so they will be able to infuse thinking skills and practice into their day-to-day lessons. They should be thoroughly familiar with the content of the separate thinking classes, for example. A history teacher who knows that students in thinking class have been trained to look for connections between subjects could plan to include this skill in a unit on ancient history. The teacher might explore with students the

relevance of ancient Greek and Roman mathematical and scientific accomplishments. He could relate them to modern-day math and science, as well as carrying out the more standard discussion of political, philosophical, and artistic achievements.

Initially, infusion takes day-to-day effort, as well as training, for regular classroom teachers. Teachers must teach themselves to use the skills they are trying to teach students, if the teachers are to plan creative and effective lessons. If they have been relying on more mindless activities, teachers may need to learn to plan their lessons in a different way. They should also take the time to become familiar with the content of students' other classes and their interests and activities outside of school. In this way, teachers can help the students themselves make connections among these arenas. The goal of such effort, of course, is to develop the thinking expertise of students. As students become expert thinkers, teachers realize not only the rewards of helping the students develop self-regulation, but also begin to shoulder less of the responsibility for the development of students' thinking skills. Teachers should gradually ask students to take on the effort of infusing thinking skills for themselves. As students become expert thinkers, a history teacher may not need to point out the connections among math, science, and history as explicitly as when the students are novice thinkers. Instead, the teacher with expert students may be able to ask students to suggest ideas themselves.

A number of different approaches have been suggested for infusing thinking into the classroom. Many build on notions of *critical thinking*, which is reasonable reflective thinking focused on deciding what to believe or do (Ennis, 1987). Table 9.2 lists some of the skills that are key to teaching critical thinking (Ennis, 1987). These skills include defining terms and concepts, making deductions and inductions, and deciding on courses of action.

Dialogical thinking is important to good thinking. **Dialogical thinking** involves being able to see not only your own point of view, but also the points of view of others (Paul, 1987). Also important is **dialectical thinking,** a type of thinking proposed by nineteenth-century German philosopher Georg Hegel (see Sternberg, 1998a, 1998b). This kind of thinking involves someone's first coming up with an idea, or thesis; then an antithesis, or opposing idea; and finally an integrating synthesis. Sometimes, the same person comes up with the successive ideas. At other times, multiple people make contributions to the chain of ideas. Good thinkers also have dispositions that aid thinking, such as the propensity to think clearly and deeply about problems (Perkins, 1995).

Educational theorists have developed various sets of guidelines to help teachers enhance their teaching of thinking in the classroom. All of these guidelines have one key point in common: They stress the importance of practicing the skills and dispositions of critical thinking often. At the beginning of the chapter, biology teacher Joan Gracek realized that her students needed more practice to develop the ability to think like scientists. She provided it in the unit on animals. We describe some ways to include regular thinking practice next.

USE ROLE PLAYING

A good way truly to understand a point of view other than your own is to try using it (Paul, 1987). Teachers can build role playing into almost any subject. For example, students can play out how the various characters of a story would react in a new situation. They can enact the thinking of famous historical figures, or figures in current political controversies. They can even role-play persons of different cultures in social studies or foreign-language classes.

USE GROUPS

Group projects provide students with natural opportunities to practice many important thinking skills. Students can work together in groups to learn concepts. For example, a science teacher might label a number of items as examples and non-examples of a plant family. He could then ask groups of students to identify the family, or concept. Students may

TABLE 9.2 Essential and Teachable Thinking Skills

Ability	Definition	Example
Focusing on a question	Identifying or formulating the key question in a situation and keeping the question in mind.	A student proposes the central question of a term paper: "Was Hamlet sane?"
Analyzing arguments	Identifying the parts of an argument, conclusion, and supporting reasons, and seeing the structure of an argument.	The student reads articles from literary scholars claiming that Hamlet suffered from hallucinations (when he saw the ghost of his father), and depression. The student summarizes the arguments in support of these diagnoses.
Asking and answering questions	Being able to ask and answer questions that clarify or challenge an argument.	The student asks himself or herself, "What do these writers mean by depression?" and "Does Hamlet really display all the symptoms of depression?"
Judging the credibility of a source	Rating the expertise, reputation, and motivations of a person making an argument.	The student notices that none of the literary scholars who claim Hamlet suffered from mental illness is a qualified psychologist or psychiatrist.
Observing and judging the reports	Making careful notes and reports of observations of others' observations without including judgments or rating the quality of others' observations.	The student notes several instances of Hamlet's well-adapted behavior throughout the course of the play.
Deducing and judging others' deductions	Using general logical rules to draw specific conclusions.	The student knows that not everyone who has hallucinations is mentally ill, and therefore deduces that whether or not the ghost of his father really existed, Hamlet could be sane.
Inducing and judging others' inductions	Drawing general rules based on specific instances, but always looking for an exception to the rule.	A key point in the arguments that Hamlet suffered from depression is the famous "To be or not to be" speech, which many scholars interpret as Hamlet considering suicide. However, the student notes that Hamlet does not consistently express an interest in dying throughout the play.
Making value judgments	Weighing and balancing alternative beliefs or plans.	The student compares the writings of those who claim Hamlet was depressed with articles that claim he was in full mental control.
Defining terms and judging others' definitions	Examining definitions closely to see how useful or well constructed they are.	The student carefully examines the definitions of sanity and insanity presented in the articles about Hamlet.
Identifying assumptions	Pointing out unstated reasons or assumptions.	The student notices that many of the writers who claim Hamlet was sane because he carried out complicated travel and other plans seem to assume that people with mental illnesses cannot do these things.
Deciding on an action	Based on the steps of the problem cycle, after identifying and defining the problem and generating alternative solutions, choosing one.	The student chooses a position on the question of Hamlet's mental health and prepares an outline for the term paper.
Interacting with others	Arguing, debating, or presenting a position.	The student writes the paper summarizing the evidence on both sides of the question, and the reasons for his or her own conclusions about Hamlet's sanity.

Source: Adapted from Table 1, pp. 12–15 from "A Taxonomy of Critical Thinking Dispositions and Abilities" by R. Ennis in *Teaching Thinking Skills* by Joan B. Baron and Robert J. Sternberg. Copyright © 1987 by W.H. Freeman and Company. Used with permission.

Note: Robert Ennis (1987) has developed a taxonomy of abilities that he believes are part of critical thinking, which he defines as reasonable reflective thinking focused on deciding what to believe or do. Ennis believes these critical thinking skills can be taught.

also work together to solve a mystery proposed by the teacher that requires deductive reasoning. Groups benefit from the expertise of each of the group members. As a result, this approach tends to increase the number and types of resources and ideas available to a group (Salas, Burke, & Cannon-Bowers, 2000). Groups comprising members with varying abilities and backgrounds demonstrate the largest gains in problem solving (Hong & Page, 2004; Sommers, 2006). In general, successful groups are those that are small, have good communication, share a common mindset, without necessarily agreeing on all details, and agree on acceptable group behavior (Shelton, 2006).

THINKING CREATIVELY

How might you plan a classroom lesson on alternative forms of government that systematically encourages children to engage in dialogical thinking?

SUGGESTION: Form a simulated alternative government in your classroom.

MODEL AND EXPLICITLY TEACH THINKING SKILLS

Teachers should model effective thinking skills, including problem solving and reasoning, as they teach day-to-day content. Modeling alone may not be enough to help students learn to think effectively, however (e.g., Palincsar & Brown, 1984; Perkins, 1987; Schoenfield, 1979). Teachers must explicitly teach the thinking skills as well. A math teacher, for example, might help her students learn to use the steps in the problem-solving cycle by posting a chart of the steps. As she works model problems on the chalkboard, she can then describe which step of the problem-solving cycle is involved. For example, the teacher identifies a problem by writing it on the board. Then she says, "Our next step is to define this problem. First, can anyone tell me what information is relevant?" She continues in similar fashion, working through the remaining steps.

Expert teachers have automatized the habit of building practice in thinking into their everyday lessons. They know that with guided and focused practice, students can become expert thinkers. Using critical thinking skills can become a low-effort, automatized habit that helps students succeed in school and beyond.

CONSTRUCTING YOUR OWN LEARNING

Taking into account all you have learned in this chapter, write down several ideas for specific ways you would infuse the teaching of thinking into a lesson on a subject with which you are familiar. Carefully consider the ages of students for which your ideas would be appropriate. Share your ideas with others. Have them comment or share their own ideas with you. In what ways are you now better equipped to teach for thinking than you were before you read this chapter?

SUMMING IT UP

WHY UNDERSTANDING THINKING IS IMPORTANT TO TEACHERS

- Critical-thinking skills enable students to purposely search for solutions to problems. These skills are important to students' success both in and out of school.

CONCEPT FORMATION

- Concepts are represented and organized in the mind by means of defining and characteristic features. Many concepts do not have defining features and, therefore, are best described in terms of either prototypes or multiple exemplars.

REASONING

- Reasoning is of two basic kinds: deductive, which goes from the general to the specific, and inductive, which goes from the specific to the general. Teachers help students learn to reason by providing practice with syllogisms, encouraging thoughtful inductive reasoning, and teaching students to avoid common fallacies, including inappropriate use of the availability and representativeness heuristics, overconfidence, and underconfidence.

PROBLEM SOLVING

- Many problems are solved via a problem-solving cycle, which is best used without sticking to a straight-line path from the beginning to the end of the sequence of steps. Problems can be classified into two categories: well structured and ill structured. It is often difficult to reach a reasonable solution for ill-defined problems. Some of the most challenging problems students and teachers alike confront are insight problems.
- Algorithms—sets of steps that guarantee a solution to a problem—often work for well-defined problems. For many real-world problems, however, algorithms are either unavailable or too complex to be used successfully. In these cases, people use informal problem-solving strategies known as heuristics, such as mean-ends analysis, working forward, working backward, and generate and test.
- A problem that seems to be impossible to solve when presented in one way can become much easier to solve when a problem isomorph is given, providing an alternative way of seeing the problem's formal structure. Often, incubation is the best way to reach an insight

when persistent efforts to solve an insight problem have failed. The thinking required to solve insight problems includes (but is not limited to) three key processes: selective encoding, selective combination, and selective comparison. Old mental sets, including functional fixedness, can sometimes interfere with insightful thinking.

- Expert thinkers differ from novices, primarily in that the former know more and better organize knowledge about their area of expertise. These advantages allow experts to develop a level of automaticity in solving problems. Although experts may be better problem solvers in their domain of expertise, entrenchment can creep in, thwarting flexible thinking. Teachers should encourage students to use both dialectical thinking and dialogical thinking to avoid entrenchment.

TRANSFER

- Transfer occurs when previous learning affects current performance. Transfer can be either positive, when previous learning aids current performance, or negative, when previous learning interferes with current performance. Transfer can also be characterized as either taking either the high road or the low road, depending on the circumstances under which it occurs. Forward-reaching transfer occurs when a person intends to transfer knowledge to a new situation. Backward-reaching transfer results when the applicability of previously learned knowledge is realized only at the time it is needed.
- Teachers can facilitate transfer by helping students overcome the disadvantages of encoding limitations, poorly organized knowledge bases, and indiscriminate use of knowledge. For example, teachers can teach students to use organization and discrimination.

DECISION MAKING

- Utility-maximization theorists suggest that we can predict what people will do by assuming that they will seek the highest possible utility. In other words, individuals make decisions that maximize pleasure and minimize pain.
- In satisficing, the decision maker considers options one by one, immediately selecting the first option that appears to be satisfactory.
- Heuristics are informal, intuitive, and often speculative shortcuts in thinking that may solve a problem but are not guaranteed to do so

TEACHING FOR THINKING

- The two common methods for teaching students how to think are stand-alone programs and infused programs. Each type of program has its own advantages and disadvantages.

KEY TERMS AND DEFINITIONS

- **Algorithm** Clear and fixed set of steps that guarantees a solution to a problem. Page 329
- **Automaticity** Execution of mental procedures with hardly any effort or even conscious awareness of doing so. Page 333
- **Availability heuristic** Shortcut in thinking by which people make judgments on the basis of how easily they are able to call to mind what they perceive as relevant instances of a phenomenon. Page 321
- **Backward-reaching transfer** Realization of the applicability of what you learned in the past only after it becomes relevant. Page 336
- **Characteristic features** Features typical of a thing represented in a concept, although not always associated with it. Page 315
- **Concept** Mental abstraction or category of similar objects, people, events, or ideas. Page 313
- **Concept map** Picture or diagram illustrating the relationships between different concepts. Page 316
- **Critical thinking** Conscious and purposeful direction of thought toward finding a solution to a problem. Page 313
- **Deductive reasoning** Process of drawing specific, logically valid conclusions from one or more general premises. Page 317
- **Defining features** Features that are necessary and sufficient for defining a concept. Page 314
- **Dialectical thinking** Thinking characterized by a progression in which first a thesis is proposed, then an opposing antithesis, and finally an integrative synthesis. Page 340
- **Dialogical thinking** Ability to see not only one's own point of view, but also the points of view of others. Page 340
- **Discrimination** Ability to recognize when information previously learned is not relevant in a new situation. Page 337
- **Encoding specificity** Ability to transfer learning only in conditions similar to those in which the original learning took place. Page 336
- **Exemplars** Highly typical instances of a concept. Page 316
- **Forward-reaching transfer** Transfer that occurs when a person intends to bring knowledge to a new situation. Page 336
- **Functional fixedness** Particular kind of mental set in which a person is unable to invent a specific new use for something because he or she is so used to seeing a conventional use for that thing. Page 332
- **Generate and test strategy (trial and error)** Way of solving a problem by generating alternative courses of action, not necessarily in a systematic way, and then seeing whether each course of action works. Page 330
- **Heuristic** Informal, intuitive, and often speculative shortcut in thinking that may solve a problem, but is not guaranteed to do so. Page 321
- **High-road transfer** Transfer that occurs when abstract knowledge learned in one situation is consciously applied to another situation. Page 335
- **Ill-structured problems** Problems that have no clear path to a solution. Page 326

- **Incubation** Temporarily ceasing to work actively on a problem so as to generate an insight. Page 332
- **Inductive reasoning** Process of drawing reasonable general conclusions from specific facts or observations. Page 317
- **Infused instruction** Teaching how to think as an integral part of a curriculum. Page 339
- **Insight problems** Problems that require the problem solver to think in novel ways that are not obvious from the way in which the problems are presented. Page 327
- **Low-road transfer** Transfer that occurs when a highly practiced skill is carried over from one situation to another, with little or no reflective thinking. Page 335
- **Means-end analysis** Analysis of a problem by viewing the goal that is sought and then trying to decrease the distance between the current state and the goal. Page 329
- **Mental set** Predisposition to think about a problem in a particular way. Page 332
- **Negative transfer** Transfer that hinders the solution of a new problem as a result of experience with an earlier-encountered problem. Page 334
- **Overconfidence** Heuristic described as an overestimate of the likelihood of the correctness of a judgment. Page 322
- **Positive transfer** Transfer that facilitates the solution of a new problem as a result of experience with an earlier-encountered problem. Page 334
- **Problem isomorphs** Problems that have the same formal structure, but different ways of expressing this structure. Page 331
- **Problem solving** Process of moving from a situation in need of resolution to a solution, overcoming any obstacles along the way. Page 323
- **Prototype** Most representative example of a given concept. Page 315
- **Reasoning** Process of drawing conclusions from evidence. Page 317
- **Representativeness heuristic** Shortcut in thinking by which people judge the probability that a particular event or object belongs to a certain category by how obviously it resembles, or represents the population from which it comes. Page 322
- **Satisficing** Decision-making model in which the decision maker considers options one by one, immediately selecting the first option that appears to be satisfactory. Page 338
- **Stand-alone program** Program in which thinking is taught as a separate unit or even a separate course. Page 339
- **Syllogism** Deductive argument that permits a conclusion to be drawn from a series of two statements, or premises. Page 318
- **Transfer** Carrying knowledge from one problem or situation over to a new problem or situation. It can either facilitate or hinder the solving of the new problem. Page 334
- **Underconfidence** Thought pattern in which people believe they are less likely to be correct than they actually are. Page 322
- **Well-structured problems** Problems with clear paths to their solutions. Page 326
- **Working backward** Problem solving that begins with an analysis of the end state, proceeding from the end to the beginning to solve the problem. Page 330
- **Working forward** Problem solving that begins with an analysis of the current state, proceeding from start to finish to solve the problem. Page 330

QUESTIONS AND PROBLEMS

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

1. Which kinds of examples would you give to help second graders learn the concept of good citizenship?
2. How would you teach third graders to avoid inappropriate use of the availability heuristic during a social studies lesson on South America?
3. How would you teach your fifth-grade students to check regularly whether answers to math word problems make sense?
4. How would you conduct a lesson designed to help first graders move from relying on the generate-and-test heuristic for building a wooden skyscraper model of Popsicle sticks to using heuristics that involve more planning?
5. How can you help fourth-grade students organize their knowledge of the plants and animals common to your region so they will be likely to transfer the knowledge to the problem of identifying different species they encounter on a class hike planned as a field trip next month?

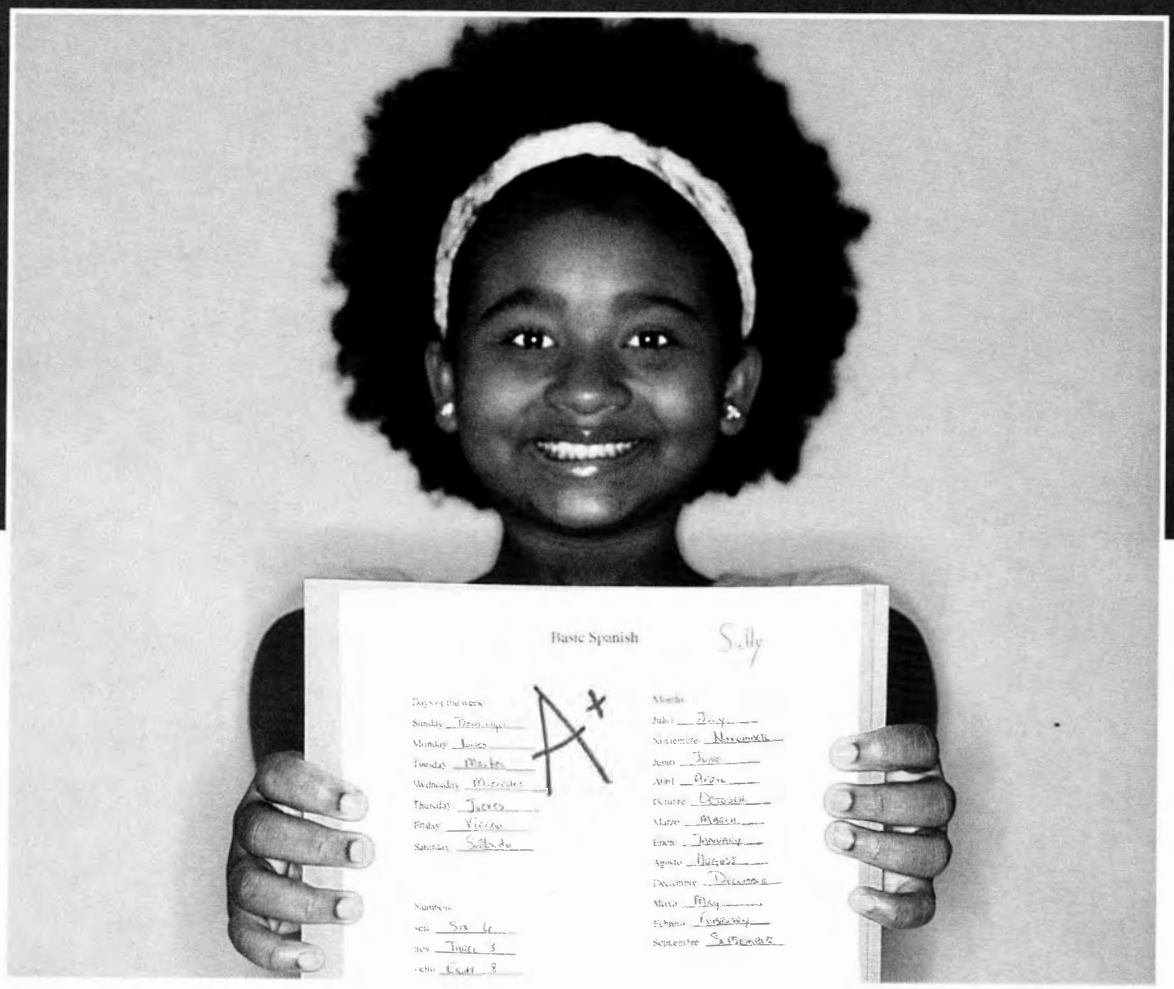
IN MIDDLE SCHOOL

1. Which personal characteristics do you suggest as being prototypical of the concept of "popularity" at the seventh-grade level? What would you avoid doing while teaching about the concept of popularity?
2. You are a new Spanish teacher. The previous teacher relied heavily on repetition and drill and, as a result, the eighth-grade students in your classes are convinced that Spanish is the most boring class in school. How will you demonstrate that their reasoning is faulty?
3. You have assigned your ninth-grade social science class a project to design a house in which a 65-year-old married couple will live after they retire. How can you help the students avoid the availability and representativeness heuristics in their assumptions about the needs of the home owners?

4. What are some exercises you can use in an eighth-grade poetry unit to help students overcome their functional fixedness about the ways words can be used?
5. How would you organize a unit on healthy eating so students in your seventh-grade health class are likely to transfer the knowledge to actually choosing their meals in the cafeteria?

IN HIGH SCHOOL

1. Develop a set of guidelines that will help students in your contemporary literature class use incubation effectively as they are completing their term papers.
2. Which kinds of analogies can you make to help students in your American government class understand the relationship between the rights of states and those of the federal government?
3. Develop some ideas for using popular movies to teach students to selectively combine what they have learned in science classes, such as physics or chemistry, with what they know about good movie plot lines.
4. How might you encourage students in your advanced biology class to transfer what they learned in the required prerequisite course, basic chemistry, to a lesson on metabolism and digestive processes?
5. Which topics would you choose to teach students in a senior-level history class the 12 critical-thinking skills defined by Ennis?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Motivating Students 10

Why Understanding Motivation Is Important to Teachers

Intrinsic and Extrinsic Motivation

Research on Intrinsic and Extrinsic Motivation

Motivation and the Development of Exceptional Abilities

The Importance of Student Interest

Extrinsic Rewards May Undermine Motivation

Four Ways to Understand Motivation

Behavioral Theories and Extrinsic Motivation

Cognitive Theories and Intrinsic Motivation

Social Learning Theories: Combining Intrinsic and Extrinsic Motivation

Humanistic Theories

The Role of Arousal Level

Arousal Level and Performance

Creating Optimal Arousal Levels

The Role of Student Goals

Why and How Goals Enhance Motivation

What Makes Goals Effective?

The Importance of Teacher Feedback and Teacher Expectations

The Role of Student Needs

Maslow's Hierarchy of Needs

Achievement Motivation

Self-Determination and Control

Importance of Student Choice

The Role of Student Attributions and Beliefs

Attribution Theory

Beliefs About Ability and Self-Efficacy

Self-Esteem Versus Self-Efficacy

Motivating Students with Special Needs

Diversity in Student Motivation and Achievement

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this chapter:

- Does motivation come from inside oneself or from the environment? What is the most effective type of motivation for a student—the internal push or the external reward?
- What are the implications of past and current research about the best ways to motivate students?
- How do the needs and goals of students determine their motivation level, and how can teachers use their knowledge of students' needs and goals to motivate students more effectively?
- How do students' beliefs about their own competence affect their levels of motivation? Can students be taught to rethink negative beliefs and thus increase their achievement?
- How can teachers keep themselves motivated? What can we learn from expert teachers about how they motivate themselves while confronting one challenging class after another?
- How can a teacher motivate students with special needs? Does the teacher need special techniques, or do the same basic techniques work with all students?
- Should the parents of students be involved if the students are having trouble in school? What are the pros and cons of such involvement?

A frustrated Jim Jenson paced back and forth in front of his fourth-grade class. "Every one of these children has the potential ability to read and to read well," he thought. Jim had tried everything he could think of to get his class excited about reading. The techniques he used had all worked well in the suburban school where he had once taught. But his current students were hard to reach and hard to motivate: The pep talks about working hard today to prepare for a successful future, the threats to call parents when students slacked off, and the reading contests designed to stimulate interest didn't work. Jim's current school was in an economically disadvantaged, inner-city community, where most of the students came from single-parent homes. Most parents were too busy working to spend time reading to their children, and the children were performing extremely poorly in reading.

At the beginning of the school year Jim had tried using an incentive program, awarding students gold stars for every reading attempt. But the students didn't seem to care about getting the stars: They threw the stars on the floor and showed no increase in reading time. Then Jim explained the power reading skills would have in the students' lives in an attempt to convince them it was worth the effort to apply themselves. He talked about students who had discovered their life interests from reading (like the female astronaut whose interest in flying started with a book she received as a gift at age 7). But still his students remained unmotivated and basically uninterested. Their lives lacked positive reading role models and they could not relate to the examples of role models he described—mostly middle-class students who attended poetry workshops and went frequently to bookstores.

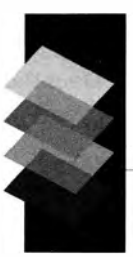
Finally, Jim decided to show his students that they could change their negative beliefs and attitudes about their reading ability by changing how they thought about reading—for example, by thinking about reading as a skill they could conquer. He used positive reinforcement and kept telling the students over and over that they had the power to read well if they could only see how their own negative beliefs were derailing their progress. These pep talks made the students feel that Jim cared about them and wanted to help, but the students still shied away from books.

Jim knows that reading ability is at the core of all academic performance, and he is determined to get through to his students. But nothing he tries seems to help. What else might he do to motivate them?

Jim's frustration is, unfortunately, all too familiar to today's teachers. For students to learn and achieve in school, they must first be motivated to pay attention, read, write, take exams, and, in general, apply themselves to the process of learning. Unmotivated students pose the greatest challenge for many teachers. A teacher may have prepared a terrific in-class lesson and take-home assignment, but if her students are not motivated to listen to her present the lesson, she cannot reach them successfully.

Thirty years ago, almost all classrooms were orderly places in which students listened to teachers. Even if the students had motivational problems, at least the teachers could speak to them and be heard. Today's teachers, by contrast, complain that often their students are so disruptive and unruly that the teachers do not even know where to start (see the Forum feature later in this chapter). At the other extreme are quiet, well-behaved students. Some of these students believe they are not capable of succeeding in school, and they, too, produce work well below their ability level.

How can a teacher motivate all of these students to believe that they are, in fact, competent? In this chapter we discuss how expert teachers motivate students of different ages and types to help them become successful learners.



Why Understanding Motivation Is Important to Teachers

Motivation is an internal state that arouses, directs, and maintains behavior. You can think of motivation as internal psychic energy or as a mental force that helps a person achieve a goal. Motivation is important in many contexts: in school, at home, and in the

world at large (Eccles & Wigfield, 2002). The key reason that motivation is important to teachers is the well-documented relationship between motivation to learn and academic achievement (Alderman, 2007; for a counterargument, see Gagne & St-Pere, 2002). Students who are motivated tend to achieve more in school; they stay in school longer, learn more, and perform better on tests. Thus, as Jim Jenson recognized, teachers must foster motivation for learning before they can expect students to profit from instruction or from school in general (Daniels, Kalkman, & McCombs, 2001; Dembo, 2000; Dembo & Eaton, 2000; Dembo & Seli, 2004; McCombs, 1996, 1998). But student motivation for school is a complex and dynamic phenomenon, marked by distinct academic and social goals (Covington, 2000; Dowson & McInerney, 2003).

To understand student motivation, remember that motivation is related to context. When students refuse to do something the teacher desires, many reasons might underlie their reluctance to participate. For instance, the students may not actually lack motivation, but rather have motivation of the wrong type (as far as the teacher is concerned). Even very young students behave differently for different motives under different circumstances. For example, one study found that a three-year-old child is highly motivated to protect a parent or loved one (Ceci, Leichtman, Nightingale, & Putnick, 1993). Close behind this motivating value is the desire to avoid pain or embarrassment. Gaining material rewards is somewhat less motivating for early elementary school students. Even less motivating, usually, is the desire to sustain a game with an adult, though that tactic may motivate older children. Middle school students display more complex patterns of motivation—they are able to describe both academic and social motivational goals (Dowson & McInerney, 2003). High school students (as most of us know) are motivated largely by their peers—right down to the level of which clothes they wear, which music they listen to, which body parts they pierce, and which slang they use.

THINKING PRACTICALLY

Which current classroom contexts do you find most motivating? Least motivating? What can you do to increase your motivation when you are in a context you do not find motivating?

SUGGESTION: Perhaps you most enjoy classroom discussions, in which students question one another and the teacher, but you are bored by lectures, in which the teacher basically just talks for a half hour or more. To increase your motivation during lectures, you might jot down the questions that come into your mind during the lecture (pretending to yourself that it is a discussion). Later, you can have a discussion with classmates, friends, or the teacher about these points.

■ **INCENTIVES CAN MOTIVATE BEHAVIOR IN DIFFERENT WAYS** An **incentive** is an object or event that encourages or discourages behavior. Not all incentives are equally motivating for all students. Specifically, a student may not respond to an incentive the teacher thinks is motivating if that incentive is not important to the student. For example, Jim Jenson found that his students were not motivated by receiving gold stars—a reward that works with some fourth graders. The right incentive for a person is one that is meaningful to her or him. Some students strive to earn praise; others work much harder for tangible rewards such as money, toys, or privileges.

Another important point about incentives is that sometimes incentives motivate behavior to meet undesirable goals. For example, the quest for peer group acceptance can motivate students to throw spitballs and write graffiti on desks. Some students are highly motivated—but their motivation is directed toward goals that are not compatible with success in school or in society at large. Assuming the values that lead to success in our culture are important to teachers and parents, a challenge for the expert teacher is redirecting student motivation toward goals that will lead to success, both in school and in the outside world.

THINKING CREATIVELY

How might you determine which classroom context is most motivating for a particular student?

SUGGESTION: You can try several different teaching approaches over a two-week span—for example, straight lecture, discussion, demonstration, group activity—and watch the student closely to see which type of instruction is most motivating for him or her.

Expert teachers know that motivation always exists in a context, and each child's situation is unique. These teachers also know that different groups may need to be treated differently to best develop their motivation. For example, research by Bronfenbrenner (1985) showed that girls and boys may need different types of assistance if they are to develop motivation. When interviewed as successful adults and asked about valuable mentors from their formative years, boys more often cited people who challenged and pushed them as essential to their development of motivation. Girls, by contrast, cited nurturant and supportive people, who encouraged them without being overly assertive, as being most important to their development of motivation. When girls and boys are assigned different types of mentors, girls tend to blossom with somewhat more supportive mentors, whereas boys tend to do better with more challenging mentors. We discussed the origin of these gender differences in student development more fully in Chapter 6; the key point here is that expert teachers must bear in mind gender and other group differences when they choose the best type of motivating mentorship.

■ **MOTIVATIONAL NEEDS CHANGE OVER TIME** Expert teachers recognize that students' motivational issues and needs change over the years they spend in school. Research has examined the decline in motivation to learn that often accompanies students' entry into

THINKING CREATIVELY

Name two unusual ways a teacher could motivate middle school students to do a book report project on ancient Egypt.

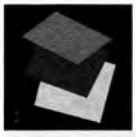
SUGGESTION: A teacher might ask the students to write a brief play based on the lives of people in ancient Egypt as a part of the book report project. Alternatively, the teacher might ask students to write essays about how ancient Egyptians spent their spare time compared to how the students spend their own free time.

middle school (E. M. Anderman, 1998; L. H. Anderman, 1999; Anderman, Maehr, & Midgley, 1999; Eccles, Lord, & Buchanan, 1996; Eccles, Lord, & Midgley, 1991; Henderson & Dweck, 1990; Midgley, Feldlaufer, & Eccles, 1989a, 1989b; Zanobini & Usai, 2002). When students enter middle school, their levels of school interest, self-confidence, and grades decline. They begin to show test anxiety and to miss school more often. But why does this decline in motivation occur at this point in students' careers, and what can teachers at the middle school level do about it (Anderman et al., 1999)?

Teachers' beliefs can influence motivation to learn (Goddard, Hoy, & Hoy, 2004). In studying students' transition into middle school, researchers find that middle school teachers are more likely than sixth-grade (grade school) teachers to emphasize classroom control and discipline, and to believe that students are untrustworthy (Anderman et al., 1999). Middle school teachers generally feel less able to influence student learning; they often are less supportive, friendly, and fair to students than grade school teachers. The researchers believe that the observed trends are exactly the opposite of what students entering adolescence and puberty need.

Expert teachers are aware of these general trends, and they recognize that these ways of thinking are erroneous. Armed with this knowledge, expert teachers take positive steps to provide adolescent students with the environment they need as they enter middle school. That is, these teachers seek to provide their students with ample support and make an effort to treat students fairly at all times. Expert teachers make clear to middle school students that they are trustworthy and capable of learning and performing well, even though their transition into adolescence sometimes derails them from these goals. In essence, effective teachers help adolescents meet the challenges of puberty.

Everyone knows talented young people who have failed to achieve their potential because of lack of motivation. Everyone also knows people who seemed about average in ability, but who have been motivated to push themselves as far as possible and have infected those around them with their almost contagious enthusiasm. Highly motivated people can accomplish remarkable feats; in contrast, poorly motivated people—regardless of how brilliant they may be—tend to go nowhere. But what is known from the standpoint of psychological science about this elusive quality that so often spells the difference between success and failure? Where does motivation come from; what, exactly, causes it; and how can a teacher create it? These are our next topics of discussion.



THE FLEXIBLE EXPERT

TEACHING AND LEARNING ABOUT MOTIVATION

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Kami sees that the value of the rewards she's giving to get her high school students to do homework is decreasing, so she switches to showing her students why doing homework is important in developing real-world skills relevant to their future careers.

THE CREATIVE TEACHER: Kami has her students write a play in which each character expresses one of the students' negative beliefs about their ability in school, and other characters prove these beliefs wrong.

THE PRACTICAL TEACHER: Kami recognizes the facial expressions that mean her students are feeling insecure about their abilities, so she gives a pep talk to them, reminding students of their past successes and the future successes the students will enjoy if they apply themselves.

THE ANALYTICAL STUDENT: Jason is able to detail the differences among the four basic theories of motivation and to state the strengths and weaknesses of each.

THE CREATIVE STUDENT: Jason draws colorful signs with motivational slogans (such as "The hardest part is beginning" and "Do something now") and hangs them in the room where he studies.

THE PRACTICAL STUDENT: Jason can tell when his friends on the chess team are having trouble motivating themselves, and he knows just what to say to get them excited about competing again.

Intrinsic and Extrinsic Motivation

Do you have friends who have tried on their own—unsuccessfully—to lose weight, and who have then joined a weight-loss program in which they participate in group meetings and are weighed in once a week? Many people unable to lose weight alone find themselves getting slimmer by the week when they join such weight-loss programs. Unfortunately, when they stop attending regular meetings, they tend gradually to regain the weight. This phenomenon illustrates the difference between extrinsic and intrinsic motivation—and also explains why so many weight-loss programs do such a brisk business.

A dieter with **intrinsic motivation** gets the push to exercise and control food intake from within. Intrinsic motivation means that an individual has developed an internal desire to do something—in this case, to meet the challenge of getting and staying in shape. A dieter who succeeds while attending group meetings is relying on **extrinsic motivation,** or motivation that comes from outside the individual. Extrinsic motivating factors may, for example, include gaining the approval of others, meeting publicly stated goals, and performing behaviors valued by the group. Most dieters find it far easier to lose weight through a formal weight-loss program that provides some extrinsic motivation than through solitary dieting. Those who manage to keep weight off over time, however, tend to rely on intrinsic motivation. In general, classic research in psychology shows that people are motivated to be active, to observe and explore their surroundings, to manipulate aspects of and objects in their environments, and to gain mastery over their environments (White, 1959).

THINKING ANALYTICALLY

Under which circumstances are you more likely to be motivated by intrinsic factors? Under which circumstances do extrinsic motivators work best for you?

SUGGESTION: Intrinsic factors motivate best when the activity is something you enjoy and have succeeded at in the past. Extrinsic factors work best when you dislike the activity, have failed at it in the past, and need an external push to get through the task.

RESEARCH ON INTRINSIC AND EXTRINSIC MOTIVATION

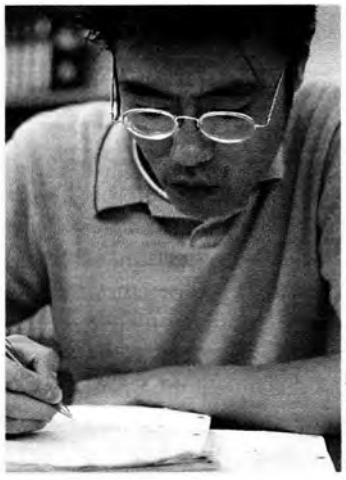
Researchers distinguish between intrinsic and extrinsic motivation in their studies of what motivates students most effectively (Covington, 2000; Covington & Mueller, 2001). Intrinsic motivation is the push students give themselves; extrinsic motivation is the push students get from pursuing external rewards or incentives (Pintrich, 2000, 2003; Pintrich & Schunk, 1996) It is essential to remember that these two types of motivation are not mutually exclusive—they can occur simultaneously as well as individually (Covington & Mueller, 2001; Lepper, Corpus, & Iyengar, 2005). It is possible, and even desirable, to encourage students using both intrinsic and extrinsic motivators.

Extrinsic motivation works particularly well for young students. Teachers of grade school students recognize this fact when they create systems of rewards, such as gold stars, points, or tokens, to get students excited about learning. As students grow older, they must develop intrinsic motivation, which often has been found to decline as students progress through school, particularly in subjects such as mathematics (Gottfried, Fleming, & Gottfried, 2001). If students do not develop motivation from within, they will never experience or develop the joy of learning. Also, low intrinsic motivation early in a student's schooling signals a particularly risky situation.

Many sources of motivation exist. The issue of where a student gains motivation—intrinsically, extrinsically, or through some combination of the two—is a critical one for teachers to understand. Knowing which motivators work is often difficult, as Jim Jenson learned with his fourth graders. Expert teachers recognize that motivating students requires the use of both extrinsic and intrinsic motivators. Through experience, teachers also learn precisely which factors are most important, and hence most motivating, for each student. For example, if a high school student tells her teacher that she would much rather be exercising than writing an essay, the teacher might suggest that the student treat herself to a special workout if she writes for two hours (an extrinsic motivator). The teacher might also suggest that the student choose a topic she is interested in and cares about—such as exercise or sports—and that she remind herself of how good it will feel to have accomplished the goal of writing the essay (intrinsic motivation). Through their experience working with students and from trying different approaches with each student, expert teachers learn that for some students grades motivate best, whereas for others the joy of self-discovery motivates best. Recogniz-

Most younger students are motivated by praise and gold stickers, whereas many older students thrive on self-motivation.

Katelyn Metzger/Merrill


Patrick White/Merrill

ing this diversity of motivating factors, these teachers may try several different approaches to motivate each student.

Research on extrinsic and intrinsic motivation (e.g., Deci, 1975; Deci, Koestner, & Ryan, 1999; Deci & Ryan, 1985a, 1985b, 1987, 2000a, 2000b, 2001, 2006; Lepper, 1988; Lepper & Henderlong, 2000; Lepper, Keavney, & Drake, 1996; Lepper, Sethi, Dialdin, & Drake, 1997; Vansteenkiste, Lens, & Deci, 2006) has evaluated which form of motivation is best in the long run for encouraging student learning. A key insight is that extrinsic and intrinsic motivation are not opposite extremes on the same continuum (Covington, 2000; Pintrich & Schunk, 1996), but rather vary independently of each other. For example, one student may have a high need for teacher praise and a high desire to learn for its own sake, and thus be high both in extrinsic and intrinsic motivation. Another student might be low in both needs, or high in one and low in the other. Expert teachers account for these differences when they help students build every type of motivation, yet place special emphasis on fostering intrinsic motivation because this type of motivation is increasingly important as students progress through the grades.

Students can also be highly motivated in one subject or context, but poorly motivated in another—something we all have experienced when assigned to write a report on one of our least favorite subjects. An effective teacher uses motivators from a subject or context students like to motivate them in a subject they dislike. For example, if Beth loves team projects in social studies and hates solitary studying in math class, her teacher might suggest she do a team project in math class. Her teacher might even ask Beth to try solitary work in social studies to show her that working alone can be a positive experience.

Research has shown that for elementary school and college students alike, a reward given for good performance can decrease students' feelings of autonomy, but increase their feelings of competence (Houlfort, Koestner, Joussemet, Nantel-Vivier, & Lekes, 2002). Expected rewards can also cause children to draw somewhat less creative pictures (Joussemet & Koestner, 1999). Perhaps children are less willing to take creative risks if the risks might results in losing out on the reward. Teachers need to remember these types of findings and consider the plusses and the minuses associated with using external rewards.

CONSTRUCTING YOUR OWN LEARNING

To better understand what motivates you and why, create a matrix, such as the one shown here, labeled with "high" and "low" intrinsic motivation along the top and "high" and "low" extrinsic motivation down the side. In each cell of the matrix, list as many activities as you can that you are able to characterize according to the amount and type of motivation you have for each activity. For example, a part-time job might rank high in extrinsic motivation because you do it for the money, and low in intrinsic motivation because you do not really enjoy it for its own sake. Cleaning your apartment might rank high in intrinsic

motivation because you enjoy doing the cleaning, and high in extrinsic motivation, too, because your roommate praises and rewards you for doing the cleaning. See whether you can fill in each cell in the matrix with a few different behaviors. What does the final matrix reveal about the sources of your motivation? Try filling out a similar matrix to understand your motivation for different aspects of teaching. If you are currently working in a practicum, consider creating a motivation matrix based on what you know about one or more of your students. What do these matrices tell you about yourself as a teacher? How do they affect your plans for motivating the students you teach?

	Intrinsic Motivation	
Extrinsic Motivation	High	Low
High		
Low		

MOTIVATION AND THE DEVELOPMENT OF EXCEPTIONAL ABILITIES

Intrinsic motivation can empower people to accomplish remarkable tasks. Consider the remarkable memory expert Rajan, who memorized the value of pi to the ten-thousandth decimal place. Rajan worked to develop his astounding memory ability without any external reinforcement; he received no external rewards. His self-professed desire was to be "the most outstanding mnemonist in the world." Regardless of whether Rajan strikes us as a success story, he is certainly an example of exceptional motivation. This type of internal push is very important in becoming successful: The world contains many successful individuals who developed a strong internal push early on in life and pursued their goals relentlessly.

Exceptional abilities such as those demonstrated by Rajan have diverse origins. Michael Howe (1999a, 1999b, 2001; Howe, Davidson, & Sloboda, 1998) studied the origins of exceptional abilities and concluded that intrinsic motivation is often important in developing exceptional talents. One group Howe studied was autistic savants—students labeled as having functional retardation but who show exceptional levels of performance on certain tasks. Some of these students had the ability to memorize perpetual calendars: They could answer accurately when asked, "On what day of the week will August 15, 2018, fall?" Howe found that these children led basically bleak family lives because of their autism. One day, some crucial event happened in the lives of each of the children who later became savants. The event rewarded the children for memorizing something. For example, if a relative visited and the child remembered the date of the relative's previous visit, the family may have praised the child and showered him with attention. Building on this initial external and minor reinforcement, the child developed an obsessive desire to memorize calendars, or to pursue whatever the particular fixation was. From this point on, the strong and now internal push propelled the child to work obsessively on learning the material.

Howe (1992) also drew attention to children in an orphanage in eighteenth-century Venice. These children were completely immersed in the study of music from an early age. The orphanage in which they were raised had a reputation for developing young musicians, and all children who lived there felt a responsibility to do their best to measure up to the expectations of the adult mentors; excellence at music was part of the culture of the group of people in the orphanage. There is no reason to assume these children had, on average, any more or less musical talent than any other group of children. Nevertheless, by age eight, not only had half the children played in a symphony orchestra, but they were also described as creating extraordinary music. The case of these children, who were taught music by the

THINKING ANALYTICALLY

What might have happened if the children in the Venetian orphanage had been adolescents when they began the total immersion in the study of music?

SUGGESTION: Although both time and place are different from those in other studies we cite, adolescents might resist adults' attempts to completely immerse them in the study of music; they might already have well-developed interests in another area. Also, some evidence suggests that very young children are better able to develop musical ability than are older children.

Italian composer Antonio Vivaldi, reveals again the importance of motivation and hard work in developing talents. Expert teachers understand the importance of motivation in helping children maximize their potential.

The value of exceptional motivation was also made clear in a study of expert racetrack handicappers, who predict the winners in a horse race (Ceci & Liker, 1986). This study showed that expert, highly successful handicappers did not differ from nonexperts in intelligence, social class, or years of schooling. Rather, the difference derived from their motivation to understand the outcomes of horse races: Once a race had been run, most handicappers turned the page of their race guide and began focusing on the next race. In contrast, the experts—the most successful handicappers—watched replays again and again, and continually analyzed and reanalyzed the race, in an attempt to understand why the horses performed as they did. These experts were extremely motivated. They worked toward the external rewards represented by financial windfalls, but also, in large part, for internal reasons (their love of horse racing).

THE IMPORTANCE OF STUDENT INTEREST

What about the role of students' interest in their motivation to learn? We all know that when we are really interested in topic, perhaps because it is personally meaningful or because we find it inherently fascinating, then we are deeply motivated to learn more about it. We have all met a child in the "dinosaur phase," who can recite the Latin names of numerous dinosaur species and describe their habitats and behavior in great detail. The thirst for knowledge about dinosaurs propels these children to read and study extensively about them. Their interest becomes the catalyst for the acquisition of an impressive array of knowledge.

Interest can affect engagement and learning both in the classroom and beyond. For this reason, the ability to develop and then maintain student interest is a key skill teachers need to possess. Teachers must understand how interest can affect learning, and they must know strategies for generating student interest, maintaining it, and even increasing it.

To date, much of the research on the importance of student interest has focused on reading (Naceur & Schiefele, 2005; Schiefele, 1991, 1992, 1996, 1999; Schiefele & Krapp, 1996). These studies argue that a significant relationship exists between interest and learning from text material. A series of studies by Schraw and his colleagues (Schraw, 1997, 2000; Schraw, Bruning, & Svoboda, 1995; Schraw & Dennison, 1994; Schraw, Flowerday, & Lehman, 2001; Schraw & Lehman, 2001) has explored in particular the type of interest termed *situational interest*, including ways to increase its level in the classroom. Situational interest here is defined as temporary interest that arises spontaneously due to environmental factors, such as task instructions or an engaging text. The researchers who have explored this topic recommend three ways to increase student interest in reading: (1) offer meaningful choices to students, (2) select well-organized texts that promote interest, and (3) provide background knowledge needed to fully understand a topic. McCrudden, Schraw, and Hartley (2006) also argue for the importance of giving students general instructions before they do assigned reading that explain the relevance of what they are about to read. Such instructions have been shown to help students form better mental representations of what they read.

Hidi (1990; Hidi & Renninger, 2006) believes that interest may be central to determining how individuals select and persist in processing certain types of information in preference to others. As a result of their explorations of various types of interest, Hidi and Baird (1986) argue that knowledge-based interest is certainly important in this respect—but that value-based interest is also important. Iran-Nejad and Cecil (1992) state that interest is both a cause and a consequence of learning—in other words, interest causes learning, and learning creates greater interest. Mitchell (1993) also discusses personal versus situational interest, arguing that both types of interest are important. And Renninger (1992, 2000) argues that individual interest increases as both the person's knowledge about and the accompanying value of the subject increase.

The literature on the importance of student interest is extensive, but one point is abundantly clear: Teachers should work to promote student interest whenever possible. The following tips for increasing situational interest in the classroom may help you achieve this goal in your own classroom (adapted from Schraw, Flowerday, & Lehman, 2001).

1. *Offer meaningful choices to students.* Choice is hypothesized to promote a greater sense of self-determination because it satisfies students' need for autonomy (Deci et al., 1991). Empirical studies of choice support this view. Teachers also suggest that choice increases students' interest in a text. For example, teachers interviewed by Flowerday and Schraw (2000) recommended offering a wide variety of choices to all students on a regular basis. Less knowledgeable or less self-regulated students should be helped to make choices. Teachers should provide feedback about the effectiveness of choices as well.
2. *Use well-organized texts.* Well-organized texts are both coherent and informationally complete. These two aspects are strongly related to interest in and learning made possible by texts. As texts become less user friendly, or as students become less knowledgeable about text content, teachers should make a greater effort to provide useful background knowledge about the text, given that knowledge and coherence appear to make separate contributions (McKeown et al., 1992).
3. *Select texts that are vivid.* Texts are vivid because they contain rich imagery, suspense, provocative information that surprises the reader, and engaging themes. Research suggests that text vividness has a positive impact on interest and learning, provided the vivid information is germane to the learning task. Texts that include irrelevant or highly seductive information may actually interfere with learning by diverting readers' attention from important text segments (Harp & Maslich, 2005; Harp & Mayer, 1998).
4. *Use texts that students know about.* Prior knowledge is related positively to interest and deeper learning. Teachers should follow one of two strategies to promote interest. First, they may use texts whose content is familiar, although not *too* well known, to the majority of students. Familiarity with a text helps students generate thematic inferences within the text as well as between the text and prior knowledge. Second, teachers may provide prereading background information to help students better comprehend what they are asked to learn. This can be done directly by the teacher or through small-group discussions among students.
5. *Encourage students to be active learners.* Students who actively make meaning learn more information at a deeper level (Loxterman et al., 1994). A number of researchers have suggested that interest increases active learning, and vice versa (Dewey, 1913; Mitchell, 1993). One way that students become more actively engaged in the learning process is by using specific learning strategies such as predicting and summarizing (Pressley, 1992). Another way is by using general study strategies in which students identify what they already know, want to know, and have learned (Ogle, 1986). Currently, it is unclear whether specific or general strategies are more effective at promoting interest and deeper learning; however, it is likely that both types of strategies do so.
6. *Provide relevance cues for students.* Understanding what is relevant to the learning task before attempting to complete that task increases interest and learning (Narvaez et al., 1999). To help set the context for learning, teachers should highlight relevant themes and information for students before they begin to read or study. This step is especially important for low-interest students (Means et al., 1997). Consider several strategies for highlighting the relevance of information. For example, encourage students to set personal reading goals before reading, help students understand what is most important or salient to the reading task, ask students to focus on causal claims, and ask students to explain the text to other students.

EXTRINSIC REWARDS MAY UNDERMINE MOTIVATION

Our society has created many extrinsic rewards to ensure that people accomplish what is in society's best interests. Much of our educational system is based on grades, diplomas, and other external manifestations of what a person has accomplished. These extrinsic rewards are examples of how society acknowledges the value of completing an educational program. But how much weight do individuals give to extrinsic rewards? In fact, people do their most creative work when they are intrinsically motivated (Amabile, 1996; Collins & Amabile, 1999).

THINKING CREATIVELY

How might a teacher encourage a student to develop intrinsic motivation for playing a musical instrument?

SUGGESTION: By telling the student he has natural talent (if at all true); by encouraging the love of music by sharing CDs and books about great musicians; and by pointing out and modeling the internal rewards that come from practice (ability to focus, belief in oneself, feelings of accomplishment).

If we look at the most creative writers, artists, scientists, or people in any other field, they are usually people who have done their work for the enjoyment of it. It is not that these individuals do not care about extrinsic rewards, such as money and fame. Rather, they are task focused—they work because they enjoy it. These individuals see money, fame, and other extrinsic rewards as merely pleasant by-products.

■ **EXTRINSIC MOTIVATORS CAN DIMINISH INTRINSIC MOTIVATION** Spence and Helmreich (1983) studied the motivation and achievement of thousands of college students, scientists, pilots, businesspeople, and athletes. They concluded that intrinsic motivation produces high achievement, and that extrinsic motivation often does not. These researchers identified three facets of people's intrinsic motivation: (1) quest for mastery, (2) drive to work, and (3) competitiveness. These researchers found that, despite having similar abilities, people oriented toward mastery and hard work typically achieve more than people not so oriented. However, those people who were the most competitive, and thereby showed a more extrinsic orientation, achieved less. People driven by a desire for meaningful learning, mastery of skills, and work—who are sometimes described as **mastery oriented**—achieved more if they were not also highly competitive.

Not all extrinsic rewards have a negative effect on intrinsic motivation, however. Three factors determine whether an extrinsic motivator will undermine intrinsic motivation. (In other words, when the following three conditions are met, extrinsic motivators will undermine intrinsic motivation.) First, the individual must expect to receive the reward upon completing the task. Second, the reward must be something important to the individual. Third, the reward usually must be tangible (a grade, money, a prize). Intangible rewards, such as praise or a smile, seem not to undermine intrinsic motivation (Deci, 1996).

■ **PERCEIVED TEACHERS' MOTIVATIONS ARE IMPORTANT TO STUDENTS** How students perceive their teachers' motivation is also important to student learning. In one study of this issue, researchers compared two groups of college students (Wild, Enzle, & Hawkins, 1992). In one class, the teacher was portrayed as being extrinsically motivated by a $25 payment. In a second class, the teacher was portrayed as being an intrinsically motivated volunteer. The teacher was the same throughout and not informed of what the students had been told. The students were taught the piano one at a time. Students who thought the teacher was a volunteer perceived the teacher as showing greater enjoyment, enthusiasm, and innovation than did students in the paid condition. Students in the volunteer condition also enjoyed the lesson more, reported a more positive mood, and were more interested in further learning. During an interval of playing on the piano in which students were free to play whatever they wished, subjects with the supposedly volunteer teacher were more exploratory and tried more new ways of playing than those with the paid teacher.

Do parents recognize that they should be promoting intrinsic motivation in their children? Barrett and Boggiano (1988) showed that the average parent or college student prefers using controlling strategies with children, and prefers using rewards and other methods for promoting extrinsic motivation, compared to alternatives that create intrinsic motivation. The average individual also thought that teachers prefer extrinsically motivated students to intrinsically motivated students, and believed that extrinsically motivated students derive more benefit from feedback.

Teachers themselves often prefer extrinsic motivation to influence their students. In particular, teachers who believe that individuals are best controlled by external forces prefer using extrinsic motivators with students. For example, one study found that teachers with an external locus of control preferred to use external motivation in teaching (Trice & Wood-Shuman, 1984). **Locus of control** refers to the location of the source of control for an individual, usually described as internal or external. Thus teachers who see themselves as being controlled by outside forces apply this same perspective when interacting with students.

Of course, it is also true that developing students' intrinsic motivation may be more time-consuming and not provide as immediate results. Teachers (and parents) who are overworked must sometimes do whatever they can to ensure students' compliance, so they often choose extrinsic motivators. Nevertheless, the extra time invested in developing intrinsic motivation

does pay dividends down the road, through its emphasis on personal cognitive control of thoughts, feelings, and behaviors, and the joys of learning and mastery.

*i*MPLICATIONS FOR TEACHING

- **Consider students' age when choosing motivators.** Extrinsic motivators, such as grades and pats on the back, tend to work best with younger students. Intrinsic motivators, including doing something for the enjoyment of it, tend to work best with older students. But do not overly limit your choices—at any age, students are individuals who do not necessarily fit general patterns.
- **Choose from a variety of techniques to motivate students.** Extrinsic motivators can cause rapid changes in behavior, but these changes are often short-lived. Intrinsic motivators, by comparison, usually cause more gradual but longer-term changes in behavior. To obtain both short- and long-term positive results, a combination of motivators is useful. The best way to know and do what works to motivate students is to try several motivating approaches.
- **Don't underestimate the substantial value of intrinsic motivation.** Students with substantial intrinsic motivation can accomplish remarkable things.
- **Plan classes that stimulate students' curiosity.** Besides modeling intrinsic motivation (for example, by describing your own enthusiasm for learning when the subject is one that you really love) , build students' interest in learning by encouraging their sense of competence. Offering students some freedom to devise their own solutions to problems and to have a positive effect on their environment will give them a taste for challenges and instill a desire to overcome those obstacles.
- **Show your own love and enthusiasm for learning, and try novel methods that reflect your curiosity and interests.** If your interest is piqued by rain forests or the modern short story, your students are more likely to take notice and follow your example.

*f*ORUM

MOTIVATION LEVEL OF TODAY'S STUDENTS

Are today's students less motivated than students in previous generations? Or are today's students actually highly motivated, albeit to achieve goals that are not related to school?

FIRST VIEW: Some educators believe that students today are simply less motivated and less disciplined than their parents were at their age. Proponents of this view note that students watch as much as seven hours of television per day. Their lives are filled with passive activities and forms of entertainment that have kept them from learning the value of hard work. Parents today provide for most of their children's material needs without even requiring disciplined participation by children in family chores and without expecting their children to do meaningful work. These are signs of our times: Parents are overworked, and children are unsupervised and undisciplined by their parents. When they are in school, these students present teachers with major challenges, if only because the students do not arrive at school with the necessary backgrounds and values for teachers to capitalize on.

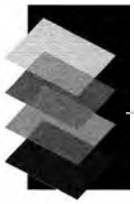
SECOND VIEW: Other educators believe that students show great discipline and motivation to engage in activities they find meaningful—but that this effort is not expended on school-related tasks. This view sees students as plenty motivated, but for achieving nonacademic goals. For example, some students spend hours playing video games; thus they have persistence, but lack the discipline to apply themselves to schoolwork. Parents

may contribute to the focusing of their children's motivation on nonoptimal goals. According to this view, teachers can do little to change the targets deemed appropriate motivating factors by students: Students are already predisposed by the time they enter school to focus on the goals the students believe are important, and these goals are not the teacher's goals. With no common ground to stand on with their students, teachers can find themselves frustrated. Parents often respond to this problem by stating that it is the task of the schools to motivate their children to care about scholastic performance.

THIRD VIEW: A SYNTHESIS: Students lack school motivation, but they are motivated; the challenge is to redirect their motivation toward goals that will bring more ultimate rewards in life. According to this view, teachers face the challenge of determining what motivates their students outside of school, and then channeling that energy and drive into more appropriate school activities. The teacher's task, then, is to harness students' natural motivation and redirect it.

To do so, teachers can ask students to describe their hobbies and how they like to spend their time, and then use this information to structure classwork and homework assignments to take advantage of their natural interest areas. For example, for a student who loves sports, a history project might focus on sports during different periods in history: who played, what games, when, and why. Teachers can also give assignments that demand hands-on participation in community events. Students can be given extra responsibility to encourage them to grow—perhaps publishing their own writing in the form of a newsletter. Members of the community whom the students would find motivating—such as athletes, businesspeople, and actors—can be used as role models; students can even write to these individuals.

All of these strategies will help students mobilize their motivation and redirect it toward activities that represent meaningful scholastic work. In addition, teachers can explain to parents that their children are directing their energies toward nonoptimal goals, and ask the parents to help enforce a focus on more appropriate goals, chosen to be as unobjectionable as possible to students.



Four Ways to Understand Motivation

Having considered how intrinsic and extrinsic motivation influence behavior, we are ready to review the major theories of motivation, which are based on the major theories of learning. Recall from Chapters 7 and 8 the description of behavioral and cognitive theories of learning. These approaches to learning also help explain motivation. Four theories of motivation follow from the learning theories.

BEHAVIORAL THEORIES AND EXTRINSIC MOTIVATION

Behaviorists think that rewards and punishments drive learning. Similarly, they see motivation as the result of rewards and punishments that mold behavior toward seeking rewards and avoiding punishments. According to this view, students become motivated to do things that are reinforced. Recall from Chapter 7 that a reinforcer is a stimulus that increases the probability the behavior associated with it will happen again. The reinforcer typically occurs immediately or very soon after the behavior in question. If it does not occur soon thereafter, learning does not take place, or is weakened.

■ **POSITIVE VERSUS NEGATIVE REINFORCEMENT** To review, reinforcers are of two kinds: positive and negative. A positive reinforcer is a reward following a behavior that strengthens the behavior and leads to increased likelihood of future occurrence of the behavior. Examples of positive reinforcers include a teacher's approval, indicated by a smile

or a favorable comment; an A on a test; or an award certificate recognizing excellent performance. The behavior that is increased is studying and achieving in school. A negative reinforcer is the removal of an unpleasant stimulus, which also increases the likelihood that the behavior will occur again. For example, an extremely hot room or an uncomfortably noisy concert serves as a negative reinforcer. The behavior that is increased is leaving the hot or noisy room. Removing an unpleasant stimulus is referred to as negative reinforcement when it increases the probability of a response. Many readers may remember being nagged by their mothers about their messy rooms—another negative reinforcer. The mother stops nagging when the child cleans the room, so room-cleaning is the behavior that is increased.

■ **PUNISHMENT: SUPPRESSING BEHAVIOR** In contrast to positive and negative reinforcement, punishment is a process that diminishes or suppresses behavior. Punishment can consist either of doing something that is unpleasant to a student who is not behaving appropriately, or of denying privileges and not doing what the student wants if the student is not behaving appropriately. In other words, punishment is a stimulus that decreases the probability of a response, either through the application of an unpleasant stimulus or through the removal of a pleasant one.

Punishment and negative reinforcement are sometimes confused with each other. The difference between the two is that punishment decreases the probability of a response, whereas negative reinforcement increases it. Examples of punishment include receiving a failing grade, being yelled at, being hit, or being humiliated. (The behavior that is decreased is forgetting to study, which results in more studying, in the case of the failing grade used as a punisher.) Punishment tends to be less effective for achieving behavioral change than reinforcement.

Thus, as we discussed in Chapter 7, both positive and negative reinforcers increase behavior, and punishment decreases behavior. A student who wins high marks in spelling early in the term and receives praise from her teacher and her parents may continue to study spelling for months afterward in response to these rewards. She may even participate in the school spelling bee in an effort to gain further recognition for her skill. The student has been positively reinforced, or rewarded, for her spelling ability. However, if the same student does not do particularly well in social studies early in the term, and consequently receives no praise or other rewards, she may not study social studies because she has not experienced an incentive or reinforcement to continue. If the same student is ridiculed by her peers for earning high marks in spelling—and is, in effect, punished for working hard—she may work less diligently to prepare for the next spelling test and hence may not perform as well.

■ **EXTRINSIC MOTIVATION CAN HAVE NEGATIVE CONSEQUENCES** You can see that behavioral approaches to understanding motivation are closely linked to extrinsic motivation, because external rewards are used to produce specific behaviors. Jim Jenson used incentives based on behavioral principles when he offered his students gold stars for progress in reading.

What are the negative aspects of the behavioral theory of motivation, and of the use of rewards, incentives, and punishments to shape behavior in the classroom? First, ask yourself this question: How do *you* feel when teachers or mentors attempt to mold your behavior by using incentives, rewards, and punishments? Many younger students seem to respond well to a system of rewards and punishments, but as they grow up, they sometimes resent such systems and the external pressures they impose. One problem with using external rewards to motivate students to learn is that the students may never develop as much intrinsic motivation as they ideally need. In fact, researchers have found that offering rewards to children for doing tasks the children find naturally motivating actually decreases the children's desire to perform the tasks (Deci, Koestner, & Ryan, 1999; Deci & Ryan, 1987, 2000a, 2000b, 2001, 2006; Vansteenkiste, Lens, & Deci, 2006). Mark Lepper (Lepper & Chabay, 1985) has shown that giving students extrinsic rewards for working on problems they find interesting has the effect of decreasing the students' interest level—exactly the opposite of what the teacher intends. Expert teachers make their use of rewards more effective by offering rewards for effort and for meaningful progress on tasks, rather than simply for handing work in.

THINKING ANALYTICALLY

Many parents pay their children for getting good grades in school. What are the pros and cons of paying children for grades?

SUGGESTION: Pros: Money is a powerful motivator in the short run, showing that parents care about children's success, and that academic success produces a tangible reward. Cons: Such payments undermine intrinsic motivation—children do not learn to value success for its own sake. Over time, this practice encourages children to perceive that their parents are "buying" their success rather than showing sincere interest; it produces feelings of being used.

In a review of the literature covering the effects of praise on children's intrinsic motivation, Henderlong and Lepper (2002) note that any glib definition of praise as verbal reinforcement is misguided. They point out that praise as an external reinforcer can either undermine, enhance, or have no effect on children's intinsic motivation—the outcome depends entirely upon how the praise is perceived. When teachers praise students, they should be trying to help their students make judgments such as "My teacher really means this and is trying to encourage me," " My teacher knows I studied hard and did not let a headcold stop me," "My teacher wants me to do well for *myself*, not just in terms of how I compare with other students," and "My teacher's encouragement makes me want to try hard because I know I can accomplish the goals she sets." These types of beliefs help develop intrinsic motivation.

External rewards can also focus students on receiving the rewards rather than on learning and growing though the learning experience. Our society supports the heavy emphasis that students place on grades as they develop. Expert teachers must confront this fact by reminding students of the joys of learning through the teachers' example and by noting the unseen rewards down the line that come from developing intrinsic motivation (Mischel, Shoda, & Rodriguez, 1989). Teachers may also find rewards difficult to use as motivating forces simply because of availability issues: There are not always enough rewards to go around. It is tough to keep students motivated all year in every subject through the use of rewards without running out of effective rewards.

Another problem with using external rewards to motivate students is that the system becomes less effective as students grow up. More mature students may sometimes perceive attempts to reward them as attempts to bribe them. What works for a 7-year-old, for example, may be seen as manipulative by a 14-year-old. In addition, offering privileges or time without homework means that older students may not do the work they need to succeed in school.

Although bonus systems motivate many adults to work harder so as to meet deadlines, adults expect to perform work in exchange for financial compensation, whereas students are not usually compensated financially for doing schoolwork. Put simply, students are expected to do their schoolwork without being given constant extrinsic rewards. Thus something more appropriate to the schooling domain than a rewards-based approach is needed. That something can be an appeal to the thoughts, pride, and feelings of self-efficacy and competence of a developing student.

COGNITIVE THEORIES AND INTRINSIC MOTIVATION

Cognitive theories of learning stress what goes on inside the student's head. This perspective is very different from the emphasis on the external environment that is so important in behavioral views. Like cognitive views of learning, cognitive views of motivation focus on what students think, how they think, and how their thoughts create or reduce motivation to act (Schunk, 1991a, 1991b, 1996a, 1996b; Schunk & Zimmerman, 2007). Thus cognitive theories of motivation emphasize the importance of intrinsic—as opposed to extrinsic—motivation. Jim Jenson took a cognitive perspective on motivation when he explained to his students the many benefits that reading would confer in their lives. Studies conducted by researchers with a cognitive emphasis have examined students' planning ability and how to improve it; the role of students' expectations of themselves, others, and their environment; the importance of goals (and how to craft effective goals); and ways in which students explain their successes and failures.

Part of what makes us human is our capacity for goal-directed, adaptive behavior. Cognitive theorists explain motivation by pointing to our human need to understand, strive, excel, succeed, advance, and continue to challenge ourselves. Some students sit for hours and work on a tough problem without even noticing the passage of time. Why do some people have such strong motivation? Why do some people enjoy doing puzzles and making up limericks? Why do some people push forward when it would be easier just to relax and enjoy life? Cognitive theorists examine these kinds of questions by exploring how students' thoughts influence their behavior.

TABLE 10.1 Using Expectancy X Value Theory to Enhance Student Motivation

Motivating the Student Who Expects to Succeed	Motivating the Student Who Expects to Fail
■ When goal is valued: High motivation and effort; the student is successful.	■ When goal is valued: The student fails to try despite wanting the goal—the teacher must encourage and reward effort and incremental progress, stressing the value of the goal to the student.
■ When goal is not valued: Normally high motivation must be harnessed—the teacher must choose new goal that is more valued and the student will succeed; the teacher should recognize and praise normally high motivation.	■ When goal is not valued: The student does not care—the teacher must first select a new, more valued goal, and must then encourage incremental effort and progress toward this new goal.

SOCIAL LEARNING THEORIES: COMBINING INTRINSIC AND EXTRINSIC MOTIVATION

Recall from Chapter 8 that social learning theory combines behavioral and cognitive approaches. Similarly, the social learning approach to understanding motivation mixes the behavioral and cognitive approaches just described. From the social learning perspective, motivation results both from what goes on inside a person's head (the person's thoughts, plans, and belief in her or his abilities), and what goes on in the external environment (the likelihood of reaching a goal, and the payoff if that goal is reached). Thus social learning approaches to motivation combine extrinsic and intrinsic motivational factors.

The scientific name for this combination of internal thoughts and how the environment is perceived is **expectancy X value theory.** According to this theory, people work hard and are motivated when they believe they have a reasonable chance of succeeding, and when the goal is personally meaningful to them (see Table 10.1). Jim Jenson used this approach when he praised and encouraged his students about their reading progress and tried to convince them that reading would bring them meaningful rewards.

HUMANISTIC THEORIES

The humanistic approach to understanding motivation is a reaction to the behaviorist and cognitive approaches that preceded it. Humanists believe that motivation results from more than just external rewards and internal conceptualizations of one's ability and performance. As the term *humanistic* suggests, humanistic views emphasize a *higher-order incentive* to achieve and excel that comes from within the person. According to this view, people have an innate, complex way of reasoning, and the things that motivate them are often equally complex. For a humanist, everything that affects the person—including thoughts, feelings, and aspects of the environment—can create or affect motivation. Humanists have used varied terms to express different aspects of the inner drive to excel. For example, Abraham Maslow (1970) believed that humans have an inborn need for **self-actualization,** or making the most of oneself. Carl Rogers (Rogers & Freiberg, 1994) termed the inner source of motivation the *actualizing tendency*; Edward Deci (1994; Deci & Ryan, 2000a, 2000b, 2001, 2006) has described a similar force as the need for **self-determination.**

How does the humanistic approach work in the classroom? The humanistic approach emphasizes the "whole student"—in other words, the emotional and social aspects of a student's life in addition to the intellectual aspects that are the focus of most instruction. This approach assumes students are naturally motivated to learn, provided that the educational experience is meaningful and that students view themselves as capable of learning. A key aspect of this approach is the frequent emphasis on helping students develop self-esteem. The humanistic approach also stresses the importance of teachers acting in a supportive and caring manner, and relying more on explaining why things must be done a certain way instead of on doling out discipline. Jim Jenson used a humanistic approach when he worked on enhancing his students' self-esteem.

THINKING ANALYTICALLY

Would a nontraditional school be better for every student (for example, a school in which no grades are given, or no formal, timed classes are held, or in which all work is project and group based)? Why or why not?

SUGGESTION: No. Students have widely varying needs: Some flourish in the structured, disciplined atmosphere of a traditional school environment; others succeed best in a less structured setting.

TABLE 10.2 The Four Theories of Motivation: Incentives to Enhance Motivation

Behavioral	
Extrinsic reinforcers in the form of rewards or punishments:	
■ High grades/low grades; praise/criticism; free time/detention; awards/demerits.	
Cognitive	
Intrinsic reinforcers based on beliefs, attributions, and expectations:	
■ Understanding the purposes of schoolwork and homework; believing in one's ability to succeed; attributing success to hard work; expecting to do well as a function of effort invested.	
Social Learning	
A mix of extrinsic and intrinsic reinforcers based on expectations and the personal value of goals:	
■ Understanding how to set workable, effective goals that can be attained; understanding the likelihood of reaching a goal and the payoff once the goal is reached; knowing how to choose goals with payoffs that are personally meaningful.	
Humanistic	
Intrinsic reinforcers based on the human needs to achieve, excel, and self-actualize:	
■ A meaningful educational environment in which students are encouraged to see themselves as capable; development of self-esteem; teachers acting warm and supportive; explaining why things must be done a certain way—no rules for the sake of rules.	

One study looked at eighth graders in a nontraditional (nongraded self-selection) school considered to be "a humanistic student-centered environment" (Matthews, 1991). This school attempted to influence the positive feelings and motives of students. Students worked in a relaxed atmosphere with small classes; their input influenced decision making and the general functioning of the school. Students in this humanistic school had higher intrinsic motivation than students in a more structured environment.

A summary of the four different theories of motivation for teachers appears in Table 10.2.

IMPLICATIONS FOR TEACHING

- **Try behavioral motivators—rewards and punishments—when you need motivational techniques that work quickly.** Behavioral motivators are often helpful in day-to-day life in the classroom. However, remember that behavioral motivations—although they influence students' behavior—do so without creating a deeper understanding on the part of students.
- **Focus on cognitive motivators for the long-term changes in the way students think.** Cognitive motivators, including beliefs in the values of work and in one's own abilities, can be more difficult for teachers to develop in students. In the long run, however, they tend to create more substantial and long-lasting changes.
- **Combine behavioral and cognitive motivators to give students the benefits of each.** Effective teachers have at their disposal numerous types of tools that work in multiple ways and at different rates. These teachers routinely use different types of approaches to motivate students.
- **Stress the meaningful lifetime rewards and positive feelings of self-actualization that result from hard work in the present.** As students show increased motivation and readiness to learn, model the valuable results of hard work by describing your own successes and the efforts that led up to them. Plan lessons based on well-known and respected people whose life stories show the ultimate value and rewards of hard work.

The Role of Arousal Level

Any attempt to explain what motivates students must consider the students' level of attentiveness to learning in general. Let us now turn to a discussion of the role of student arousal in creating and maintaining motivation.

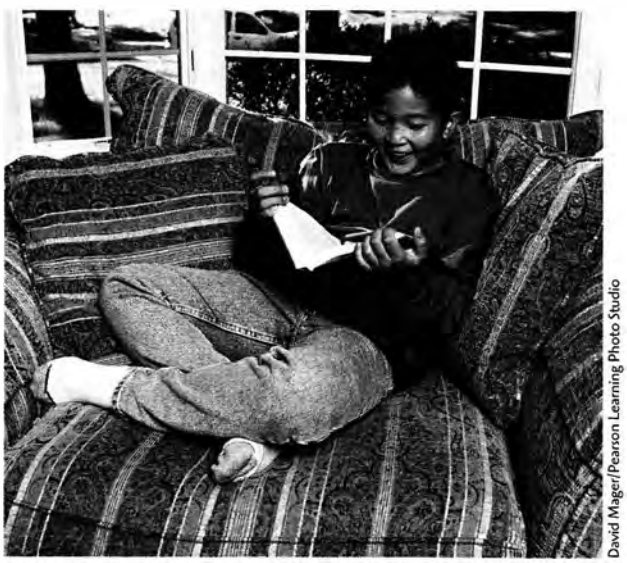
Arousal is an individual's level of alertness, wakefulness, and activation (Anderson, 1990). It is a state of physical and psychological readiness for action provoked by the activity of the brain and the rest of the central nervous system. Most people are familiar with the sensations of arousal—sitting in the dentist's waiting room, walking out on the high diving board, waiting to go on stage, and those last few minutes before an important standardized test. All of these situations tend to create a state of arousal. More moderate arousal happens before an enjoyable activity, such as seeing an old friend after an absence, entering a movie theater to see an anticipated sequel to a favorite movie, or ordering a favorite dessert. Too much arousal is often associated with **anxiety,** a sense of nervousness, worry, and self-doubt.

If you think about your own arousal tendencies, you will realize that each individual responds differently to different situations as a function of unique experiences, capabilities, and goals. For example, someone who does not particularly care about going to college may not experience much arousal in the moments before an entrance examination, whereas someone who is determined to get into a competitive college may be literally overwhelmed with anxiety.

AROUSAL LEVEL AND PERFORMANCE

In the early part of the twentieth century, Yerkes and Dodson (1908) showed that very low arousal and very high arousal are both associated with poor performance. Put simply, a moderate level of arousal is associated with the best performance. People generally also feel their best when their level of arousal is moderate (Berlyne, 1960). Too much stress can impair people's ability to learn and remember, although the precise nature of the mechanisms involved is complex (Shors, 2004).

Expert teachers habitually use a moderate level of arousal to their students' advantage. They capture their students' interest and provoke them with intriguing questions and problems to solve. But expert teachers do not create a high anxiety situation for their students by overly stressing performance on tests, for example. That is, instead of saying, "Your whole grade depends on how well you perform in the next hour!", an expert teacher might say, "You



David Mager/Pearson Learning Photo Studio

Prentice Hall School Division

Study habits vary, especially among older students. On the left, a junior high school student reads in the living room, while on the right, another student studies while she talks on the phone.

EXPERT TEACHER INTERVIEW

FOCUS ON: ACROSS-THE-CURRICULUM MOTIVATION

PEGGY GARWOOD: OAK GROVE SCHOOL, GREEN OAKS, ILLINOIS—GRADE 8, ALGEBRA

Peggy Garwood has been teaching eighth-grade algebra for more than 25 years. She strongly believes that it's important to teach across the curriculum by linking math projects with art, social studies, and other subjects. In this interview, she describes one particularly successful undertaking—a fund-raising quilting project that requires students not only to use their math and algebra skills, but also to acquire business and social understanding.

What is the quilting project?

Students in the eighth-grade math classes used their geometry skills to design several quilts. The quilts were then raffled off. Students sold the raffle tickets, and the money that was raised went to benefit a local soup kitchen. The quilt project has grown enormously over the five years that we've been doing it. The first year 38 students made one quilt, which was raffled for $2700. This year, 117 students designed three quilts. The raffle raised $7000.

How does this project teach students math and geometry?

Creating the quilts incorporates math and geometry skills. I begin the project by spending one class period explaining the art of quilting. I discuss its history and specific methods, while I show examples of quilts and point out math applications. In the same week, I teach concepts of geometric construction using a straightedge, compass, and protractor. Then each student is asked to design a seven-inch square quilt block using these techniques. Sometimes I give students guidelines they need to follow. For example, this year each design had to be symmetric to a line or a point. As the students are making their quilt designs, they have to be precise so that all the quilt blocks will fit together.

Raffling the quilts also helps build math skills. The students are in great competition with each other when they sell the raffle tickets—the class that sells the most tickets gets a bag of candy. They are competitive even for that little bag of candy. This level of competition provides a highly motivational opportunity for students to learn the concept of unit pricing. Class sizes range from 12 to 23 students. This year, a larger class raised the most money from the raffle tickets. When I asked the other classes, "Should I take their jar of money and say they win?" the students replied, "No, it's not fair. They have more students in their class." I guided them as they figured out a fair criterion, based on the amount of money raised per student.

How do projects like the quilt motivate students?

These projects are motivating to students because of the broad range of subjects and interests that are addressed. Every student can find something to enjoy. Having something to look forward to makes coming to class more fun. Every year, there are students who say they have heard about the projects I do, and that they can hardly wait until they can be in my class.

THINKING PRACTICALLY

Which techniques can students use to keep from becoming overly aroused before important tests?

SUGGESTION: They can focus on past successes, get enough rest the night before the test, eat a nutritious breakfast and lunch on the day of the test, practice deep breathing, and remember there will be other opportunities if this test does not go well.

have one hour to show what you have learned about mitosis and meiosis. I am interested in seeing how you think about the problems we discussed in class." Effective teachers also provide opportunities for doing extra work to help compensate for poor test grades, which sometimes result from nervousness rather than a lack of knowledge.

In an attempt to preserve discipline in the classroom, beginning teachers sometimes create too high a state of arousal and anxiety, thus hindering learning. The converse, creating too little arousal, results in a classroom in which students find themselves doodling, daydreaming, or even drifting off to sleep. Probably all of us can remember teachers who made the mistake of creating too much arousal or too little arousal in their students. In general, effective teachers strike an effective balance by using a variety of methods to assess students.

CREATING OPTIMAL AROUSAL LEVELS

The optimal level of arousal for performance varies with the task as well as with the individual. For simple tasks, moderately high arousal is better, whereas for difficult tasks, moderately low arousal is better (Broadhurst, 1957). If students need to complete those fairly repetitive and mindless tasks that are sometimes necessary in the classroom, a higher level of arousal may be needed to create enough motivation. When students need to complete complex tasks, however, lower levels of arousal will help them avoid the anxiety that may be associated with poor performance (see Table 10.3 on page 366).

How does this project encourage students' social and moral development?

Giving the money to the soup kitchen helps students develop socially and personally. Staff members at the soup kitchen have pointed out to students that, because of the support from the quilt project, the kitchen is able to take care of many of its needs. The students are proud that every penny of each raffle ticket goes to the kitchen. A sewing center donates the material; the school pays for printing the raffle tickets and a few supplies. One year, the school board offered to buy the quilt, but selling tickets not only offers the potential of making more money for the soup kitchen, it gives students additional opportunities to do a service for the community.

Students also get a personal opportunity to serve. When the students visited the kitchen, they met one man who had been going there for 16 years. Many students at my school are wealthy; they were stunned by this man's story. Some of the money we raised for the soup kitchen helped him. The kids were proud of this and were motivated to help even more. They noticed that forks and spoons were needed and brought them to the soup kitchen. My students have become better citizens in the community.

How do students of varying abilities approach this project?

All students have to participate in this project. And each student approaches it differently. One or two students designed their quilt blocks on the computer. One student with cerebral palsy found the drawing difficult, but she designed a quilt block herself with only a little help on the physical work of drawing. One boy had information processing difficulties. He made five designs and none of them worked, but he persisted. When he finally caught on, he was very proud of his work.

What advice would you give to new teachers?

When I was a beginning teacher, everything was done strictly out of the book. Now, every quarter, I have projects that relate to other subjects. I help students relate math to science, art, and poetry. Our projects have included creating a geometry collage, constructing a dual dodecahedron, and using origami to construct a polyhedron. During almost every project, I see a student who didn't really like math become much more excited about it because he or she is interested in the connection between math and another subject.

Look for ways to relate your topic to students' everyday lives and to other subjects. Don't just stick to the book.

Students themselves also differ in terms of their optimal arousal level. Some students work well under deadlines and flourish when a lot is expected of them. Other students work best when there are few demanding standards; then they feel no anxiety and are able to focus on learning instead of on getting high grades. For the average student, however, a moderate level of arousal is generally best.

To gauge a student's arousal level, watch for signs of too-low arousal (daydreaming, nodding off, doodling, passing notes, whispering to other students, and generally just zoning out). Watch also for signs of too-high arousal (nervousness, crying or flushed face, stomachaches in younger students, acting up, talking loudly and interrupting others, and other visible signs of being upset). Moderate and optimal arousal is associated with students acting excited, interested, and ready for learning.

What creates a moderate and effective level of arousal in students? One cause we are all familiar with is a student's curiosity. Students may wonder, "How does that work? Who invented that? Where does this lead? Can I learn how to do that?" Pique their curiosity by asking students leading questions and by encouraging them to ask themselves these same questions when studying at home. Often, the right questions can raise arousal to an optimal level in which students are primed to learn and to pay attention, and are driven by the need to understand.

Some students are naturally curious, perhaps because their home environments foster a curious, questioning perspective as they are growing up. Other students may have been pun-

THINKING CREATIVELY

How can a teacher reduce test anxiety while simultaneously increasing students' desire to perform well on tests?

SUGGESTION: Give more frequent, smaller, less formal tests. On occasion, allow students to retake tests if they score poorly. Design tests that give students multiple ways to show what they know. Recognize effort as well as achievement.

TABLE 10.3 Helping Students Cope with Test Anxiety

Coping with Emotional Problems

- Role-play stressful pretest situations with the students. Have one student assume the teacher's role and give advice to an anxiety-ridden student played by the teacher.
- Role-play a positive self-image and a positive, confident attitude toward tests with the students. Emphasize the following attitudes:
  - Think about the test as an opportunity both to show what you know and to learn something about yourself.
  - Tell yourself, "I can and will perform well on this test." See yourself in control of your test performance.
  - Remember that no test is perfect. Some, for example, assess only a single ability. Simply do your best with the test before you.
- Acknowledge the expertise of the skillful test takers in your class by having them discuss and demonstrate what they do to stay calm and clear-headed in a testing situation. (If necessary, add to their discussion the techniques of focusing, relaxing, and positive thinking.)

Coping with Physical Problems (of the "I was too hungry/tired to concentrate" variety)

- Tell students that, on the night before the test, they should eat and sleep as they normally do: They should get their usual amount of sleep, relaxation, exercise, and food.
- If remembering to stick to the normal routine is a problem, suggest that students use the buddy system: Have a friend call and remind them about bedtime, or wake them up in time for breakfast.

Coping with Intellectual Problems (not understanding the questions, forgetting information, getting stumped)

- Tell students to ask questions (another role-playing opportunity here).
- Suggest that students write immediately on the edge of their paper any facts/formulas they might forget.
- Suggest skipping hard questions (marking them so they will know to come back).

Coping with Situational Problems (running out of time, not having notes or pencils)

- Tell students to check the time limit at the beginning and plan how much time to allot to each part.
- Suggest that students pack their book bags the night before.

THINKING PRACTICALLY

How can you utilize the natural curiosity of students to motivate them to learn?

SUGGESTION: Begin lessons with a demonstration focused on an unusual object relating to the lesson—ask students what they think it is and what it is used for. For example, when studying farming in nineteenth-century America, bring to class an actual old farm implement or a photograph of one.

ished for being curious in the past by adults who complained, "You ask too many questions!" For these students, who can be recognized by their timidity and nervousness during attempts at questioning, expert teachers extend a supportive welcome to ask more questions. To reach these students, respond to questions positively and listen fully to everything the students say.

What makes students curious about some things but not others? People tend to be curious about things that are moderately novel to them and are moderately complex (Heyduk & Bahrick, 1977; Mark, 1998). If something is totally familiar to students, they often ignore it; and if something is totally novel or very complex, the students have no basis for understanding it. Something novel but within students' realm of understanding creates in them the curiosity to explore it.

Historically, some teachers and schools have viewed curiosity as disruptive, although this view is less common today. These schools have emphasized heavy-handed discipline under the assumption that learning is very serious business and that students must be kept under tight control. In truth, overemphasis on discipline can be shortsighted if it produces too high an arousal level due to worries about being sharply disciplined, punished, and controlled. One study compared different versions of the same educational activity for third to fifth graders; the activity carried out with each group was identical in instructional content but different in motivational appeal. The results indicated that, at this level, making learning fun increased both learning and retention and subsequent interest in the subject matter (Lepper & Cordova, 1992). Thus neither too little nor too much stress on students is desirable; both conditions create nonoptimal arousal levels.

iMPLICATIONS FOR TEACHING

- **Work to create optimal arousal.** Both underaroused and overaroused students perform below their ability level on assignments and tests. It takes practice and patience to develop a set of teaching techniques that creates optimal arousal. Experienced teachers can be an excellent source of ideas.
- **Create optimal arousal levels in students by piquing their curiosity and getting them interested in learning.** Overly stressing performance on tests can put a damper on learning. Too much or too little arousal hinders student learning and test performance; aim to strike a balance that helps students show what they know.
- **Learn what works best for each student.** Individual students vary in their optimal levels of arousal. In addition, a student often has a different optimal level for each subject. It takes time to learn your students' arousal problems. Meanwhile, aim for moderate levels of arousal; later, you can tailor individual comments and interactions to students' specific needs.

The Role of Student Goals

Once you prepare students to pay attention and learn by helping them develop an optimal level of arousal, you must proceed to the next step in channeling and maintaining student motivation: the effective use of goals. A *goal* is something an individual is working to accomplish. Setting effective goals can make the difference between a student who succeeds and one who falls short. Those students who persist in an activity often pursue a self-selected goal, whereas those who quit rarely have in mind any clear, desired goals for the activity.

WHY AND HOW GOALS ENHANCE MOTIVATION

Why are goals so effective as motivators of performance? According to Locke and Latham (1990), four main reasons explain their success:

1. *Goals help focus attention.* We pay more attention to tasks if we have clearly defined goals in executing them.
2. *Goals help mobilize resources.* They give us a sense of what we need to do to get where we want to be.
3. *Goals facilitate persistence.* If we know we want to read one extra book a week over and above our school requirements, keeping this goal in mind will constantly remind us of where we are versus where we want to be.
4. *Goals facilitate accomplishment.* Having goals helps us define and enact specific steps to reach the goals. Goals motivate us to keep on trying to succeed; if we find our first plan is not working, we can always create a second or third plan to help us achieve our goals.

Along with goals come *plans*, or strategies for getting from where we are to where we want to be (Miller, Galanter, & Pribram, 1960, 1986). Goals can help motivate behavior only if they are accompanied by one or more plans for reaching the goals. For example, if your goal is to become principal of your school, your first step should be to formulate a plan for achieving that goal. Set a series of subgoals and then calculate the differences between where you are and where you want to go. You can then take action to reach each of the subgoals, working within the broader scheme of reaching the final goal. A first step, for example, might consist of working over the summer for the state department of education to meet the people who control educational resources. A next step might be competing for a major teaching award to

THINKING PRACTICALLY

Devise a plan for increasing the motivation of an underachieving student to work hard in school—to master academic tasks, study information, do homework, and so on. Indicate which of the theories of motivation are guiding your plan.

SUGGESTION: Consider a situation in which the student comes from an unsupportive or abusive home. The teacher can work with the student, enhancing her belief in herself, while providing positive feedback and reinforcement for efforts in the right direction. Guided by the humanistic theory of motivation, the teacher might also give hints on how to master academic tasks.

create name recognition and awareness of your accomplishments. A later step might consist of serving on several influential committees so that you are seen as a person with educational and administrative ambitions.

■ **ONLY REALISTIC GOALS ENHANCE MOTIVATION** Having unrealistically high goals can be self-defeating for students. For example, some students are perfection oriented and consequently never attain their goals of doing perfect work. They feel worse than if they had never tried to do perfect work in the first place. Even when their grade is an A-, they believe they have failed. Realistic and attainable goals are the answer, and expert teachers help students define and focus on realistic goals in their daily work. Based on their experiences with many students, these teachers help students define their goals in terms of what they can reasonably expect to accomplish with hard work and perseverance in the time allotted. Remember, though, that not all high standards represent harmful perfectionism—Accordino, Accordino, and Slaney (2000; see also Grzegorek, Slaney, Franze, & Rice, 2004) found that very high personal standards meant that students tended to have lower levels of depression and greater self-esteem. The key is that goals must be attainable, not impossible.

What about another type of goal—deadlines? Are deadlines effective? Researchers have studied the effects of externally imposed deadlines on students' task performance and subsequent interest in the task (Amabile, DeJong, & Lepper, 1976). Students given a deadline were less interested in the task than those not given a deadline. Thus expert teachers remember not to use deadlines all the time, with the goal of increasing students' interest in their tasks and students' intrinsic motivation.

Expert teachers know the value of the right types of goals. These teachers make tasks a slight stretch for students—neither too easy, nor too hard. Researchers since the early 1970s have known (e.g., Atkinson, 1972) that many people prefer tackling tasks on which they have about a 50–50 chance of succeeding. In other words, if you give individuals a choice of standing close to a target they are aiming at, they will prefer to stand at the point where they have a 50–50 chance of hitting the target. However, students with low achievement motivation (i.e., drive to excel) will stand very close to the target because of a fear of failure.

Another important point to bear in mind is that goals will not motivate students unless they are accompanied by clear feedback. If a child doesn't know how close she is to achieving a goal, she will not know when to work harder.

WHAT MAKES GOALS EFFECTIVE?

A study by Meece, Blumenfeld, and Hoyle (1988) examined whether students used high-effort or effort-minimizing strategies while completing science activities. The researchers found that students who emphasized **task-mastery goals,** which stress working to understand and succeed at a task, reported more active engagement in their tasks than students who did not emphasize task-mastery goals. In contrast, students motivated by gaining social recognition, pleasing the teacher, or avoiding work reported a lower level of engagement. Thus task-mastery goals helped focus the students' behaviors in a positive way.

Meece and Miller (1999, 2001) found that elementary school students' motivation goals were reasonably consistent over time from grades three through five, although all students tended to show a decline in task-mastery and performance goals over time. When teachers stressed task mastery goals, students' achievement values increased; conversely, when teachers stressed performance goals, students' achievement values decreased (Anderman, Eccles, Yoon, Roeser, Wigfield, & Blumenfeld, 2001). Students tend to prefer high-challenge tasks because they are less boring (Miller & Meece, 1999).

■ **SELF-MONITORING OF SUBGOALS ENHANCES LEARNING** Of course, students can have different types of goals: subgoals or portions of the overall task (e.g., breaking the task into ten steps), ultimate goals (e.g., the completion of the entire task), and time-oriented goals (e.g., spending three hours studying). Which types of goals are more effective?

Morgan (1985) compared three types of self-monitoring of private study to investigate the effects of these types of studying on academic performance and intrinsic motivation.

Self-monitoring refers to students keeping track of their own progress. The participants, who were college students, were assigned to one of four study conditions: (1) self-monitor subgoal condition—keeping track of their progress on each step in completing the task; (2) self-monitor time-on-study condition—keeping track of time spent studying; (3) self-monitor distal-goal condition—keeping track of whether they had achieved the overall goal; or (4) control—studying the way they normally would. Key findings were as follows:

- In end-of-year exams, students who used self-monitored subgoals, or keeping track of their progress on each step in completing the task, outperformed students who used self-monitoring of either time spent studying or distal goals, such as doing well in the entire course.
- Students who self-monitored the duration of their study time actually spent longer studying than did control students, who did nothing special, but these self-monitors did not score better on exams. Students who self-monitored distal goals did not perform as well as those who self-monitored subgoals.

Besides the beneficial effects on learning, subgoal self-monitoring increased intrinsic interest in the course. The results of this study suggest that, as a teacher, you should make clear for your students how to use self-monitoring of progress toward subgoals during studying, perhaps by talking students through your own way of studying with subgoals. Also, encourage and reward students who use this approach.

THINKING ANALYTICALLY

Think of an assignment you must complete. Break the assignment down into a minimum of eight subgoals. Track your progress as you complete the assignment.

SUGGESTION: Perhaps you have a term paper due in your educational psychology course. Your subgoals can be as follows: (1) Brainstorm various topics, (2) choose a topic and discuss it with the teacher, (3) gather sources and resources, (4) review information and compose an outline, (5) write the first draft, (6) seek comments and feedback from others on the first draft, (7) research areas that need work and add or correct material, and (8) write the polished final draft.

■ **LEARNING WITH THE GOAL OF TEACHING IS INTRINSICALLY MOTIVATING** How about the effect of the overall goals students are aiming for in their learning? Benware and Deci (1984) studied whether learning with an active orientation would be more intrinsically motivating than learning with a passive orientation. They defined an active orientation as learning material with the expectation of teaching it to another student, and a passive orientation as learning with the expectation of being tested. For the college students in this study, learning with the goal of teaching the material was more intrinsically motivating. In addition, students who learned with the goal of teaching what they learned had higher conceptual learning scores and perceived themselves as being more engaged. However, the rote learning scores of students with active and passive orientations were equal.

THE IMPORTANCE OF TEACHER FEEDBACK AND TEACHER EXPECTATIONS

Think of how you feel when you read your teacher's comments on your term paper. Such feedback is of central importance in developing expert learners. It is the vehicle through which students see themselves as others see them and learn to improve.

What is the effect on students' motivation of receiving versus not receiving feedback? Butler and Nisan (1986) showed that students maintained their intrinsic motivation after getting a nonthreatening, task-related evaluation. In contrast, their intrinsic motivation was undermined when the students repeatedly failed to receive feedback. Butler (2000, 2006) showed that both the timing and the form of feedback are important, although to some extent students' responses to all feedback are the result not only of the type of feedback, but also of the students' own views about ability (such as whether success comes more from being born smart or from working hard).

■ **TEACHERS' EXPECTATIONS AFFECT STUDENT MOTIVATION** Teachers' expectations of students, and the feedback based on these expectations, are extremely important in creating or dampening student enthusiasm. Expert teachers recognize the importance of their own expectations in molding their reactions to students.

The subject of how teachers' expectations affect students' motivation has been the focus of research dating back to a classic study by Rosenthal and Jacobson (1968). This study showed that student performance was influenced by teachers' expectations of students' ability levels, even when the information that teachers relied on to make their judgments was randomly generated by the researchers. In other words, teachers were told that some students were likely to blossom during the year; these students did, in fact, do better. But the students

THINKING PRACTICALLY

Have you ever had a teacher who had very high expectations of your ability? How did you perform in the class? How did the teacher convey these high expectations?

SUGGESTION: A supportive teacher who conveys high expectations along with suggestions for how the student can actualize them will likely be rewarded with good student performance, including yours.

named as likely to blossom were actually chosen at random. The effect of teachers' expectations on student performance was called the *Pygmalion effect.* The Pygmalion effect refers to the growth in accomplishments that can result when a teacher believes in and encourages a student. The name comes from the ancient mythological King Pygmalion, who created a statue and then brought it to life.

Although this research has been criticized (e.g., Elashoff & Snow, 1971; Snow, 1995) and the findings have not always been replicated (e.g., Goldenberg, 1992), it is generally agreed that the Pygmalion effect does happen (Harris & Rosenthal, 1985; Madon et al., 2001; R. Rosenthal, 1995, 2002; Smith, Jussim, & Eccles, 1999; Smith, Jussim, Eccles, VanNoy, Madon, & Palumbo, 1998). The Pygmalion effect–inspired research has shown that teachers generally perceive their expectations of students to have been confirmed (Brophy, 1983a, 1983b, 1985a; Brophy & Good, 1974; Crano & Mellon, 1978; Humphreys & Stubbs, 1977; Rist, 1970; Williams, 1976). Other research has shown that inaccurate teacher expectations (given to teachers by researchers) also influence teacher behavior and student performance (Harris & Rosenthal, 1985; Jussim, 1991a, 1991b; Raudenbush, 1984). The Pygmalion effect has also been demonstrated for business managers and people in the military (McNatt, 2000).

In general, the lesson from this research is that high teacher expectations create better student performance, or at least the perception of better performance. When teachers are told that certain students are very smart, these students tend to perform better—or, even if the students do not actually perform better, the teachers *think* they perform better. Positive teacher expectations and feedback can be highly motivating to a student. Expert teachers capitalize on this fact when they provide students with positive feedback whenever possible. Even if students make errors, expert teachers are able to find something to praise while at the same time showing students how to improve. Research has shown that students who receive praise for their effort and for what they succeed at doing perform better overall than students who are not praised in this way (Lepper, 1988). Realize as well that low expectations may hurt student performance.

iMPLICATIONS FOR TEACHING

- **Emphasize student goals of mastering tasks and completing meaningful learning.** Avoid or downplay goals of performing at specific levels or achieving specific scores. Focus on the essence of learning and the joy it brings, not on comparing one student with others.
- **Maintain positive expectations of all students.** Don't let preconceived notions about students' capabilities stop you from expecting their best efforts. Many students will perform better than you might have expected if they are held to a high standard.
- **Teach students to monitor and control their own rates of progress.** Self-monitoring is truly a life skill that will provide continual rewards in any endeavor.

The Role of Student Needs

Goals are only a part of what motivates students. Students' needs are also important as controllers of and contributors to motivation. Students have many and varied needs that expert teachers can use as motivators. Expert teachers understand the differing types of student needs and know how they can appeal to those needs that will effectively motivate each student. Student needs include the need for power, the need for affiliation, and the need to achieve.

- People who rank high in the **need for power** seek to control others. They try to make the world conform to their own image of what it should be. When they are

part of groups, they want to be individually recognized (Winter, 1973). They are also concerned with their visibility among the general public (McClelland & Teague, 1975). Teachers can motivate students with this need by making them leaders of projects (as long as the students are reasonably competent) and by giving them public recognition.

- People who rank high in the **need for achievement** have a strong drive to excel and succeed. The need for achievement has been studied extensively by David McClelland (1985) and his associates. People who rank high in the need for achievement, such as successful entrepreneurs and athletes, seek out moderately challenging tasks, persist at them, and are especially likely to pursue success at their occupations. Why do these people seek out tasks that are moderately challenging? Because in these tasks the people are likely both to succeed and to extend themselves. They do not pursue overly challenging tasks they have no hope of accomplishing, nor are they attracted to simple tasks that pose no challenge.
- People who rank high in the **need for affiliation** like to form close connections with other people and be members of groups. They avoid arguments (Exline, 1962) as well as competitive games (Terhune, 1968). They also tend to become anxious when they feel they are being evaluated (Byrne, 1961). Expert teachers who wish to motivate students with a need for affiliation are attentive to creating a nurturing environment that is neither competitive nor evaluative. These environments might stress creative activities that are ungraded and group activities that are ungraded in which working together is encouraged.

Which behaviors might you, as a teacher, see in the classroom that would alert you to the needs of your students? Students with a need for power try to take control of situations with their peers, teachers, and friends. They want to be leaders and to be in charge, and they tend to be forceful and to act self-confidently. Students with a need for affiliation do their best to get along with others and as part of groups. They prioritize making and keeping friends over other types of accomplishments. Students with a need for achievement are generally motivated self-starters who work tirelessly until goals are met. They get great satisfaction from achievements but also move quickly onto the next challenge to attain additional achievements.

MASLOW'S HIERARCHY OF NEEDS

The needs for power, affiliation, and achievement all fit into the theory of motivation proposed by the humanist Abraham Maslow (1970). Maslow believed human needs form a kind of hierarchy. Individuals first need to satisfy needs at lower levels of the hierarchy before they seek satisfaction of higher-level needs. Levels 1 through 4 refer to deficiency needs, and levels 5 through 7 to growth needs.

DEFICIENCY NEEDS Levels 1 through 4 of Maslow's hierarchy comprise deficiency needs.

- Maslow's first level includes basic biological needs such as for food, water, sleep, and oxygen, which are necessary for continued survival. In fact, many homeless people face the challenge of getting these needs met every day. In some schools, certain students also face these needs—students who do not have adequate nutrition, for example. Until their need for food and sleep is satisfied, such students may have a very difficult time learning in school. In particular, children living in poverty face numerous obstacles in the fulfillment of these basic needs (Prince & Howard, 2002; Prince, Pepper, & Brocato, 2006).
- Maslow's second level addresses needs for safety and security—in other words, for shelter, protection, and emotional safety. Safe schools provide such a secure environment for students, and Maslow's hierarchy demonstrates why schools must be free of violence.
- The third level is the need to belong, to feel that other people love and care about us and to be a part of a meaningful group. The importance of this need is illustrated by

the bond between parents and their children, as well as by the bond between members of peer groups at school and by the relationships that develop between expert teachers and their students.

- The fourth level is the need for self-esteem—to feel worthwhile as a person. Students gain self-esteem from successfully performing activities that are meaningful to them, and particularly from meeting challenges.

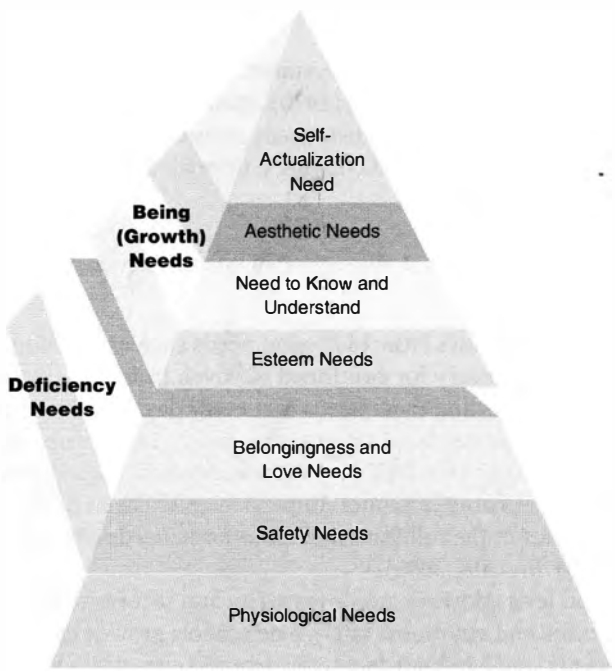
GROWTH NEEDS Levels 5 through 7 of Maslow's hierarchy consist of growth needs.

- The fifth level is the need to know and understand. This need reflects the facts that ignorance and lack of insight into the world around us can be a debilitating condition, and that people generally seek to understand their surroundings and themselves.
- The sixth level represents aesthetic needs—the need for beauty and balance in the physical, intellectual, emotional, and spiritual world we occupy.
- The highest level in Maslow's hierarchy, level 7, is the need for self-actualization, the need to fulfill our potential as human beings. We might consider athletes who compete in the Olympics as having achieved their self-actualized athletic potential, and top-notch brain surgeons, astronauts, and Nobel-Prize–winning scientists as having achieved their self-actualized intellectual potential. For other people, achieving this level might be measured in different ways—for example, by running a soup kitchen that successfully feeds and shelters homeless people in the winter. Maslow believed that few people achieve level 7.

Figure 10.1 illustrates the seven levels of Maslow's hierarchy of needs.

The level that a student occupies in Maslow's hierarchy can give her teacher a clue about the motives that will work for the student. For example, if the student is at the most basic step (need for food and water), opportunities to alleviate hunger and thirst will motivate the student. If the student has met that need and has entered Maslow's next level (the need for safety), behaviors that provide opportunities for shelter and security will motivate the

FIGURE 10.1 Maslow's Hierarchy of Needs



Source: Figure "Hierarchy of Needs" from *Motivation and Personality, 3rd ed.* by Abraham H. Maslow. Copyright © 1973 by Pearson Education. Reprinted by permission.

student. Expert teachers sense when a student is fixated at the third level, the need for love and affection, and use their ability to provide emotional warmth as a motivator for the student. Only when a student has satisfied these three basic needs (food, safety, and affection) will he or she crave respect from classmates and begin to develop a need for self-esteem. Maslow believed that few or no individuals ever truly reach self-actualization, the highest step in his motivational framework. Jim Jenson, the teacher in the chapter-opening vignette, worked in a poor, inner-city school; he had to ensure that his students had their basic needs met before he could expect them to make progress in reading.

THINKING CREATIVELY

Propose an addition or modification to Maslow's hierarchy and defend your proposed change.

SUGGESTION: The need for independence and self-reliance might be added between levels 4 and 5, stressing the importance of belief in one's ability to get things done.

ACHIEVEMENT MOTIVATION

The role of **achievement motivation** is clear in Maslow's growth needs. How do people with a high need for achievement motivate themselves? Researchers have found that people with a high need for achievement privately set goals for themselves (McClelland & Watson, 1973; see also Ablard & Lipschultz, 1998). Because these goals tend to be of intermediate difficulty, the people are likely to get a continuing sense of personal accomplishment. The researchers also found that people with a high need for power seek to stand out publicly, and do so (for example) by taking more extreme risks. Conversely, those with a high need for affiliation try to avoid public competition by taking relatively low risks.

Achievement motivation tends to be domain specific. For example, some students may be highly motivated to achieve at athletics, but not at academics. Other students may reject school psychologically, instead joining peer groups or even gangs in which school achievement is seen as undesirable. These students may have a high need to achieve, but the need may be directed toward nonschool-relevant goals, such as peer approval, and sometimes toward goals that damage society, such as gang-related criminal behaviors.

How do students react to teachers' demands for achievement (see Alderman, 1999, for an overview)? Consider the situation in which a teacher knows from past experience that a particular student is capable of doing far better work than she is currently doing. However, the student herself may not believe in her own competence. In this scenario, the teacher's demand for achievement may go unmet, not because the student is incapable, but because she is unaware of her capabilities. The perception of reality, rather than reality itself, is the more powerful predictor of how people, especially children, react to demands for achievement (Phillips, 1984). Unfortunately, girls—particularly as they grow older—often perceive their competence to be lower than boys' perceptions of their own competence. The result can be lesser expectations for achievement on the part of girls—and, therefore, lesser achievement (Phillips & Zimmerman, 1990). This effect emerges as early as kindergarten (Frey & Ruble, 1987).

■ **THE NEED TO ACHIEVE CAN BE STRENGTHENED THROUGH TEACHING** The motivation to achieve appears to be present in every culture that has been studied (Markus & Kitayama, 1991). The goal of one reasonably successful project in India, for example, was to raise the achievement motivation of Indian businesspeople and workers in their companies so as to help these people improve their lives. The employees attended an intense series of seminars designed to get them to think, talk, and act like achievement-oriented businesspeople (McClelland & Winter, 1969).

The fact that the need to achieve could be strengthened through training is highly relevant to teachers. Expert teachers often use similar techniques to get their students to "think big" about their potential and their future lives. These teachers stop students from talking in a non-achievement-oriented manner and model achievement-oriented behaviors for their students, such as how to use positive self-talk and possibility thinking to motivate themselves. For example, they say aloud, "I wasn't sure how to solve this problem, and I felt stumped. But then I thought, 'You can do it! Think of the times you have been successful in the past. Brainstorm five ways to solve the problem and work from there . . .' ."

In the discussion of group differences in Chapter 6, we noted that achievement patterns vary among different ethnic and cultural groups. One study of achievement motivation in China showed that Chinese parents place great emphasis on achievement, but their focus is

THINKING ANALYTICALLY

What are the ethical implications of teaching the values of one culture to people from another culture?

SUGGESTION: Teachers may have trouble keeping a perspective on the customs of different cultures without some degree of bias. People often do not have the vocabulary to express fundamental differences between cultures. Students may conclude that a specific culture's values are being endorsed.

different from that of American parents (Ho, 1986). Whereas American children are motivated to achieve so as to become independent, Chinese children are motivated so as to please the family and community. However, Leung (2002) found that among children from Hong Kong, Japan, Korea, and Singapore, there are few common attitudes unique to these countries that are capable of explaining these students' superior performance in mathematics. Expert teachers remind themselves frequently that what motivates one child may differ from what motivates another child, and that no "one size fits all" explanation exists for group performance trends.

SELF-DETERMINATION AND CONTROL

In everyday activities, people's behavior depends to some degree on intrinsic motivation. People seek to be active, to observe and explore their surroundings, to manipulate aspects of and objects in their environments, and to gain mastery over their environments (White, 1959). People also seek *self-determination*, the ability to make things happen, to have control of oneself and one's environment. People prefer self-determination over determination by outside forces. Most people are unhappy when they feel controlled, whether by another person or by outside events. In short, we are motivated to be in charge of our own destiny.

Edward Deci and his colleagues (Deci, 1996; Deci & Ryan, 2000a, 2000b, 2006; Deci, Vallerand, Pelletier, & Ryan, 1991) have proposed a theory of self-determination. According to this theory, humans need to feel competent, related, and autonomous. Deci suggests that intrinsically motivated activities satisfy people's need for competence as well as their need for autonomy. In contrast, many extrinsically motivated activities can undermine people's sense of autonomy because they attribute the control of their behavior to sources outside themselves, rather than to internal ones.

Deci and his colleagues found that students with self-determined motivation are more likely to stay in school, behave well, show conceptual understanding, and be well adjusted. Motivation increases when students feel competent. Students feel competent when they face the right types of challenges and when they receive appropriate feedback on their performance. They also feel more competent when they feel that they belong within a social group. This feeling of belonging is increased if students' parents are involved in their lives and if their peers accept them. Another way motivation is increased is when teachers encourage autonomy as opposed to retaining tight control over students.

IMPORTANCE OF STUDENT CHOICE

Turning to the practical side of the the issue of self-determination in the classroom compels us to ask: What about the role of student choice in student motivation? Does giving students more choices always increase their engagement and learning? Deci, Ryan, and their colleagues have conducted a program of research that examined the importance of student choice in how motivated students become (Deci, 1992; Deci & Ryan, 1985a, 1985b, 1987, 2000a, 2000b, 2001, 2006: Deci, Vallerand, Pelletier, & Ryan, 1991). This work has generally supported the positive learning effects that result from giving students more choices in the classroom. Nevertheless, a growing body of research suggests that more choices may not always lead to greater motivation and learning. Teachers must understand the issues that they must consider when deciding whether to allow choices, and to what extent to allow them. The key questions are as follows: When does giving choices work? For whom does it work? And how should opportunities for choice be structured to create maximal motivation and learning?

In one interesting study, Flowerday and Schraw (2000) intensively interviewed 36 teachers and analyzed the results. Their goal was to describe in teachers' own words which types of choices they offer students, how they decide when and to whom choices should be given, and why they offer these choices.

These researchers found that most types of choices fall into one of six categories: topic of study, reading materials, methods of assessment, order of activities, social arrangements, and procedural choices. Most choices center on topic of study or reading materials. Fewer choices involve classroom assessments, because teachers are often required to conduct assessments in

TABLE 10.4 Guidelines for Classroom Practice: Offering Choices to Students

- Recognize that choice matters to students.
- Use choice in all grades, but offer choices more often with older students and with more competent students.
- Use choice when students know a lot about a topic or task.
- Use choice in a variety of settings.
- Use choice on different types of tasks (homework, assessment).
- Use choice for academic and social activities.
- Offer simple choices at first.
- Help students practice making good choices.
- Provide feedback about choices.
- Use team choices for younger students.
- Provide information that clarifies the choice.
- Offer choices within a task (e.g., topic, sequence).

specific ways. Choice of learning activities is also common. Teachers offer a variety of choices for homework, in-class free time, and ways to demonstrate knowledge.

In deciding who is to be given choices, teachers consider age, ability, and prior knowledge. Older students get more choices. Likewise, students of higher ability receive more choices. Having high prior knowledge about a topic on the part of a student also increases the likelihood of the student being given greater choice.

Turning to the issue of when choices are given, many teachers use choice as a reward to maintain existing good behavior. Students who are performing well tend to have more opportunities to make choices. Although the past research suggests that giving students choices can increase their motivation and performance, in practice, teachers give choices to students who have already demonstrated motivation and good performance. All in all, teachers give students choices for three main reasons: to increase student self-determination, to increase personal interest, and to provide an opportunity for students to practice their decision-making skills. The findings of Flowerday and Schraw (2000) suggest the guidelines presented in Table 10.4.

In other research, Schraw, Flowerday, and Reisetter (1998) concluded that giving students choice of reading materials does not increase cognitive engagement or performance on tests or essays, though it does improve attitude toward the task. Making a more general argument, Schwartz (2000) described the "tyranny of freedom" in which too many and too varied choices lead to negative outcomes, such as general life dissatisfaction and increases in rates of depression.

Iyengar and Lepper (1999) offered a reconceptualization of the value of choice within a cultural context. These authors noted that decades of research point to the positives of choice—among them, increased levels of intrinsic motivation, greater persistence, better performance, and higher satisfaction. In their study, they tested the positive effects of choice for Anglo American versus Asian American children. They found that Asian Americans were most intrinsically motivated when choices were made for them by trusted authority figures or peers. By comparison, Anglo American children did better when they made their own choices. What is interesting about this study is that its findings show quite clearly the role of culture. Teachers must be sensitive to the fact that the optimal level of choice is a function of students' cultural backgrounds and beliefs (see Chapter 6 for a discussion of cultural issues in teaching).

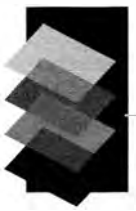
In summary, the keys to the effective use of choice depend on several different factors: an understanding of students' cultural beliefs and expectations, an appreciation of when choice can be offered while still maintaining the integrity of curricular content, and an appreciation of the balance between the positives and the negatives associated with choice.

*i*MPLICATIONS FOR TEACHING

- **Assess students' needs by observing them and their behavior, both with their schoolwork and with their peers.** Try to determine which type of response from others and which type of stimulation from the environment make students act in certain ways. Help those students with a need for power and achievement by giving them

leadership opportunities and presenting them with challenges. When possible, work with and not against student dispositions. Guide students to direct their natural dispositions toward meaningful, positive accomplishments.

- **Help students with a need for affiliation by being nurturing and providing constructive criticism in a positive environment.** Be aware that these students may not perform well in an environment that stresses competitive games, argumentation, or judgments of their performance. Fulfill students' needs so as to free them to learn at their capacity and best demonstrate their knowledge.
- **Motivate students to develop the need for self-determination by allowing them to earn autonomy.** Give students control over assignment topics and tasks whenever possible. Teach by example—share your own experiences about how you developed the need for self-determination and describe its positive effects in your life.
- **Ensure that students' basic needs for food, shelter, and security are being met before challenging them to achieve at higher levels.** Enlist the support of the school administration and social agencies if necessary. Do not waste your own and the students' time by challenging them to achieve if their basic needs have not been met.



The Role of Student Attributions and Beliefs

Students' goals and needs intimately affect their motivation levels. At the same time, another important factor in the development and maintenance of motivation are students' beliefs about their own and others' behaviors. Students' motivation is often affected by how the students explain their own successes and failures, as well as those of their peers. These explanations are called *attributions.* The ways students understand the workings of the school environment also affect their motivation. These explanations are called *beliefs.* Thus two important types of student understanding are attributions and beliefs.

ATTRIBUTION THEORY

An **attribution** is an explanation pointing to the cause of a particular behavior. For example, for Tomás to explain his newfound fondness for geometry, he might make an attribution that explains his perceptions of himself, telling himself that he is the type of person who likes geometry. Attribution theories clarify how people explain not only their own behavior, but also the behavior of others. People make attributions so they can understand their social world and answer questions such as "Why did I act that way?" and "Why did she do that?"

Fritz Heider (1958/1983), who developed attribution theory, pointed out that people make two basic kinds of attributions. The first kind are personal, or **dispositional attributions.** These explanations of behavior are based on internal characteristics in a person—"My nervousness when taking tests and my poor memory made me fail." The second kind are **situational attributions.** These explanations see behavior as being caused by external factors such as settings, events, or other people—"The overcrowded, hot room and the noisy play rehearsal next door made me fail."

Bernard Weiner (1982, 1985; Grietemeyer & Weiner, 2003; Reyna & Weiner, 2001) has shown that people use a variety of sources of information to explain the causes of their behavior in achievement-related contexts. The most important causes of success and failure are people's perceptions of their ability and effort. Other salient factors are the home environment and the teacher. Thus, in Weiner's theory of motivation and emotion, how people explain their behavior is of central importance (see Figure 10.2).

BELIEFS ABOUT ABILITY AND SELF-EFFICACY

Students who achieve in school and students who do not differ in terms of more than their ability levels. The difference is also related to students' perceptions of their ability (Dweck, 1999a,

FIGURE 10.2 How Students Explain Success and Failure

Success and Failure Viewed as Stable Traits

	Success		Failure	
	Controllable	Uncontrollable	Controllable	Uncontrollable
Internal	"I am smart because I always study."	"I am smart and succeed no matter what I do."	"I never try."	"I am stupid."
External	"The teacher likes me."	"I got the easy version of the test."	"The teacher hates me."	"The cutoff grade for passing was too high."

Success and Failure Viewed as Unstable Traits

	Success		Failure	
	Controllable	Uncontrollable	Controllable	Uncontrollable
Internal	"I worked really hard this time."	"Sometimes I am on, and sometimes I am not."	"I did not study enough."	"I got sick and could not think straight."
External	"I got the teacher a birthday card last week."	"I was really lucky."	"My parents did not quiz me at home."	"I had awful luck."

Source: Figure from "How Students Explain Success and Failure" from *Human Motivation: Metaphors, Theories, and Research* by B. Weiner. Copyright © 1992 by B. Weiner. Reprinted by permission of CCC/Sage Publications, Inc.

1999b, 2002; Dweck & Bempechat, 1983; Grant & Dweck, 2003; Hong, Chiu, Dweck, Lin, & Wan, 1999). Students who believe they are not capable but who have high ability generally perform less well than their ability would predict. Teachers may be surprised when a student who knows correct answers when called upon nevertheless scores poorly on a test of the same material. This situation can happen if the student believes she is not capable. By comparison, students who believe they are very capable often perform better than their ability would predict. Dweck's research on entity versus incremental views of intelligence is relevant here (see Chapter 1). People who subscribe to the **entity view of intelligence** believe they are born with a fixed amount of intelligence that cannot be increased, whereas those who subscribe to the **incremental view of intelligence** believe they are born with a certain amount of intelligence that can be increased.

The entity view that "What you are born with is what you have got" contrasts with the incremental view of more successful students, who believe that improvement comes from effort and hard work. Students who see the value of effort and hard work in achieving their goals are more likely to be motivated and to push themselves to excel. Thus such students possess an internal rather than external locus of control (as discussed earlier in this chapter).

Expert teachers can help students develop an incremental view of their abilities and an "effort attitude" by stressing that improvement comes from effort and that everyone has the ability to improve through hard work. Expert teachers avoid making statements about how some children are simply born smarter or more talented; instead, they stress the role of hard work in becoming expert learners. Some schools may unintentionally encourage an entity view of intelligence by labeling certain children as gifted or outstanding students without stressing that they have worked harder than have lower-achieving students.

THINKING CREATIVELY

Describe three ways a teacher could encourage a student to hold an incremental as opposed to an entity view of intelligence.

SUGGESTION: Provide examples of students and famous people who started out as failures and later succeeded. Reward effort and a positive attitude. Praise students who improve over past performance and encourage them to share their hints for success with other students.

■ **HOW STUDENTS RESPOND TO CHALLENGES** Researchers have found that students working on very challenging tasks respond to the tasks in two different ways (Dweck, 1998; Dweck & Leggett, 1988; Nicholls, 1984). What happens to a child when he or she is no longer able to complete a task? Some students, termed *helpless*, tend to give up easily or to

show poor performance when they confront difficult problems. These helpless students seem not even to be trying at the level their ability would predict. Other students, called *mastery oriented*, keep trying just as hard or even harder when problems become more difficult. Helpless students often blame low ability for their poor performance; mastery-oriented students blame their poor performance on lack of effort and maintain their higher expectations for future success.

Researchers have found that helpless and mastery-oriented students do not differ in ability. Instead, what separates these students is their attitude about ability and achievement (Dweck & Leggett, 1988; Nicholls, 1984). Helpless students tend to have **performance goals,** which are related to the judgments others make of their performance: They want to look smart, earn positive teacher comments, and avoid negative judgments of their ability. Mastery-oriented children have **learning goals**—they want to improve their skills and learn new things. These two types of students have very differing views of the nature of ability (see Table 10.5). Helpless students hold an entity view of intelligence, in which intelligence is seen as a fixed quantity that each of us is born with. Mastery-oriented students hold an incremental view of intelligence, which suggests that intelligence can be improved through effort.

The helpless view has been observed in children as young as four years old, and more generally in five- to six-year-olds (Heyman, Dweck, & Cain, 1992). When children from the two groups are highly confident about their abilities, they may reach similar levels of achievement. However, when children lack confidence in their abilities *and* see intelligence as something fixed rather than something that can be developed, they give up easily and often fail, believing themselves capable of no more. This line of research offers an important lesson for expert teachers: Too much emphasis on performance goals (such as praise, grades, and high scores) can undermine students' focus on mastery-oriented goals (such as learning new things and improving themselves). The message of this research has also been shown to apply to college students (Strange, 1997), for whom an incremental view of intelligence is associated with mastery-oriented achievement attitudes and behaviors.

■ **KEEPING STUDENTS FOCUSED ON LEARNING GOALS** Expert teachers must maintain a focus on the love of learning and skill building for their own sake, especially as children get older, so as not to allow children to become overly fixated on performance goals at the expense of learning goals. If a teacher stresses performance and grades, students will learn their lessons to please the teacher, not because the lessons hold students' interest. As these students grow older and move up through the grades, they will encounter more complex material; unless they are able to enjoy learning for its own sake, they will become frustrated with the new experiences of challenges (Henderson & Dweck, 1990). Instead of seeking challenges and the learning they offer, they will avoid challenges to avoid failure.

When it comes to the school district's need to administer formal assessments, the teacher can tell the students that the tests are important, but that they do not measure everything that is important about learning. Undermining the standardized assessments may, however, lead to students not trying as hard on them. Thus, although it can be confusing for teachers, the best

TABLE 10.5 Recognizing Students with Learning Versus Performance Goals

Students with Learning Goals	Students with Performance Goals
■ Define success in terms of improvement and progress.	■ Define success in terms of recognition, high grades, and perfect scores.
■ Place intrinsic value on effort, hard work, challenges, and meaningful learning.	■ Place intrinsic value on outperforming others and consistently scoring highly.
■ View errors as a normal part of the learning process.	■ View errors as unacceptable and embarrassing.
■ Are oriented toward the process of learning.	■ Are oriented toward the product of learning.
■ Enjoy the act of learning something new.	■ Enjoy the act of performing well in comparison to others.
■ Measure their success against their own past performance.	■ Measure their success against others' performance.

strategy is generally to acknowledge that formal assessments are a part of life and that students should do their best on them. After instilling this message, teachers can move toward stressing other types of more intrinsic motivators associated with optimal learning.

In Jim Jenson's class, which is profiled in the chapter-opening vignette, Jim would focus on helping students adopt learning goals that represent meaningful mastery of material, rather than performance goals that will be undermined—in this case, by the students' beliefs that they cannot accomplish meaningful tasks. You can encourage learning goals by emphasizing meaningful understanding rather than by simply working through 20 sample problems, for example. Remember that teachers who are themselves intrinsically motivated are better at getting students to seek the intrinsic rewards of learning (Csikszentmihalyi, 1997).

How does receiving instruction affect students' motivation? One study sought to answer this question by having students play a computer game (Sansone, Sachau, & Weir, 1989). The experimenters varied whether students received performance feedback. The game also gave students instruction on how to perform better. The findings showed that receiving instruction actually lowered motivation, but only when no performance feedback was provided. When feedback was given, instruction did not decrease motivation; in this case, students remained interested and motivated.

The lesson for the expert teacher is that instruction must be coupled with meaningful feedback on performance. In another study, the experimenters changed how meaningful the context was by describing the activity's goals as either skill related or fantasy related. Instruction decreased interest in the fantasy-emphasis context but increased interest in the skill-emphasis context. Thus, when instruction matched perceived goals, students felt more positive while performing the task.

■ **PERCEPTIONS OF ABILITY AS INFLUENCES ON ACHIEVEMENT** As an example of the importance of perceptions of ability to achievement, consider the relationship between girls' and boys' SAT math scores and their attitudes about their competence in math. Girls and boys tend to have different perceptions about their abilities. Girls often believe they are less capable and boys often believe they are more capable in math. Research has shown that students who believe they are quite capable do better than predicted by their ability level, whereas students who believe they are not capable do less well than predicted by their ability level. In general, children with negative thoughts about their ability become distracted from learning, lose track of the details of their tasks, and sometimes become immobilized from further learning (Brown, Bransford, Ferrara, & Campione, 1983). Thus these children wind up getting less and less practice in the areas in which they need practice the most.

STEREOTYPE THREAT. A program of research by Claude Steele and his colleagues (1997b; Davies, Spencer, & Steele, 2005; Steele & Aronson, 1995; see also Aronson, Fried, & Good, 2002) has also looked at the issue of students' beliefs about their own competence. This research has focused on minority students' beliefs about their general academic competence, and female students' beliefs about their competence in mathematics. Steele has attempted to show that students' negative beliefs lower their performance. Before giving a tough math test to a group of boys and girls, he had the test administrator tell half of the students that girls and boys have equivalent performance on the test. The other half of the test-takers were given no information related to gender. Steele showed that girls' performance was substantially higher on the same test when they were told beforehand that girls perform the same as boys, compared to when girls were given no information about gender-related performance.

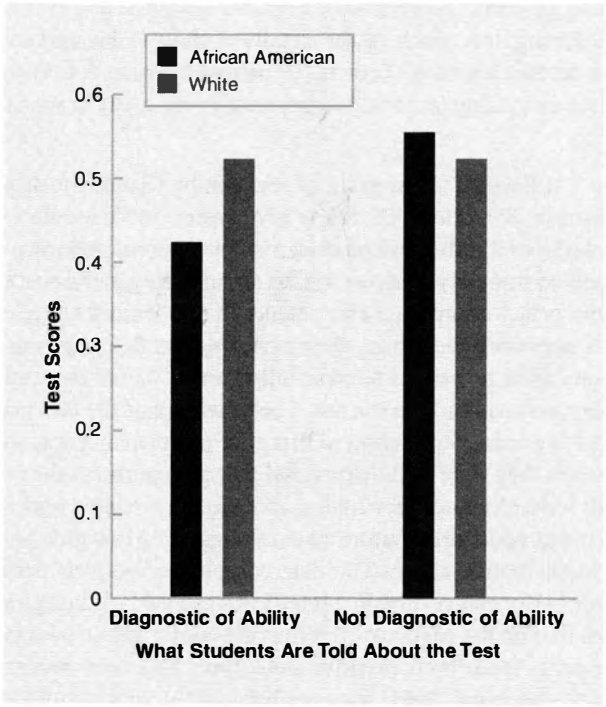
Steele explains the jump in girls' performance by suggesting that girls hold negative stereotypes about their mathematical ability. These stereotypes depress girls' performance on difficult math tests (only performance on difficult tests was assessed). When girls are told that past research has shown that on the particular test they are taking, girls perform the same as boys, then girls do not suffer from their negative stereotype, and their performance shoots up (Steele, 1997b). In this situation, Steele suggests, because the girls are told that girls do as well as boys, they are not hindered by their negative stereotypes. Steele labels this phenomenon *stereotype threat.*

In one of Steele's (1997a) studies on stereotype threat, African American and white students were given intellectual tests under two conditions: (1) *diagnostic*, in which they were told, "This test is a genuine test of your verbal abilities and limitations . . . and will help us in an analysis of your verbal ability"; and (2) *not diagnostic*, in which they were told, "This study is designed to better understand the psychological factors involved in solving verbal problems . . . Try hard even though we will not be evaluating your ability." Results showed that, after statistically controlling for differences in participants' SAT scores, African American subjects performed worse than white subjects when the test was presented as a measure of their ability (see Figure 10.3). Their performance improved dramatically—matching or even exceeding the performance of whites—when the test was presented as less reflective of ability (in which case the performance of whites decreased). Steele believes that when taking an intellectual test, African American students risk confirming as self-characteristic a negative stereotype of low intelligence. This vulnerability interferes with performance on tests because it causes anxiety, diverts attention to other concerns, and produces overcautiousness and self-indicting interpretations (in other words, "stereotype threat").

Many interesting studies have focused on the causes, consequences, and potential ways to reduce the effects of stereotype threat. Schmader and Johns (2003) found that stereotype threat works by reducing working memory capacity in threatened individuals. Cadinu, Maass, Rosabianca, and Kiesner (2005) found that the stereotype threat effect in women was linked to negative thinking. Osborne (2001) found that anxiety played a major role in explaining ethnic differences in academic performance, but that it was less important in explaining sex differences in mathematics achievement. Interventions have been found to be successful in increasing the performance of individuals of color and from low-socioeconomic-status (SES)

FIGURE 10.3 How Stereotype Threat Works

In the condition represented by the bars on the left, a group of African American and white students were told the intellectual test they were taking was diagnostic of their ability. In the condition represented by the bars on the right, another group of African American and white students were told the same test was not diagnostic of their ability. African American students' performance improved when they believed the test was not diagnostic of their ability.



Source: Steele (1997b).

backgrounds (see, for example, Ambady, Paik, Steele, Owen-Smith, & Mitchell, 2003). In some interventions, potentially vulnerable students are mentored and encouraged to either view intelligence as malleable or to attribute earlier academic difficulties to external factors (Good, Aronson, & Inzlicht, 2003).

PERCEPTIONS OF COMPETENCE AND PERCEPTIONS OF CONTROL OVER OUTCOMES. Researchers have also examined the role of perceived competence and control in students' preference for taking on a challenge (Boggiano, Main, & Katz, 1988). As part of this line of inquiry, they have investigated students' perceptions of their academic competence and their beliefs in their level of personal control over school-related performance. These perceptions and beliefs appear to affect students' intrinsic interest in and preference for challenge in a setting in which they would be evaluated. In one study, students with higher perceptions of their academic competence and personal control demonstrated more intrinsic interest in schoolwork and more preference for challenging school activities. When given an evaluative, controlling directive (e.g., "Your last three answers are not correct—try another sample problem and let me check your work before you go on to Chapter 3"), students who had high perceptions of their own academic competence and control preferred a greater challenge than did students who had lower perceptions of their academic competence and control. No difference between the groups of students in terms of preference for challenge was evident when no controlling directive was presented. Thus students' belief in their academic competence is important, as is their belief in their ability to control their school performance (Leondari & Gialams, 2002).

SELF-ESTEEM VERSUS SELF-EFFICACY

■ **SELF-ESTEEM** **Self-esteem** refers to the value a person places on himself or herself. Self-esteem is related to **self-concept,** or one's ideas about one's attributes and abilities. According to research by Harter (1990; Harter & Whitesell, 2003), people's self-concepts became increasingly differentiated as they explore their abilities and learn more skills. They may think highly of themselves in one of these differentiated areas, but not in another. Between the ages of four and seven, children can make reliable judgments about themselves in four personal domains: cognitive competence, physical ability, social ability, and behavioral conduct (Harter & Pike, 1984). By adulthood, people can rate themselves within 11 different domains of competency: intelligence, sense of humor, job competence, morality, athletic ability, physical appearance, sociability, intimacy, nurturance, adequacy as a provider, and household management (Messer & Harter, 1985).

THINKING PRACTICALLY

Rate yourself in each of the 11 domains of competency, on a 1-to-10 scale in which 1 = extremely poor, 5 = average, and 10 = outstanding.

SUGGESTION: Think about how you perform in different types of situations for each of the domains. Compare your ratings with a classmate's.

Not only do our own judgments of ourselves affect our self-esteem, but other people's judgments of us do, too (Cooley, 1982). In general, children's perceptions of their ability become more modest and more accurate as they grow older (Frey & Ruble, 1987; Stipek, 1984). When self-perceptions are too modest and, therefore, inaccurate, problems sometimes result. Self-evaluations of low ability may lead to motivational problems, especially in older children (Rholes, Blackwell, Jordan, & Walters, 1980; see also Rholes, Jones, & Wade, 1988). Children who underestimate their abilities also seem to seek out less challenging tasks than do children who view their abilities more realistically (Harter, 1982, 1990). Children from low-SES backgrounds have been shown to display less positive self-perceptions in a number of life domains compared to higher-SES children (Muldoon, 2000).

Herbert and Stipek (2005) looked at the emergence of gender differences in children's perceptions of their academic competence from kindergarten through fifth grade. Children, their parents, and their teachers rated the children's competencies in math and reading. Math and reading skills were also assessed directly. Beginning in third grade, girls rated themselves as less competent in math than boys rated themselves. However, there was no gender difference in math achievement or in teachers' ratings of children's math ability. Parents rated boys' math competencies higher than girls' abilities in both third and fifth grades. Although girls outperformed boys on the reading achievement measure in third and fifth grade, and teachers' ratings of children's reading ability reflected this gender difference in performance, gender differences were not found in either parents' or children's ratings of

their ability. Actual achievement and teachers' ratings both predicted children's judgments of their literacy skills. Parents' ratings of children's competence were a particularly strong predictor of children's judgments of their math skills.

Teachers cannot neglect the importance of self-perceptions, especially given that inaccurate self-perceptions guide how children handle both schoolwork and life outside of school (Phillips, 1984, 1987). For example, children who seriously underestimate themselves have low expectations for their success, believe that respected adults also take a dim view of their abilities, are reluctant to sustain effort in difficult tasks, and are more anxious about being evaluated than are other children (Phillips & Zimmerman, 1990). Often, the concept of self-esteem is described as though the effects of self-esteem are simple and straightforward. The converse is actually closer to the truth—in practice, self-esteem is multidimensional, complex, and influenced by numerous factors (DuBois & Hirsch, 2000). Helping students develop accurate self-perceptions is part of the way teachers help students mature and grow in their abilities. In one study of nearly 25,000 eighth-grade students followed through twelfth grade, Ross and Broh (2000) found that academic achievement in the eighth grade was associated with an internal locus of control in the tenth grade, which was also associated with academic achievement in the twelfth grade. Doing well in school at an earlier age and having supportive parents increased self-esteem. Having higher self-esteem did not improve either grades or test scores, however.

■ **SELF-EFFICACY** **Self-efficacy** refers to a person's belief in his or her ability to get things done. How does our belief in our own competence affect the likelihood that we will attain a particular goal? Self-efficacy theory emphasizes that our ability to achieve a goal is based on our belief as to whether we can achieve the goal (Bandura, 1986a, 1986b). People's expectations of self-efficacy can derive from a number of different sources: direct experience, interpretations of the experiences of others, what people tell them they are able to do, and others' assessment of their emotional or motivational state. In general, if someone has a higher degree of self-efficacy, then she or he is more likely to attain the outcome desired.

Students' level of self-efficacy can lead to self-fulfilling prophecies. When students believe they are able to do something, they are more likely to expend the effort and resources to do it, and thus eventually to achieve their objective. Indeed, Jim Jenson kept telling his students that they were capable of reading if only they applied themselves. One success leads to another, helping students to view themselves as being continually successful in maintaining the outcomes they desire. In contrast, if students have a low sense of self-efficacy, they may believe they are unable to succeed and, as a result, may hardly try. Not surprisingly, the result is failure, which then leads to the expectation of future failure. Expert teachers enhance students' self-efficacy by setting for the students realistic, highly specific, and attainable goals, and then helping them plan how to meet these goals (see Table 10.6).

*i*MPLICATIONS FOR TEACHING

- **Discourage students from blaming their failures on bad luck or other unfortunate situations.** Instead, encourage students to blame failures on lack of hard work. Model effective techniques by talking positively about your own school failures and their causes (and potential or actual solutions).
- **Encourage students to view success in school and in life as a result of hard work, not innate ability.** Point out that students who excel have often worked long and hard to earn their accomplishments. Make clear that this level of dedication applies to all their favorite athletes, writers, or performers. Make examples of hard workers, and ask these students to share their secrets for success with the class.
- **Emphasize that students can feel good about themselves as a result of meaningful accomplishments, both within and outside of the traditional school domain.** Discourage the idea that "everyone should feel good about herself or himself regardless of what she or he does." Stress the role of concrete, effective action rather than simply thinking good thoughts.

TABLE 10.6 A Lesson Plan for Helping Students Develop More Effective Conceptions of Intelligence

The goal of this lesson is to move students away from common misconceptions about intelligence and toward more productive attitudes. Although it can take a long time to change someone's attitude about intelligence, this lesson raises important questions and suggests the variety of ways that people can be talented.

Common Misconceptions

- Intelligence is a fixed thing that you either have or don't have.
- There is only one kind of intelligence—everyone who's smart is smart in the same way.

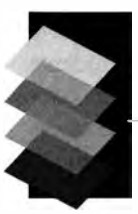
More Useful Conceptions

- Intelligence is something that you can improve through work, by thinking about yourself, and by monitoring your actions.
- There are many different ways to be intelligent—everyone is smart in some ways and not so smart in others.

What to Do

1. Introduce the importance of thinking about intelligence. One possible way:
   - Part of your (the students') job this year will be to show me (the teacher) how you are smart.
   - This job will be easy because each of you is already smart in many different ways.
   - This job will not be so easy because you may not know how you are smart, how to demonstrate your abilities, or how to develop them.
   - Part of my job is to help you figure out what your strengths are and how to use them.
   - A good place to start is by thinking about what "smart" or "intelligent" means. Our own personal definitions of intelligence can influence how we think of ourselves and what we do—both in and out of school.
2. Give students a chance to think individually about intelligence by writing in journals or simply having a moment to think quietly before class discussion.
3. For a class discussion, ask students to describe particular people they think are very good at something. If they have trouble, you might ask them to think of relatives, friends, famous people, heroes—people they would want to be.
4. Encourage diverse examples. If students focus mainly on academic talent, ask them to think of talented musicians, athletes, artists, actors, cooks, auto mechanics, and so on. Continuing for about ten minutes, ask students to talk about how each person is talented. What kind of intelligence does that person need to do what she or he does so well? You might keep track of the range of responses on a board.
5. Review students' ideas and have the class think about what it means to be intelligent.
6. Encourage the notion that intelligence is an ability to do things that we value and there are many different ways to be productive and talented. Also encourage the notion that people's abilities change and improve over time.
   - Can you think of people who are smart at one thing and terrible at another?
   - Can you remember when you could not do something that you are very good at now?
   - If someone does well in school, will that person do well in anything she or he tries?
7. Sum up what the class has said. Inform students that they will spend much of the year thinking about their own talents and improving how they work in school.

Source: From *Practical Intelligence for School* by W. M. Williams, T. Blythe, N. White, R. J. Sternberg, and H. I. Gardner. Copyright © 1996. Reprinted by permission of Allyn & Bacon.



Motivating Students with Special Needs

Once you have helped students set goals and develop effective self-concepts, these students will still face daily challenges in staying motivated. However, for some students, the typical and traditional methods of motivation aren't enough. Today's classrooms include many challenging students with special needs, and you are likely to encounter these students and be expected to motivate them from your first day on the job.

Modern-day teachers face many students who come from backgrounds that may place these students at a disadvantage for developing motivation. For example, students from single-parent families often need more motivation than they now tend to have (Bronfenbrenner, McClelland, Wethington, & Moen, 1996). Compared with other students, those from single-parent homes miss school more often, and on average are more pessimistic about the value of schooling and the value of planning for later life. Children from single-parent homes tend more often to be living within a lower-SES household; as a consequence, they tend to have a lower standard of living and to experience greater economic and other types of stresses, yet have fewer resources with which to overcome these obstacles (Weinraub, Horvath, & Gringlas, 2002).

Expert teachers are alert to the needs of students from single-parent families, who may require special assistance in developing motivation. Of course, children vary widely, and no one profile fits all children from single-parent families, just as no research findings predict the behavior of all children living in these families.

DIVERSITY IN STUDENT MOTIVATION AND ACHIEVEMENT

THINKING CREATIVELY

What advantages might students from single-parent households have compared to students from dual-parent households?

SUGGESTION: Children from single-parent households might be more independent and self-reliant; they might be more mature and exhibit more adult-like behaviors and skills. As a consequence, they might have better success in school.

Consider one finding about student motivation and achievement: Among high school seniors in the years 1990 to 1992, 22 percent of students coming from two-parent homes achieved an A grade-point average, whereas only 16 percent of students coming from families headed by a single mother did so. In other words, there is a 38 percent increase in the number of students who earn an A average when we compare two-parent homes to single-parent homes. Thirty percent of students from two-parent families had skipped one or more days of school in a four-week period, 34 percent of students from families headed by a single mother had done so, and 37 percent of students from other nontraditional family structures had done so.

In general, students' motivation to plan for the future has declined since 1980 (White & Wethington, 1996). This decline has been associated with a widening gap in which students from single-parent families are becoming even less motivated to plan for the future. However, the more education a student's mother has, the more likely student is to believe in the value of planning for the future (White & Wethington, 1996). In an examination of a nationally representative sample of Hispanic students, Battle (2002) found that socioeconomic status was much more important to educational achievement than family configuration, such as whether students lived with a single parent or both parents. In a series of analyses, Jeynes (1999, 2000) found that the effects of family structure on academic achievement vary considerably among the most common family structures. For children living with a cohabiting (unmarried) couple or a remarried widower, achievement is negatively affected. Thus researchers have not found support for the common assumption that children of divorced parents living with one parent are worse off than are children living with a reconstituted family.

Consider another finding that shows the relationship between parental/family involvement and patterns of student motivation and achievement. Ginsburg and Bronstein (1993; see also Bronstein, Ginsburg, & Herrera, 2005) looked at family factors related to students' intrinsic/extrinsic motivational orientation and academic performance. Students with an extrinsic motivational style who earned lower grades were likely to have parents who policed their homework. These students were also likely to have parents who maintained either too much or too little control over their children. These parents were often not involved meaningfully in students' school performances and tended to use extrinsic rewards to motivate their children. In contrast, students with an intrinsic motivational style were likely to have received parental encouragement in response to their grades. Intrinsically motivated students were likely to have higher academic performance and to have parents who exerted less control and supported reasonable independence in their children. In general, expert teachers remember that there are numerous, complex, interacting factors that influence student motivation and achievement.

■ **MOTIVATING STUDENTS FROM LOW-SOCIOECONOMIC-STATUS BACKGROUNDS** Antonio Roazzi (1988) examined which incentives work to motivate children from different socioeconomic groups. He gave children tough paper-and-pencil tasks to complete under one of three conditions: verbal reinforcement ("That's great!"), a modest financial reinforcement, or gustatory reinforcement (a chocolate bar). Roazzi found that the effects of incentives varied by social class. For middle-class students, verbal reinforcement was just as effective as the the other two types of reinforcement. For lower-SES students, however, verbal reinforcement was not as effective. (It is possible that teachers from higher-SES groups may have trouble choosing the most effective verbal reinforcements for lower-SES students, and may also have trouble earning the respect of lower-SES students in general.) Chapter 6 discusses the implications of social class for teachers in more detail.

The teacher of lower-SES students must realize that the teaching tips that work to motivate middle-class students may sometimes need to be adjusted to motivate low-SES students. When working with hard-to-motivate students of any type, expert teachers know they must begin by determining what really matters to each student. Knowing what is most important to a student enables a teacher to choose the incentive or reward that is most motivating (McCombs & Pope, 1994).

Students from disadvantaged social, ethnic, and cultural groups may sometimes benefit from an extra dose of motivation to enable them to overcome obstacles that may keep them from succeeding in the mainstream culture. These students must often work harder than their nondisadvantaged counterparts to succeed equally well. A key finding about ways to motivate low-SES minority children comes from work by Zena Blau (1981) with inner-city Chicago children. Blau found that the children who were motivated enough to escape the cycle of poverty had in common one educated adult in their lives—teacher, parent, friend, or other role model—with an educational focus (i.e., someone who heavily stressed the value of education). Even if the children's parents themselves were not well educated, her research showed that a single educated adult who provided mentoring and role modeling helped these children turn their lives around. Interacting with one person with an educational focus was essential to the child's outcome. Expert teachers remember this critical role they can play in their students' lives every day.

■ **MOTIVATING STUDENTS IN SPECIAL EDUCATION PROGRAMS** Students in special education programs represent another type of challenge, depending on the specific disability and learning issues they possess (Rankin-Erickson & Pressley, 2000). One popular method for dealing with special education students is to set incremental goals. As an illustration of how motivation can be increased through the use of incremental goals, consider the programs created for students with special needs. In Chapter 5, which focused on exceptional children, we discussed the use of individualized educational plans (IEPs), as mandated by Public Law 94-122, the Education for All Handicapped Children Act. These IEPs are created by the teacher in consultation with the child and parents, and they specify the child's learning and performance goals. The plans begin with global statements about what the student will attempt to achieve in a given year. Next, the plans provide incremental and specific goals for achieving the plan. These goals are spelled out in sequential steps that identify individual behaviors and performances for each step. Once the student works through the steps, he or she has accomplished the overarching goals for the term or year.

Krista Greco/Merrill

In order to improve his fine motor skills, a teacher encourages a young child with disabilities to paint. Motivation is particularly important to children with mental and physical challenges. Expert teachers understand how important it is to use incremental goals to motivate students and to make every task seem reachable.

The message for the expert teacher is clear: IEPs are used for students with learning challenges not only because they are required by law, but also because they work by focusing students on the smaller individual goals that lead to larger goals. In fact, expert teachers know the power of using incremental goals to motivate *every* student and to make *every* task, regardless of how daunting, seem within reach. Incremental goals also work in the world beyond the school environment: One teacher recently expressed disbelief to the person painting her house that he could possibly paint the entire building working alone. He answered that he paints only one side at a time and does not think about the remaining sides.

Motivational orientation is particularly important for populations with learning challenges. One study looked at the motivational orientation and academic achievement of elementary and middle school students with behavior disorders compared to their peers without learning challenges (Schultz & Switzky, 1993). The researchers found that students with behavioral disorders showed significantly greater academic performance differences due to motivational orientation (intrinsic versus extrinsic) compared with peers without learning challenges. In addition, individual differences in motivational orientation appear to affect the academic performance of students with behavioral disorders more than their peers without learning challenges. On an encouraging note, Rawson (1992) increased academic intrinsic motivation of boys with learning disabilities who had severe classroom behavior problems through a highly intensive academic remediation curriculum. Teachers of students with special needs must be particularly alert to helping these students develop optimal motivation.

*i*MPLICATIONS FOR TEACHING

- **Recognize that students from single-parent homes may need extra encouragement, support, and direction.** In some situations, these students may not receive as much attention at home as do students from dual-parent households.
- **Set students up with older mentors and study partners if possible.**
- **Encourage students to join after-school programs** to provide some of what they may be missing at home.
- **Use behavioral motivators (rewards and punishments) to start for students with learning disabilities or students from challenged groups.** Later, phase in cognitive motivators. Begin with small, incremental goals, and do not allow yourself to become easily frustrated by the challenges of teaching these students.
- **Work especially hard to meet the needs of students from groups with learning challenges.** These students often depend more on their teachers than do students from other groups. Your dedication and experience may be tested, but remember that over time you will grow in your ability to meet such challenges. Often, teaching the students who need you the most will provide the greatest rewards over time.

SUMMING IT UP

WHY UNDERSTANDING MOTIVATION IS IMPORTANT TO TEACHERS

- Motivation is closely related to academic achievement, is influenced by context, and changes over time. Incentives are objects or events that encourage or discourage behavior.

INTRINSIC AND EXTRINSIC MOTIVATION

- Intrinsic motivation comes from within the person—it is an internal push to do something. Extrinsic motivation, which is tied to the environment, comes from external factors, rewards, and incentives. Both intrinsic and extrinsic motivation are important in motivating

students, although intrinsic motivation generally helps students accomplish more on their own.

FOUR WAYS TO UNDERSTAND MOTIVATION

- According to behavioral theories, motivation results from rewards and punishments that serve to mold behavior. Cognitive theories of motivation focus on what students think, how they think, and how their thoughts create or reduce motivation to act. According to social learning theories, motivation results both from what goes on inside a person's head and from what goes on in the external environment: Social learning theories combine behavioral and cognitive theories. Humanistic theories of motivation propose that motivation results from a higher-order push to achieve and excel that comes from within a person.

THE ROLE OF AROUSAL LEVEL

- Arousal, or alertness, is important to motivation—neither too much nor too little arousal is desirable for optimal learning and performance. Curiosity can be used to create a moderate level of arousal and interest in learning.

THE ROLE OF STUDENT GOALS

- Goals are important to help students focus attention, mobilize resources, persist in achieving a goal, and see different methods for achieving a goal. Task-mastery goals—working to understand and succeed at a task—are best for students.
- Self-monitoring is the student's ability to keep track of his or her own progress. It can help students achieve goals and follow through on plans.

THE ROLE OF STUDENT NEEDS

- Maslow's hierarchy of needs suggests that students must be adequately sheltered and fed, and have adequate love and attention, before they can learn effectively.
- The need for achievement is an internal drive to excel. The need for self-determination is a drive to control our environment and our destiny.

THE ROLE OF STUDENT ATTRIBUTIONS AND BELIEFS

- Students' attributions, or ways of explaining their own behavior, are important to their academic performance. Individuals may make either internal (dispositional) attributions or external (situational) attributions.
- Those who hold an incremental view of intelligence believe that intelligence can be increased. Those who hold an entity view of intelligence believe that intelligence is fixed at an inborn level. Students with incremental views outperform students with entity views. Learning goals (the desire to improve skills) are better for student performance than performance goals (the desire to look smart and avoid negative judgments of ability).
- Students' self-concepts become increasingly differentiated over the course of development—that is, students come to think of themselves as good in some things but not in others. Self-efficacy, or belief in one's ability to get things done, is important to student achievement. It differs from self-esteem, which reflects the value we place on ourselves. Expectancy X value theory says that people work hard and are motivated when they have a reasonable chance of succeeding, and when the goal is personally meaningful to them.

MOTIVATING STUDENTS WITH SPECIAL NEEDS

- Students from nontraditional families sometimes need extra help with motivation so they will stay in school and perform well. Students from different socioeconomic levels often are motivated by different factors. Students in special education programs are especially in need of specific goals and plans to focus their actions.

KEY TERMS AND DEFINITIONS

- **Achievement motivation** Drive to excel. Page 373
- **Anxiety** Sense of nervousness, worry, and self-doubt. Page 363
- **Arousal** Individual's level of alertness, wakefulness, and activation. Page 363
- **Attribution** Explanation pointing to the cause of a particular behavior. Page 376
- **Dispositional attributions** Explanations for behavior, based on internal characteristics of a person. Page 376
- **Entity view of intelligence** Belief that intelligence consists of a fixed amount that a person is born with and cannot be increased. Page 377
- **Expectancy X value theory** Theory proposing that people work hard and are motivated when they believe they have a reasonable chance of succeeding, and when the goal is personally meaningful to them. Page 361
- **Extrinsic motivation** Motivation that comes from outside the individual—for example, from gaining the approval of others, meeting publicly stated goals, and performing behaviors valued by the group. Page 351
- **Incentive** Object or event that encourages or discourages behavior; a reason to behave in a certain way. Page 349
- **Incremental view of intelligence** Belief that intelligence can be increased. Page 377

- **Intrinsic motivation** Motivation that comes from within the individual and can take the form of personal energy, drive, or ambition. Page 351
- **Learning goals** Goals focused on improving skills and learning new things. Page 378
- **Locus of control** Location of the source of control for an individual, usually described as internal or external. Page 356
- **Mastery oriented** Being driven by a desire for meaningful learning, mastery of skills, and work. Page 356
- **Motivation** Internal state that arouses, directs, and maintains behavior. Page 348
- **Need for achievement** Drive to excel. Page 371
- **Need for affiliation** Desire to form close connections with other people and to be a member of groups. Page 371
- **Need for power** Desire to control others. Page 370
- **Performance goals** Goals focused on the judgments others make of a performance. These involve "looking smart," earning positive teacher comments, and avoiding negative judgments of ability. Page 378
- **Self-actualization** Need to make the most of oneself. Page 361
- **Self-concept** Ideas about our attributes and abilities. Page 381
- **Self-determination** Ability to make things happen, to have control of ourselves and our environment. Page 361
- **Self-efficacy** Beliefs in our ability to get things done. Page 382
- **Self-esteem** Value one assigns to one's own characteristics (for example, one's abilities, talents, and actions). Page 381
- **Self-monitoring** Keeping track of our own progress. Page 369
- **Situational attributions** Explanations for behavior based on external factors such as settings, events, or other people. Page 376
- **Task-mastery goals** Goals that stress working to understand and succeed at a task. Page 368

QUESTIONS AND PROBLEMS

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

1. Your goal is to motivate first-grade students to listen attentively during reading class and not talk to one another or fidget. Which types of incentives would be most motivating for these students? Which steps would you take to introduce these students to the concept of incentives in an effective manner?
2. Why might a fourth-grade student lack motivation for mathematics? (Name as many reasons as you can.) What could you do in response to each problem to help the student develop more motivation?
3. Imagine you are working with a gifted sixth grader. She is particularly capable in science, and you can see a bright future ahead for her. What could you do to help this student capitalize on her talent in this area?
4. You are leading a class of 14 second graders who are of mixed levels of ability. What types of goals would you want your students to define, and how would you help them do so?
5. Your class of fifth graders contains three students who suffer from severe test anxiety, which is inhibiting their performance on tests. How can you help these students approach tests more effectively and score more in line with their level of ability?

IN MIDDLE SCHOOL

1. Your class of seventh graders contains many students in the midst of puberty who are undergoing major developmental transitions. Which problems might this create for you, and which steps would you take to solve these problems?
2. You have recently been transferred from a fourth-grade class to an eighth-grade class. Previously, when working with the younger students, you had success while using extrinsic motivators. Do you think this situation will change? Will your new students respond similarly? What role will intrinsic motivators play with the older students?
3. You are teaching seventh grade in an inner-city area. You have found that your students do not seem to set goals for themselves. How can you demonstrate the value of goal setting to these students to convince them that it is worthwhile to do so?
4. Your eighth-grade math class contains two students who claim they just are not smart enough to do well in math. Which steps could you take to help these students?
5. Your seventh-grade students seem to have plenty of self-esteem, but they lack self-efficacy (the belief that they can accomplish what they wish). How can you build on their general positive feelings to help them develop more confidence in specific abilities—such as writing compositions or taking math tests?

IN HIGH SCHOOL

1. Your tenth-grade class writes essays that are deadly dull. You want to motivate these students to be more creative, but their other teachers tend to downplay the importance of creativity. How can you solve this problem?
2. Your ninth-grade class includes three students with learning disabilities who have substantial difficulties completing their mathematics assignments on time. These students already have extra tutoring in addition to your class. How can you help these students main-

tain their motivation to work through the obstacles they encounter?

3. You have recently begun teaching twelfth grade, and you are surprised by the large number of students with little or no school-related motivation in your classes. Your classes of ninth graders seemed far more motivated to do well in school. Why might this be happening with the older students, and what can you do about it?
4. Suppose your goal is to promote rapid changes of behavior in your tenth-grade students—you want them to study more this week and complete the next two assignments on time, for example. Which type of motivation (extrinsic versus intrinsic) should you attempt to instill if you are looking for quick results? How about the situation in which you are seeking longer-term changes in behavior—which approach would work best, and why?
5. Your ninth-grade students seem to be more motivated by the need for affiliation than by the need for achievement. Which problems do you foresee developing for these students? Which steps can you take to help these students develop more achievement orientation?

BUENOS

Classroom Management 11

CHAPTER OUTLINE

Why Understanding Classroom Management Is Important to Teachers

Changes in Our Society and in Our Schools

Goals of Classroom Management

How Effective Teachers Manage Their Students

A Pioneering Study of Classroom Managers

Additional Findings About Classroom Management

Developing and Implementing Rules and Procedures

The Role of Good Planning

Procedures and Rules

Responding to Broken Rules

Managing Students from Age 6 to Age 18: Age-Related Issues

Maintaining Control and Preventing Problems

The Importance of Good Communication

Responding to Student Misbehavior

General Behavioral Influence Techniques

Coping with Violence in School

Special Approaches to Classroom Management

Group Consequence Systems

Token Reinforcement Systems

Contingency Contract Systems

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this chapter:

- How can the science of educational psychology help teachers manage their classrooms? What practical, useful information can this textbook provide to a teacher for day-to-day teaching?
- How can good planning prevent classroom problems? Which is a more effective approach: planning to prevent problems before they occur, or dealing with problems when they actually occur? Should a teacher place primary emphasis on teaching first and management second, or vice versa?
- Which rules, regulations, policies, and procedures do expert teachers use to manage their classrooms? What is the appropriate role of rules and procedures in classroom management?
- Should a teacher's management goals and strategies vary, depending on the age of the students? What are the challenges of managing children with special needs, and how can a teacher meet these challenges?
- What are the characteristics of teachers who are especially effective at classroom management?
- How can effective communication strategies assist teachers to become good classroom managers?
- How can a teacher create a classroom environment that is orderly and appropriate for learning when students place little value on school and learning? How much order and discipline are necessary in a class containing bright, motivated, and successful students?

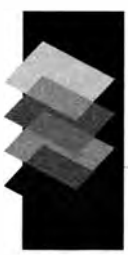
Charlie Grenda was thrilled. He had just been hired to teach social studies at a suburban middle school. Charlie was a new teacher, and when he arrived at the school to meet with the principal he was filled with positive anticipation. The principal, Shirley Walker, began by giving Charlie some words of advice. "Middle school students are at a difficult transition point in their development. Many teachers find that classroom management is their toughest challenge with these students. I know you have had good preparation about how to teach, but I hope you have also thought about how to manage your classroom and your students. The other teachers can provide an invaluable resource." Charlie grinned and said he recognized that he was new, but he believed he could handle anything these kids might challenge him with.

Shirley suggested a tour of the school, and Charlie appreciated the escort as he learned about his new work environment. As Shirley led him through the building, Charlie was surprised to find a remarkable degree of variety from class to class. The first class they observed was a sixth-grade science class taught by a seasoned veteran. The students were carrying out a laboratory assignment that involved using elaborate equipment and working in groups; the room was orderly and the students appeared engrossed in their lesson. A student who needed assistance walked to the front of the room and waited patiently and without interrupting as the teacher helped another student. Charlie was very impressed.

The next room Charlie and Shirley visited was an eighth-grade language arts class. Although the students were supposed to be listening to the teacher as she read aloud to them and discussed a poem, they were acting up. Several boys in the last three rows were talking and throwing wads of chewing gum at one another. Two girls were passing notes. Other students were doodling aimlessly in their notebooks. Charlie was amazed that the teacher just kept reading and talking as if nothing were wrong. "See what I mean?" Shirley asked. "It can be tough to maintain discipline with kids at this age—but it can be done. Let me show you another example of a teacher who is really in control."

The third room Shirley led Charlie to was a seventh-grade social studies class. This class was filled with students busily taking notes, raising their hands, listening to one another, and obviously showing respect for their teacher. Again, Charlie was struck by the differences he observed among the classes. He saw clearly that if he failed to establish appropriate control over his students, little that he tried to teach would matter. Charlie also recognized that he was not particularly well prepared for dealing with the ins and outs of classroom management, because his formal training had not stressed such skills. He knew that being able to see and appreciate the differences from one classroom to the next did not mean he was ready to handle the situations that were causing trouble in the less well-managed classrooms. Obviously, one of his most important goals as he began his teaching career would be to consider and implement positive techniques for classroom management.

Charlie has recognized how important it is for teachers to be able to manage their students to create an orderly classroom where everyone is ready and able to learn. While at college, he had worked diligently to prepare himself to be an effective teacher; as yet, however, he didn't have much practical know-how about how to manage a classroom full of students. **Classroom management** is a set of techniques and skills that allow a teacher to control students effectively so as to create a positive learning environment for all of them. This practical know-how can be learned from other experienced and effective teachers (Covino & Iwanicki, 1996; Evertson & Smithey, 2000); it can also be learned by reading about the techniques found through research to be useful in managing students (Midthassel & Bru, 2001).



Why Understanding Classroom Management Is Important to Teachers

His first day of teaching made clear to Charlie Grenda that he was not well prepared to effectively manage his students. Listen to a group of teachers talking about the problems they face at work, and you will find that at the heart of most of their

problems is the issue of classroom management (Kokkinos, Panayiotou, & Davazoglou, 2004; Martin & Baldwin, 1996). When students are disruptive and off-task, learning ceases. When students ignore rules and challenge their teacher's authority, learning again takes a backseat. When students fight with one another and create a hostile environment filled with fear and uneasiness, learning is the last thing on anyone's mind. How often do these events happen?

Unfortunately, the answer is "more often than they should" (Eisenbraun, 2007). Every year, a Gallup Poll is conducted to assess the public's perception of the biggest problems facing our schools. Every year, maintaining discipline is seen as a primary concern—with the list of potential problems in recent years being topped by the problems surrounding the use of drugs, which is itself another type of discipline problem (see, for example, Elam & Rose, 1995; Rose & Gallup, 2007). You are undoubtedly familiar with the term *discipline*. When used in the domain of classroom management, **discipline** refers specifically to teacher-initiated actions designed to minimize student behavior problems and distractions so as to create a maximally effective learning environment.

CHANGES IN OUR SOCIETY AND IN OUR SCHOOLS

Were schools always such undisciplined and seemingly unmanageable places? Have teachers historically had to fight such a tough battle every working day? The answer, as our parents and friends of generations past tell us, is no. For example, classrooms of the 1950s were more orderly than classrooms of today, and children in those classrooms were easier to manage (see Elam & Rose, 1995; Rose & Gallup, 2007). Lowell Rose and Stanley Elam summarized Gallup Polls from 1969 through 2007 regarding the quality of schools and the public's concerns about them. In the 1950s, top-ten teacher concerns were "gum chewing" and "littering." Today, teachers worry about "violence in school" and "drug use." How can we explain this major and significant shift in the types of behaviors characterizing students over the past half-century?

■ **CHANGES IN FAMILIES AND ATTITUDES** To understand what has happened in our schools, we must first understand what has changed in our society. Families today are different from families a generation or two ago, and children consequently grow up in different environments than in the past. Most households of today do not stress the same values that were seen as important 25 to 50 years ago. As a result, most of today's students differ from their counterparts in previous generations in important ways. Consider some illustrative statistics, drawn from the 2006 "Report Card on the Ethics of American Youth," an annual survey of 35,000 high school students across the nation conducted by the Josephson Institute. On the positive side, young people are almost unanimous in saying that ethics and character are important in people's personal and business lives—94 percent believe that trust and honesty are essential in business and the workplace, and 89% percent believe that being a good person in more important than being rich. However, today's high school students are also deeply cynical: 59 percent agree that "in the real world, successful people do what they have to do to win, even if others consider it cheating." Forty-two percent believe "a person has to lie or cheat sometimes in order to succeed," and 82 percent lied to their parent and 62 percent lied to their teacher about something significant within the past year. Sixty percent cheated on a test at school, 23 percent stole from a parent or relative, 19 percent stole from a friend, and 28 percent stole from a store.

The change in the American family has also played an important role in the attitudes of today's youth. The United States leads all other developed nations in rates of single parenthood and divorce; more and more children are being raised by one never-married parent. Twenty-two percent of students from two-parent households achieve grade-point averages of A, whereas only 16 percent of students from mother-headed households, and 14 percent of students from father-headed households and households headed by other adults, do so.

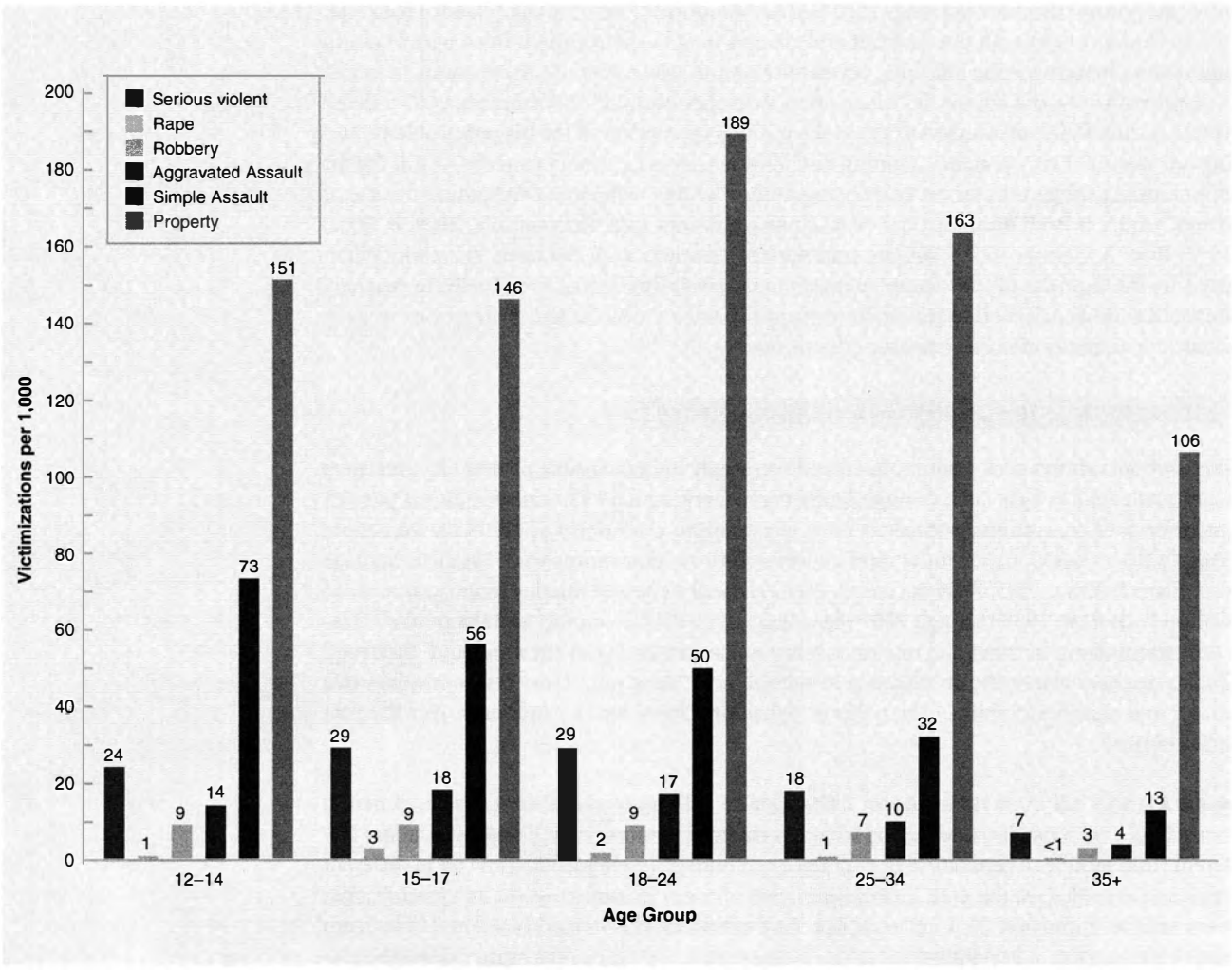
■ **INCREASE IN VIOLENCE** Consider also the data on violence in schools and students' out-of-school lives. In 2003, 15 young people ages 10 to 24 were murdered every day; 82 percent of these individuals were killed with firearms. Of the 5,570 homicides reported in 2003

THINKING ANALYTICALLY

Name three ways in which the students of today may be easier to manage than the students of a half century ago.

SUGGESTION: Today's students may be more independent because they spend more time alone, away from parents; they may be more mature at a younger age because of the effects of growing up in our society; and they may be more goal oriented and concerned about the future, given the pressures of modern life and its frequent emphasis on preparation for the future. Of course, they are also more technologically sophisticated.

FIGURE 11.1 Youth Are More Likely Than Adults to Be Victims of Violent Crime



Source: Adapted from H. Snyder & M. Sickmund, *Juvenile Offenders and Victims: 1999 National Report* (p. 26). Washington, DC: Office of Juvenile Justice and Delinquency Prevention, 1999.

among 10–24 year olds, 86 percent were males and 14% females (Centers for Disease Control, 2005). But school-associated violent deaths represented less than 1 percent of homicides among school-age children (Anderson et al, 2001). A nationwide survey of high school students conducted by the Centers for Disease Control in 2004 found that 33 percent reported being in a physical fight one or more times in the past year; 17 percent reported carrying a weapon; and 6% reported not going to school on 1 or more days in the past month because they felt unsafe traveling to school or at school. Furthermore, 30 percent of third to tenth graders in the U.S. were involved in bullying—either as the aggressor or person being bullied—in the preceding year (Nansel et al., 2001). In general, school violence is most likely in schools located in high-crime areas, in large schools with large classes, in schools containing a high percentage of male students, and in schools with weak administrators (Baker, 1985).

Snyder and Sickmund (2006) compiled a more recent report describing trends in rates of crime by juveniles. They found that the rate of juvenile violent crime arrests has consistently decreased since 1994, in recent years falling to a level not seen since the 1970s. During this same period, the rate of female juvenile crime increased, meaning that relatively more girls are committing crimes. Juvenile violent crime was found to occur mostly during afterschool hours.

In summary, since the 1960s, school crime and violence have become major concerns for teachers, administrators, parents, and our society as a whole (Eisenbraun, 2007; Hoffman, 1996). While the recent downward trend in crime involving young people is certainly encouraging, the rate of juvenile crime remains a concerning issue throughout our society.

Given these facts and figures, it is understandable that today's teachers report classroom management to be their major concern and responsibility (Long, Biggs, & Hinson, 1999). We can sympathize with teachers who become exhausted and decide to go easy on discipline, as long as the students are not harming one another or damaging the classroom. Furthermore, teachers often must reconcile conflicting pieces of advice from fellow teachers, administrators, and even parents, each of whom has a different approach and solution to the teacher's daily problems. In this chapter, we review what is known about effective classroom management, with the goal of helping you develop and hone a collection of insights and strategies you can use in your own teaching to make your classrooms as open to learning as possible.

GOALS OF CLASSROOM MANAGEMENT

What are the specific goals of classroom management? The first goal is to create an environment that maximizes student learning. Good management techniques will, in turn, lead to enhanced learning. Management techniques that lead only to quieter classrooms and classrooms with fewer student questions, however, do not necessarily result in more learning. The students may have been managed into being quiet and orderly, but their docile behavior may not be in the service of learning. Thus teachers must ask themselves whether their management techniques are, in fact, contributing to a positive atmosphere of learning.

One study (Bru, Stephens, & Torsheim, 2002; see also Bru, 2006) looked at students' perceptions of class management, and the relationship between teachers' management styles and students' misbehaviors. In general, misbehavior was somewhat but not highly related to the type of management a class experiences. Individual students tend to be either compliant or not so compliant (a fact teachers know all too well). How well teachers adapt their management style to individual students' needs was important in this study. Perceived emotional support from teachers on the part of students was most closely related to positive student behavior. The moral of this story is that some students will certainly challenge you more than others, and may do so repeatedly, but effective teaching that adapts management to the needs of students will bring nearly all students' behaviors more in line with expectations.

■ **ALLOCATED VERSUS ENGAGED TIME** One key way for you as a teacher to assess the outcome of classroom management techniques is to evaluate how much time students really have for learning. **Allocated time** is the time you earmark and plan to use for learning. **Engaged time** is the time that students actually spend on learning. A surprising study showed that students are engaged in meaningful academic learning for only one-third of the total instructional hours they are mandated to receive, which translates to approximately 333 hours of quality learning time per student per year (Weinstein & Mignano, 1993). Three hundred hours divided by 187 school days equals about 90 minutes per day of actual quality learning time. Studies that have examined the relationship between students' opportunity to learn and time spent on learning have found the amount of content covered by the teacher predicts, to some degree, the amount students learned (Berliner, 1988, 1990). Better-managed students yield more time for teachers to spend on content, which in turn yields greater student learning.

Thus a well-managed classroom means more quality learning time, and more quality learning time means more actual learning can take place. Keeping track of the amount of time students spend in quality learning is one way that teachers can evaluate the success of their management techniques. Of course, the emphasis must be on quality learning—time in and of itself will not translate to greater learning if this time is not well spent. Teachers can increase quality learning time in the following ways:

- By minimizing downtime between activities and tasks
- By being well prepared and highly organized
- By effectively disciplining troublemakers
- By maintaining order and control in the classroom

THINKING PRACTICALLY

Describe three additional ways a high school teacher could increase the amount of quality time her students spend in learning activities over the course of a normal school day.

SUGGESTION: The teacher can make sure that tasks are well matched to students' levels of competence—not too easy and not too difficult; create incentives and rewards for students who remain on-task longer; and make examples of students who spend more of their time on quality learning versus other activities.

THINKING CREATIVELY

How might a teacher convince his students that managing their own learning is a key to real-world success?

SUGGESTION: By bringing in stories of role models—successful people who attribute their achievements to good self-management; by demonstrating to students that they do better on a quiz following deliberate work at self-management, compared with a quiz taken without such preparation.

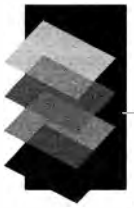
■ **PROMOTING SELF-MANAGEMENT** Two other important goals of classroom management include these:

- To help students gain in maturity so they learn how to manage themselves
- To show students how to internalize rules and procedures that enhance learning

As we discussed in Chapter 7 on behavioral approaches to learning, self-management is the control people maintain over their own learning. By helping students develop their ability to understand, control, and evaluate their own learning, teachers help students mature into lifelong learners. Of course, the same skills are highly valuable for teachers as well (Kremer & Tillema, 1999; Tillema, 2000; Tillema & Kremer-Hayon, 2002). A key part of reaching the goal of helping students mature is knowing how to put the focus on developing a sense of responsibility for their own learning. Developing obedience and conformity for their own sake will not do the job. It may take extra time to explain to students how and why they should take responsibility for their own learning, but in the long run students who manage themselves are easier to teach and better equipped for life. The more mature students become, the better they can manage themselves effectively. The principles of cognitive development discussed in Chapter 2 are relevant to teachers as they undertake this endeavor, as they must tailor their expectations to students' cognitive capacity and developmental age (Bergin & Bergin, 1999; Curwin, 2003).

*i*MPLICATIONS FOR TEACHING

- **Encourage students to reflect about their behaviors and school performance.** To encourage self-reflection and analysis, frequently question students about what they are doing and why.
- **Recognize and reward meaningful effort.** Give verbal reinforcement and praise for students' positive attempts at self-management.
- **Make an example of successful students' techniques.** Have students describe good techniques to the class. Review case studies of famous children—and adults—who used successful self-management strategies. Gather relevant material from news stories and biographies and ask friends for examples.
- **Provided students are succeeding, allow diversity in methods of self-management.** Do not expect all students to conform to the same strategies.
- **Model good self-management techniques.** Talk about how to use these techniques and explain the benefits that come from using them. Assign students to interview successful adults to learn their self-management strategies; have students prepare papers or projects and present them to the class on this theme.



How Effective Teachers Manage Their Students

An obvious first step in being a good classroom manager is to conduct well-planned and carefully thought-out instruction. The right lessons—ones that intrigue and challenge students—will help keep students on-task. Teachers' supervision and active leading of lessons also encourage student engagement. When students know what is expected of them and have the necessary materials and resources available to complete their tasks, their time spent on-task will increase. All these factors are aspects of good instruction, which is the topic of Chapter 12.

Charlie Grenda knew how to plan effective instruction; nevertheless, he still found he was not equipped to manage his students. What about the issue of good classroom management independent of what is being taught? What is known about the characteristics of good classroom managers in general—regardless of exactly what they are teaching (Emmer & Stough, 2003; Emmer & Gerwels, 2005; Long et al., 1999)?

A PIONEERING STUDY OF CLASSROOM MANAGERS

What are the basics of being a good classroom manager? One of the first researchers to study this question was Jacob Kounin (1970), who conducted a series of pioneering studies examining student reactions to various methods of teacher control. The key classroom management skills and behaviors Kounin uncovered are as useful today as they were in 1970. What are these key behaviors underlying expertise in classroom management?

■ **"WITH-IT-NESS"** According to Kounin, **with-it-ness** means that teachers are observant and attentive to everything going on around the teacher in the classroom. Teachers who show they are with it have fewer discipline problems than do teachers who are unaware of or do not react to what is going on. Effective teachers respond immediately to the very suggestion of a discipline problem. Less effective teachers either may not notice the potential discipline problem or may not respond to the incipient problem once they do notice it, in the hope that it will disappear on its own.

Teachers can become more with it by monitoring the entire classroom every minute for signs of disruption or other problems, and by making frequent eye contact with students and calling them by name to show they are fully aware of what each student is doing. When multiple problems arise, with-it teachers always deal with the more serious problems first. You can increase your with-it-ness by making maximal use of your voice, eyes, and body language to remain simultaneously in contact with different students. In addition, aim to be aware of students' outside-of-class activities and interests, so as to have more common ground with them and to encourage students to see you as up-to-date on their lives. With-it teachers use the techniques for student management described throughout this chapter to keep students under control.

THINKING PRACTICALLY

Which additional steps can a teacher take to become more with it more often?

SUGGESTION: Participate in a youth group or youth organization outside of school; get plenty of rest and exercise to increase alertness; make an effort not to criticize youthful styles of clothing and music that the students enjoy.

■ **COPING SIMULTANEOUSLY WITH NUMEROUS SITUATIONS** Some people prefer to focus on just one thing at a time. This preference can be an asset if the person's occupation requires intense concentration in a solitary environment. For a teacher, however, this preference can be a major problem. Expert classroom managers must do several things at once:

- They must be aware of what's going on all around them (with-it-ness).
- They must be leading a lesson.
- They must be monitoring which students are comprehending the lesson and which students are getting lost.
- They must know how much time is left before the lunch bell rings.
- They must even know that the open window in the back of the room is distracting a student who is sitting in front of it.

Overlapping is supervising several activities at once: A teacher might find herself checking on the work of one group of students while simultaneously disciplining a student from another group. On top of everything else, she might be watching the clock and timing what's going on in the classroom. Managing such overlapped activities can be quite demanding.

The teaching profession is a good match for people who are able and willing to cope with a lot of things going on all at once. If you are not one of these people, and if you are committed to a career in teaching, you can develop the skill to deal with numerous simultaneous events. The key is deliberate practice (Ericsson, 1996a, 1996b, 2000/2001, 2005): Expert teachers are not simply *born*—they are *made*, through hard work and practice. A good

Even the most expert of teachers is often barraged by the multiple demands of students.

Scott Cunningham/Merrill

THINKING CREATIVELY

Devise a creative plan for improving your ability to deal with several things at once.

SUGGESTION: Turn on both a radio or television talk show and listen while also doing another task, such as reading or revising a paper, or talking on the telephone. Then assess your comprehension of the paper or of your conversation.

way to develop this skill is to practice it during your student teaching assignment or to work in another environment that requires coping with simultaneous events (for example, being a food server in a restaurant, or working in a store or other environment in which you are expected to deal with a lot of information at once).

An expert teacher working with one group of children on their science projects simultaneously monitors all the other children in the room, ensuring that they, too, are working on their science projects. Despite a normal low-level drone of discussion, all students should be actively engaged in the task. If a disagreement between two troublesome students breaks out across the room, the expert classroom manager spots it immediately and verbally admonishes the students. If words are not enough, the teacher might quickly walk over and stop the behavior—but first she tells the group of students she is working with to continue doing whatever they are doing. The mistake a novice teacher might make is to stop her work with the student group in midstream after the shouts from across the room have interrupted the work of all students and have brought the problem to the teacher's attention.

■ **CREATING MOMENTUM AND ENSURING SMOOTH TRANSITIONS** Less effective teachers often interrupt one activity or discussion to present something else, to admonish a student, or to redirect student behavior. These interruptions disrupt the natural flow of student behavior. Another mistake often made by less effective teachers is to follow their lesson plan relentlessly, without regard to the state of mind of their students. These teachers spend on each step precisely the amount of time they planned to spend, regardless of whether the students already know the material and are bored, or are lost and are absorbing nothing. Less effective teachers may also have trouble distinguishing the important from the trivial, such that they bore their students and lose their attention.

THINKING ANALYTICALLY

Name three ways a teacher can tell if he is switching too frequently from one activity to the next.

SUGGESTION: If students act nervous or disoriented and lose track of what is happening; if the teacher feels overly stressed; if students keep asking off-point questions, showing they do not understand the topic of instruction.

In general, interruptions in the classroom detract from meaningful learning. Interruptions pull students off-task, and many students may have trouble getting engaged again. They may even give up on the task and resort to less productive behaviors, such as spitball fights and note passing. Even as adults, an interruption (such as a telephone call) can pry a person loose from a task, making it hard to get engaged in the task again. Of course, the challenge of maintaining and reestablishing concentration is far greater for schoolchildren.

Expert classroom managers spend as much uninterrupted time on an activity as needed before switching children to another activity. They maintain an awareness of student interest and comprehension levels, and they tailor their instruction to fit student strengths and limitations. For example, if usually attentive students are daydreaming, doodling, or passing notes, the expert teacher interprets these signs as indicating that the lesson has dragged on too long, failed to hold students' attention, or exceeded the students' comprehension level. Expert classroom managers plan their instruction ahead of time, but they also tailor their plans to students' reactions. For example, an expert teacher might make use of a particularly good student response to a lesson by extending the lesson for an extra half-hour, either on the same day or on the next day, if the students change classes at a specified time.

Expert teachers also keep unnecessary activity changes and interruptions to a minimum. When something happens that requires the teacher to divert her attention, the teacher gives the students an activity to keep them busy ("Do three problems in your workbook now") while she seamlessly attends to the other issue ("Carlos, open your book. Steve, move to the other side of the room now, please."). When a classroom is being managed smoothly and seamlessly, the teacher and the students (as well as any observers) can feel the classroom working and can see the positive results. Table 11.1 summarizes the techniques used by expert teachers to manage their classrooms.

■ **INVOLVING EVERY STUDENT** Even if expert teachers are helping an individual pupil or responding to a question, they remain attentive to other students' needs. One way teachers can succeed at involving every student is to call on students using a somewhat unpredictable order. If a teacher always calls on students in the same order, those students who know their turn is far in the future may drift off or, even worse, become disruptive. If a teacher surprises students by calling on them at random, she will hold their attention because they will be uncertain when their turn will come.

TABLE 11.1 Techniques of Expert Classroom Managers

Demonstrate "With-it-ness"	Manage Overlapping	Create Momentum and Ensure Smooth Transitions
Be observant and attentive to everything going on around you in the classroom.	Supervise several activities at once.	Create and maintain excitement and interest; move seamlessly from one activity to the next.
Examples: "Amaya, keep your hands on your own desk. Jacob, I will help you in a moment. Claire, trace your letters from the workbook please. Luis, stop humming."	Examples: "Laura and Annie, please carry the diorama back to the windowsill. Marco, pick up your charcoal pencil with your thumb and first fing smooth line. Haijun, try a Google search for Komono dragon at the workstation."	Examples: "In science this week, we have been studying different species of reptiles from around the world. Let's try drawing the habitats of our favorite reptiles in art class today. I will print out photos from the Web to help us."

A mistake made by some teachers, particularly when teaching elementary and middle school students, is to engage a single child in a lengthy interaction, allowing other students to tune out the lesson. High school students who place an emphasis on school achievement may be less apt to drift off when another classmate is being queried. However, high school students not committed to doing well in school may be just as apt to tune out as first graders when the teacher does not include them directly in the lesson

Which specific techniques can you use to keep every student involved in classroom activities? In general, successful management techniques encourage all students to share in the responsibility for learning, foster participation by all students, and keep students alert and guessing when their turn will come.

Consider a few examples of effective techniques.

- Expert classroom managers engage the entire class in a problem being completed on the board by one student by asking all students to complete the problem in their notebooks.
- They break up material into parts and ask several different students to answer related questions about the material.
- Effective teachers call on several students in a row, using a random order to select students, and get all students to provide answers to the same open-ended problem. They ask a question first and then call on an individual student for an answer. In this way they send the message that all students need to listen in case they are called on.
- Expert classroom managers ask questions in a way that allows all students to display their answers. For example, a teacher might pose a question and say, "All those who disagree with this statement, raise one hand; all those who agree, raise both hands." (Next, the teacher might ask students why they agree or disagree.) Or a teacher might ask all students to complete a problem in their workbooks and to raise their hands as soon as they have answers—with one finger showing for choice A, two fingers showing for choice B, and so on. These methods encourage vigilance by a student who might otherwise have daydreamed instead of doing the problem.

THINKING CREATIVELY

How might a teacher ensure that she is involving all her students in a lesson? Describe two methods not mentioned in the text.

SUGGESTION: Surprise quizzes, either graded by students or teachers and either counted toward the class grade or not; confide sheets distributed to students on which students can indicate their level of involvement and satisfaction with instruction.

■ **GENERATING ENTHUSIASM AND KEEPING LESSONS INTERESTING** Teachers generate enthusiasm and excitement when they use a variety of approaches and presentation styles. We have all met teachers who made it clear that they were excited and interested by their work. Their enthusiastic attitude is usually contagious. Unfortunately, some other teachers act bored by following the same monotonous procedures every day. When teachers are monotonous, students tune out.

Not surprisingly, expert management requires maintaining students' interest levels. Enthusiastic teaching leads not only to better instruction, but also to fewer behavior problems in the classroom. As we discussed in Chapter 7 on behavioral approaches to learning,

THINKING PRACTICALLY

How might a teacher improve her level of enthusiasm on a day when she is feeling overwhelmed by the demands of her job?

SUGGESTION: Take a few minutes alone to unwind, and focus on examples of other people with far more stressful jobs or life experiences.

R. Sidney/The Image Works

A sixth-grade science teacher holds the rapt attention of her students as she uses simple colorful balloons and blocks to demonstrate Newton's third law of motion.

a teacher's appropriate use of praise and encouragement is also essential in maintaining a positive atmosphere of control in the classroom.

Teachers can maintain interest levels only within the limits of students' attention spans. Holding students' attention is in part a function of adept teaching, but limitations are imposed by students' developmental age. Younger children do not have the same attention spans as older children. It is rare for a young child to be willing or able to concentrate for a long period of time on any one thing.

Because children's needs are different at different ages, techniques for effective classroom management likewise differ for students of different ages. An elementary school teacher must watch for short attention spans and have new activities or appropriate distractions ready if children lose interest in a task. This loss of interest can occur in as little as ten minutes. The attention spans of middle school children are somewhat longer, but these students still do not have the same attention span as a high school student or an adult. By high school, a teacher can expect motivated students to have attention spans comparable to their own. Regardless of the age of the student, expert teachers remember that attention span is not a fixed quantity; rather, it varies with the type of material and the way this material is presented, and it also reflects what is going on in the student's life.

In general, expert classroom management of elementary school children requires the use of a variety of activities and teaching methods, because these children cannot be expected to remain on one task or engaged in one activity for very long. Teachers of more advanced students find that the variety appreciated by younger students might be perceived as disruptive once students' attention spans have developed and lengthened. A knowledge of cognitive development (see Chapter 2) is helpful to a teacher in deciding what she can expect from her students and in choosing which methods will best keep them excited about learning.

■ **CRITICIZING STUDENTS CONSTRUCTIVELY** Knowing how to give constructive criticism is essential for effective classroom management. Constructive criticism is specific and clear, and it focuses on inappropriate behaviors rather than on the person performing the behavior. For example, a teacher might say, "When you turn in a paper with misspellings, it makes it difficult for me to concentrate on your ideas," or "When you talk while I am lecturing, it distracts the other students and interferes with learning." Constructive criticism is also free of anger, yelling, shouting, sarcasm, or intentional mean-spiritedness. Students can sometimes try a teacher's patience, but expert classroom managers do not give in to their anger, and they never allow themselves to be controlled by it.

Constructive criticism is effective for more people than just the student to whom the criticism is directed: Other students who observe the misbehavior or outburst, and then observe the teacher's reaction to it, are also influenced positively by an atmosphere in which criticism is delivered constructively. Conversely, a teacher who loses her temper and yells at a student delivers a negative message to every other student who sees or hears about the incident.

How do expert classroom managers respond to misbehavior? Kounin (1970) identified several techniques that work (summarized in Table 11.2):

- State the name of the student who is misbehaving and clearly describe the undesirable behavior. Focus on the behavior and not on the person. In other words, state what was done that was unacceptable, rather than stating that the student himself or herself is unworthy, stupid, or incompetent.
- Provide a reason why the behavior was undesirable.
- Describe the desirable behavior that should replace the undesirable one.
- Be firm and in charge, and do not act in an overtly angry or threatening manner.

TABLE 11.2 More Techniques of Expert Classroom Managers

Involve Every Student	Generate Enthusiasm and Keep Lessons Interesting	Criticize Students Constructively
Examples: "James, Toni, please come up to the board and write the answer to the following question. Class, please write the answer on your worksheet. I will walk around and read your answers in one minute."	Examples: "Everyone learned so much when we discussed the discovery of DNA yesterday. Today I brought in stories about people who have learned from analysis of their DNA that they had serious diseases. Let's discuss these stories and consider some of the good and bad aspects of knowing about our own DNA and what it predicts about our future."	Be specific and clear. Focus on behaviors, not people. Examples: "Kami, when you speak without being called on, it means other students do not get their turn. This is not fair to the others. Please raise your hand and wait to be called on. I appreciate your help. Don't worry—I'll get to you, I promise!"

ADDITIONAL FINDINGS ABOUT CLASSROOM MANAGEMENT

Since the work of Kounin was published, other researchers have also studied how expert teachers manage their classrooms (see, for example, Brophy, 1979; Good, 1983a, 1983b; Good & Brophy, 1994). These studies have shown that well-managed classrooms share the following characteristics:

- Students who are actively engaged in lessons being led by their teacher
- Students who know exactly what is expected of them in the classroom
- Students who have feelings of self-efficacy regarding their schoolwork—that is, they believe they are capable of accomplishing it
- Absence of interruptions, confusion, and wasted time
- A balanced atmosphere in which academic work is stressed
- Moderation of discipline and control so that students are not making more of an effort to keep quiet than to learn

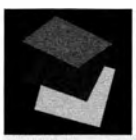
Well-managed classrooms are a direct result of teachers' effective use of the management techniques such as the ones just described.

Educational psychologists at the University of Texas at Austin have conducted numerous studies of classroom management (e.g., Emmer, Evertson, Sanford, Clements, & Worsham,

THINKING ANALYTICALLY

In your view, what are the greatest classroom management challenges (1) at the elementary level and (2) at the secondary level?

SUGGESTION: Challenges at the elementary level: neglected children who are tired, hungry, or ill equipped for school; children who have no idea what to expect from school and no idea what is expected of them. Challenges at the secondary level: sexual development leading to inappropriate behavior and attention; violence due to a sense of not belonging; students who become tuned out and less involved with school.



THE FLEXIBLE EXPERT

TEACHING AND LEARNING ABOUT CLASSROOM MANAGEMENT

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Well in advance of the first day of school, Rita thinks carefully about the likely effects of the rules and procedures she will put into place.

THE CREATIVE TEACHER: Rita asks her students to draw comics and cartoons that show the consequences for students who break the rules—then, as a reminder, she displays this artwork prominently in the classroom.

THE PRACTICAL TEACHER: Rita asks misbehaving students to put themselves in the positions of their classmates and to give her three good reasons why they should change their disruptive behavior.

THE ANALYTICAL STUDENT: Lance keeps himself on-task by reminding himself of the extra points and privileges he will earn by behaving well.

THE CREATIVE STUDENT: Lance writes a report in which he describes ten ways for non–English-speaking students to become integrated into the classroom more quickly.

THE PRACTICAL STUDENT: As a part of an extra assignment, Lance meets with his friends and develops a list for his teacher of potential ways to improve the classroom's learning environment.

TABLE 11.3 A Plan to Ready Yourself for Your First Day of Teaching

- Have realistic expectations. Review these expectations, especially those for day 1, with seasoned teachers.
- Find a mentor to help you right from the start—from the same or another school.
- Line up your friends and ask for their support; clean your house; and assume you will not have a minute of spare time for at least a month.
- Be overprepared; start off the year on a positive note, and expect the unexpected. Anticipate what might go wrong and develop a list of three strategies to deal with each problem.
- Bring well-thought-out lesson plans for each class, plus backup plans in case the primary plans fail.
- Develop a list of rules and procedures based on your own expectations and your school's normal policies and procedures, and present this list to your classes on the first day.
- Expect to have some unreasonable colleagues, and prepare for some unpleasant surprises on the job.
- Expect to be exhausted, frustrated, and overworked.
- Expect to be tested and evaluated by your students, who often can quickly detect your novice status.
- Expect difficult parents to challenge you on your decisions regarding their children.
- Maintain a sense of humor and recognize that every new teacher feels almost overwhelmed at fi

1997; Emmer & Gerwels, 2002; Emmer & Stough, 2001; Evertson, 1988, 1989; Evertson, Emmer, Clements, & Worsham, 1997; Evertson & Neal, 2006; Evertson & Smithey, 2000; Evertson & Weinstein, 2006). These researchers observed a large number of classrooms. The most and least effective classroom managers were identified by looking at the quality of classroom management as well as at student achievement in the classes. After observing the techniques of the more effective teachers, the researchers taught the techniques of the effective teachers to a new group of teachers. When these new teachers used the recommended techniques, they found they had fewer behavior problems in their classes. Their students were less disruptive, spent more time on task, and had higher achievement.

Studies of student management in the elementary school (Evertson et al., 1997) and in the secondary school (Emmer et al., 1997) have provided substantial details about the best ways to manage students. Although there are some differences between the management techniques that work best for elementary school students and those that work best for secondary school students, many general principles apply to students of all ages.

First, expert classroom managers are well prepared for the first day of class; they have developed ahead of time a set of rules and procedures, which they explain to students on the first day of class. Second, for the first few weeks of a new school year, effective teachers work with the entire class at once. In other words, they avoid activities that separate students into small groups, so in the opening weeks all students feel included in the instruction. Once the school year is well under way, the best classroom managers continue to give students clear directions, regardless of the specific activity, and maintain the standards represented by the rules and procedures already announced. They also provide students with regular feedback on their performance. Table 11.3 offers guidelines to prepare you for your first day of teaching.

*i*MPLICATIONS FOR TEACHING

- **Show students you are "with it."** Pay attention to everything going on in the classroom, maintain control of events, and promptly correct misbehaviors. Teachers seen by students as out of touch with what is going on in the classroom lose the respect of their students, and with it the ability to manage students effectively.
- **Learn how to supervise numerous activities at once.** This skill can be honed through practice. Teachers cannot afford to be good at doing only one thing at a time; they must be able to do several things at once without becoming flustered. This is one of the main reasons why teaching is such a demanding profession.
- **Establish and preserve a natural flow of student activities.** Generate momentum, enthusiasm, excitement, and interest and ensure smooth transitions from one activity to the next. Teachers who "go with the flow" and maintain high energy stay more closely attuned to classroom rhythms.

- **Involve every student in classroom activities and schoolwork.** Resist the tendency to call on the same students every time, even if it is easier than probing the more reluctant ones.
- **Criticize students constructively to help them improve.** Provide specific suggestions for improvement, not simply warnings to "do better next time." Avoid statements about ability and focus instead on effort: "You must work harder to memorize your vocabulary lists—learning new words takes time and effort."

Developing and Implementing Rules and Procedures

A good recipe is important, but it does not always mean a good outcome when you are baking a cake. Similarly, a good plan for running a classroom is important, but it does not automatically translate into an orderly and attentive group of students. Developing and implementing management plans can be challenging. As Charlie Grenda learned, much to his chagrin, formal course work does not always prepare a teacher for the challenges of real-life classroom management. What are the issues, factors, and concerns to take into account when you are developing and implementing rules and procedures for managing the classroom?

THE ROLE OF GOOD PLANNING

Given the omnipresent need for teachers to manage their classrooms effectively and efficiently in an era that would try any teacher's patience, the role of good planning has become increasingly important. Effective teachers use good planning to prevent classroom management problems from developing: By far the best way to handle classroom problems is to prevent them from happening in the first place. The effort involved in planning is always less substantial than the effort required to repair the damage done by lack of planning in the classroom.

Consider an example shared by a model teacher: Nancy noted that, in her early years of teaching, she was always a bit unprepared on the first day of school. In fact, the first few weeks found her always running to catch up. When her students filed in the first day, Nancy would be a bit nervous and would sit passively and wait until all of the students had stopped talking, taken seats, and settled down before announcing her name and describing the goals of her class. The message to the students was clear: Their teacher was nice, a bit disorganized, and not completely in charge. The students acted accordingly, and over the subsequent months Nancy had problems asserting her authority.

Today, Nancy reports that she learned the hard way that time spent in organizing and preparing for the first day of class is time well spent. Today, when a new group of students enters her class on the first day of school, she greets them individually and firmly directs them to take assigned seats (which they locate by looking at a chart with their names on it in front of the room). There is an assignment already handed out to them on their desks that they are expected to start immediately. When Nancy addresses the class, she speaks in a commanding voice and makes clear her expectations and the class rules and procedures. Her classrooms today are orderly and well managed.

■ **RESEARCH ON EFFECTIVE PLANNING** Research has borne out Nancy's observation about the importance of planning to prevent management problems (Kounin, 1970). Kounin found that expert and nonexpert teachers did not differ much in their methods for handling student misbehavior. What *did* distinguish these two types of teachers was the expert teachers' use of strategies to prevent classroom disruptions from happening—in other words, good planning. But where do good plans come from? Which management factors should you take into consideration while drafting rules and procedures (Kokkinos et al., 2005)?

In preparing effective plans, consider the developmental age and maturity level of the students. Plans and procedures that work well with fourth graders might be perceived as insulting by eleventh graders. Plans and procedures that are within the grasp of sixth graders might not be understandable by first graders. Earlier chapters in this book discussed cognitive, social, and moral development of children. In those chapters, you learned that children's ways of understanding the world around them change and mature as their cognitive capacity and reasoning ability develop. Expert teachers take such considerations into account when creating workable classroom management systems.

■ MANAGING PRIMARY VERSUS SECONDARY SCHOOL CLASSROOMS

Although the techniques for effective classroom management covered i n this chapter apply to all teaching situations, the secondary school classroom is a different kind of environment from the grade school classroom.

Let us first consider the routine that students follow in primary versus secondary school, and the implications for their teachers. The elementary school teacher typically has just one class of, say, 15, 20, or even 30 students. This teacher will be responsible for teaching every or nearly every subject (although other teachers may handle special aspects of the curriculum such as music or art). By comparison, the secondary school teacher typically teaches five different classes per day, each one containing at least 20 or 30 students. The secondary school teacher must remember the names and characteristics of at least 150 students and consequently has less detailed knowledge of any particular student than does the elementary school teacher.

THINKING CREATIVELY

We have discussed the differences between teaching elementary school and secondary school students. Now describe how the two kinds of teaching are similar.

SUGGESTION: Teachers must understand the age of students they teach and must prepare material that is appropriate.

The secondary school teacher is more likely to see a wide range of discipline problems and has only a limited amount of time each day with each student in which to deal with these problems. A difficult fourth-grade girl has one teacher all day, and this teacher will be more likely to develop effective ways to control the girl than would her five different teachers in eighth grade, each of whom has exposure to the girl for only 50 minutes a day. An additional challenge faced by secondary teachers is that they have only the 40- to 50-minute class period in which both to seize the students' attention and to provide instruction. Given these time constraints, disciplinary problems can be extremely upsetting to the secondary teacher's agenda. For all of these reasons, secondary teachers—even more than elementary teachers—must focus on preventing misbehavior from even developing in the first place.

The book *Classroom Management for Secondary Teachers* (Emmer et al., 1997) provides guidance for how secondary teachers can accomplish their goals in this challenging environment. For starters, Emmer and colleagues suggest paying careful attention to the physical environment of the classroom. Plan the layout of the furniture and the positioning of resources to facilitate instruction and learning. Organize the classroom so high-traffic areas are kept free of congestion and teaching materials and supplies are found within easy reach. Set up the room so you can see all the students and keep track of what they are doing, and so the students can see you and all displays, presentations, and visual aids.

Emmer and colleagues found that secondary students often misbehaved because they did not clearly understand rules and procedures. For this reason, it is a good idea to emphasize rules and procedures at the start of the term and post them in a prominent place. High school students may also be given a handout listing the rules. Secondary students, even more than elementary students, may be more compliant with rules when they have been involved in establishing them. Note that there are pitfalls to this approach, however: Several teachers who teach the same subject may have very different rules because of student participation in rule setting. Even in smaller schools, it can be confusing and potentially unfair to students when some teachers have far more restrictive rules and procedures than other teachers. Thus, as a secondary school teacher, you should remain aware of your students' contacts with other teachers and check with other teachers and school administrators about their rules and guidelines.

Secondary classes sometimes require more elaborate procedures than do elementary school classrooms. Effective procedures make it possible for you to accomplish your goals within the time constraints of a 40- to 50-minute class period. For example, secondary teachers need effective procedures for getting the students into their seats, ready to work, and on time for class; for collecting and distributing assignment sheets, homework, and tests; for sharing materials and equipment; for handling in-class presentations and small-group work; and for monitoring

classroom discussion. The secondary school environment can sometimes be less tolerant of poor teaching because of its greater regimentation and because of the greater demands of controlling adolescents. At the same time, elementary school teachers must also be highly organized because they do not have timed class periods to impose external organization on them. Elementary teachers must ensure that students complete many different activities within unstructured blocks of time.

THINKING PRACTICALLY

Which type of school environment might make a teacher more likely to use restrictive rules and procedures?

SUGGESTION: A relatively unsafe or potentially violent school environment; an uncontrolled environment; or an environment in which the administration and other teachers strongly encourage and support restrictive rules and procedures.

■ **THE SCHOOL** In preparing effective plans, also consider the general environment of the school. The word *environment* in this context has several meanings. Some schools have a generally permissive environment in which the norm is few rules and restrictions. Other schools resemble army training camps, and discipline is the word of the day, every day. You may believe the best way to reach students is with a relaxed and autonomy-oriented rule system; however, if the school has a rigidly controlled environment, you may not succeed with such a system. The principal, other administrators, or other teachers may protest what they see as lax management of your classroom. For the students, the contrast of a tight rule-bound environment in all classrooms except one may be confusing. Thus you should create rules that are consistent with your overall school environment. Alternatively, you can work to influence and change the school environment as you see fit.

Another aspect of the school environment relevant to your planning has to do with the physical characteristics of the school. Some schools are spacious and have few students; others are tiny and crowded. Some schools have computers and laboratory equipment for all students; others have little equipment and few supplies—or even none. In addition, the physical layout of classrooms can work to make your job either easier or more difficult. Work within these physical realities when developing the rules and procedures for your classes (see Figure 11.2).

FIGURE 11.2a An Elementary Classroom Arrangement

This fourth-grade teacher has designed a space that allows teacher presentations and demonstrations, small-group work, computer interactions, math manipulatives activities, informal reading, art, and other projects without requiring constant rearrangements.

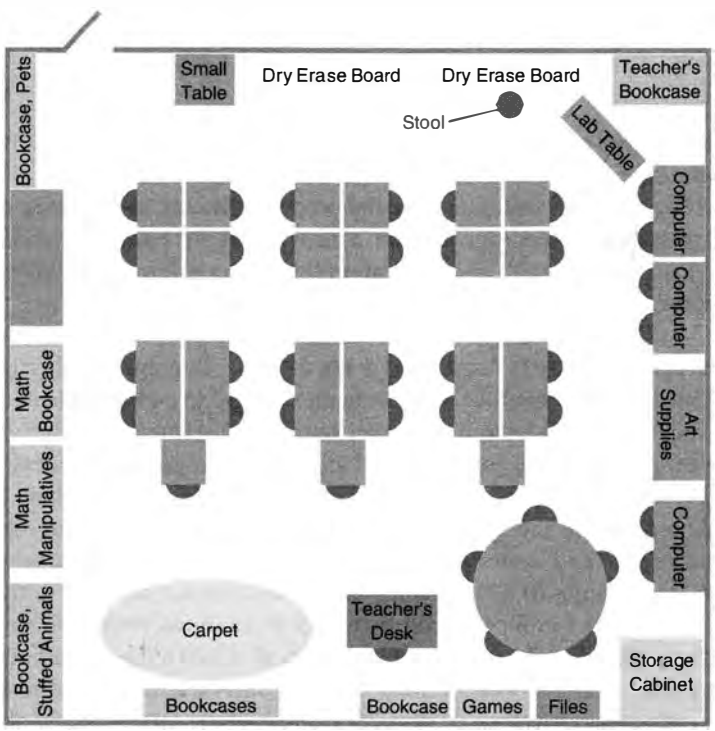


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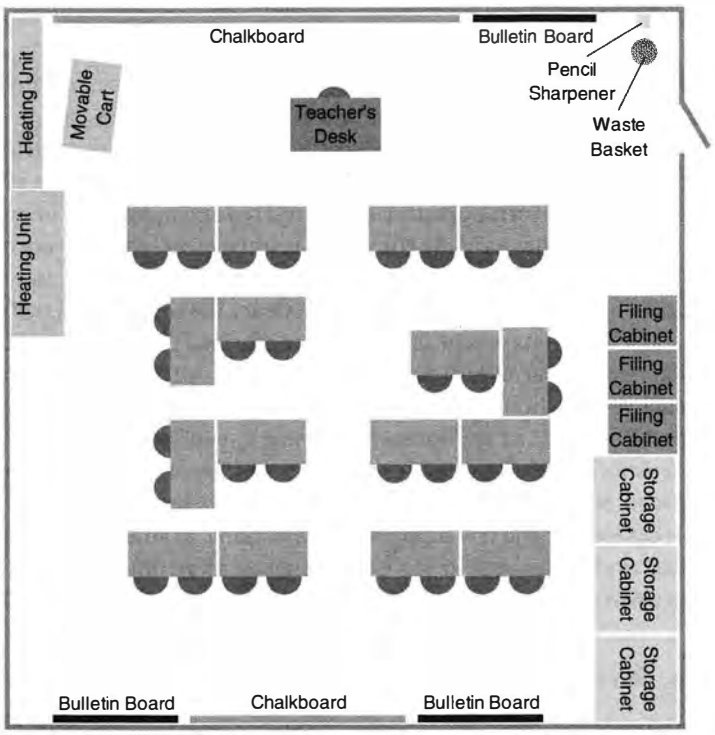
FIGURE 11.2b A High School Math Classroom

This high school teacher has designed a math classroom that allows teacher presentations and demonstrations as well as small group work. By moving three tables, the room can be transformed into four horizontal rows for independent work or testing.



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Yet another aspect of the school environment to consider when developing plans is the school administration's tolerance for new, unusual, or creative rules and procedures. Some school environments tolerate virtually no new rules and procedures; other school environments actively encourage teacher creativity. Savvy teachers check with other experienced teachers and with administrators before developing their classroom management system.

■ **STUDENT CHARACTERISTICS AND HISTORIES** In preparing effective plans, also consider the relevant histories of the students in the class. Middle-class students in an upscale suburb may respond differently from lower-socioeconomic-status (SES), rural students, who may themselves respond differently from urban students in general. Students from some socioeconomic and ethnic groups or from certain geographical areas may have had less adequate school preparation, and may be weaker in school achievement, than other students. Socioeconomic status and associated social factors are powerful influences on children's development (see Chapter 6). As a teacher, you should remain sensitive to the needs and expectations of different groups of children, and be cautious when applying rules that worked on one group of children to another group of children from a different socioeconomic background. Children with a history of school success tend to respond differently to a teacher's management plans than do students with a history of negative school experiences. Each individual student has his or her own unique scholastic history, and it is always helpful to become familiar with this background information as well.

One teacher began his career in a rural working-class community and found that the students were well behaved in school and readily accepted the rules he instituted and the teaching plan he implemented, as well as his authority, in general. When this teacher later began working in a relatively affluent suburban school, he found the students talked back frequently and mocked and challenged his rules and procedures. Whenever you change teaching environments, you must take stock of your new situation before creating new rules and new teaching plans. Generalizations are difficult, but one thing is certain: You must remain attentive to the differing needs and characteristics of students from different groups when developing and implementing rules and procedures.

THINKING CREATIVELY

How might you evaluate the types of students in your class so you can develop appropriate rules and procedures for all of them?

SUGGESTION: Begin by watching and listening so as to gather information; then try out some sample rules and procedures on a trial basis to see how students respond. Modify the plan as necessary.

PROCEDURES AND RULES

The terms *procedures* and *rules* have been mentioned often in this chapter. When Charlie Grenda started teaching, he suddenly realized how essential procedures and rules are. Let us take a closer look at procedures and rules, and how they are best used by expert teachers.

■ **PROCEDURES** **Procedures** are the methods for accomplishing classroom activities in an orderly manner. They are needed to specify how students will get things done and accomplish the activities necessary for learning. Procedures determine how students get their class folders from the side of the classroom,

- Divide the activity into the individual steps required to accomplish it and enumerate these steps clearly.
- Ask yourself what might go wrong with each step, and build in safeguards to prevent problems and misunderstandings and to maintain order.
- Seek student feedback and modify the procedure as appropriate.
- Explain the procedure verbally or write it down and post it in the classroom.
- Review the procedure periodically to ensure that it is still accomplishing meaningful objectives as efficiently as possible.

Which types of classroom activities should be covered by procedures? Establish basic administrative procedures for taking attendance and ensuring that homework is completed; procedures governing students who wish to leave the room; procedures for maintaining a clean and orderly classroom environment; procedures for collecting and returning assignments, exams, and homework; and procedures governing how students should interact with one another, and how students should interact with you (Weinstein & Mignano, 1993, 1997).

■ **PAYING ATTENTION TO CULTURAL DIVERSITY WHEN DEVELOPING PROCEDURES** Sometimes, members of one culture are familiar with a certain procedure as a result of growing up in a similar environment. However, when students from different cultures join the classroom, you should not assume they have a similar knowledge of procedures. Explain to students the precise steps involved in classroom procedures so all individuals will be equally aware of these procedures. A student who is unaware may behave inappropriately without even knowing why. For example, a student from another country, or even from another region of the same country in which the school is located, may have previously been taught never to speak out unless called on by name. If the student's current teacher encourages students to speak out spontaneously—or gives extra credit to students who speak out with enthusiasm during open discussions—this procedure should be clearly explained to the student. Adjusting to new classroom procedures can take time. Some students may remain uncomfortable with fundamentally new procedures for many months. Teachers in schools located in areas where families move frequently should be particularly sensitive to helping students learn the new procedures.

■ **RULES** Procedures specify how things get done in the classroom, whereas **rules** are statements that specify acceptable and unacceptable behaviors in the classroom. Rules tend to be

THINKING PRACTICALLY

How might you convince a rule-resistant student that rules are in everyone's best interest?

SUGGESTION: One method is to explain how the rule-resistant student himself directly benefits from the rules. Another method is to review a situation in which the lack of rules ended up causing some kind of injury to a student or teacher.

fewer in number and more explicit than procedures. In fact, effective classroom managers write down the class rules, post them, and hand them out (to older students). The nature of the rules in a classroom helps shape the learning environment that will exist (see, for example, Weber, 2002; Malone & Tietjens, 2000). Thus you should carefully consider the rules you are setting, and even discuss them with colleagues and the principal, before implementing them. Think of rules as creating the necessary limits on student behavior that will lead to an optimal learning environment for all students.

As noted earlier, when setting the rules for your own classroom, you must be aware of the general school rules. Confusion or resentment may result if one teacher allows students more freedom than is allowed by the school rules or the rules of other teachers. Some teachers make the mistake of having too many or too detailed rules, and students in their classes spend more time trying to figure out what the rules are than they spend engaged in productive learning. In general, having a short list of clear and concise rules that apply to many different types of situations is preferable to having an exhaustive list of rules that no one—sometimes not even the teacher—can remember. Effective teachers often involve students in creating, reviewing, and reworking classroom rules and consequences for breaking them, while providing these students with input about administrative and general school requirements (Weber, 2002; Malone & Tietjens, 2000).

Evertson and colleagues (1997) list five types of general rules that are helpful for elementary school students:

1. Be polite and helpful.
2. Respect other people's property.
3. Listen quietly while others are speaking.
4. Do not hit, shove, or hurt others.
5. Obey all school rules.

The last rule is important because it clarifies for students that school rules are always to be followed, regardless of teacher.

Especially with elementary school students, it is important to provide clear examples of the behavior prohibited by each rule. Students need to discuss these examples to ensure that everyone understands the concepts that underlie the rules. If you must replace or amend a rule, fully apprise the students and explain the reasons for the change. Posting written rules prominently in the classroom—in several spots—is an excellent idea.

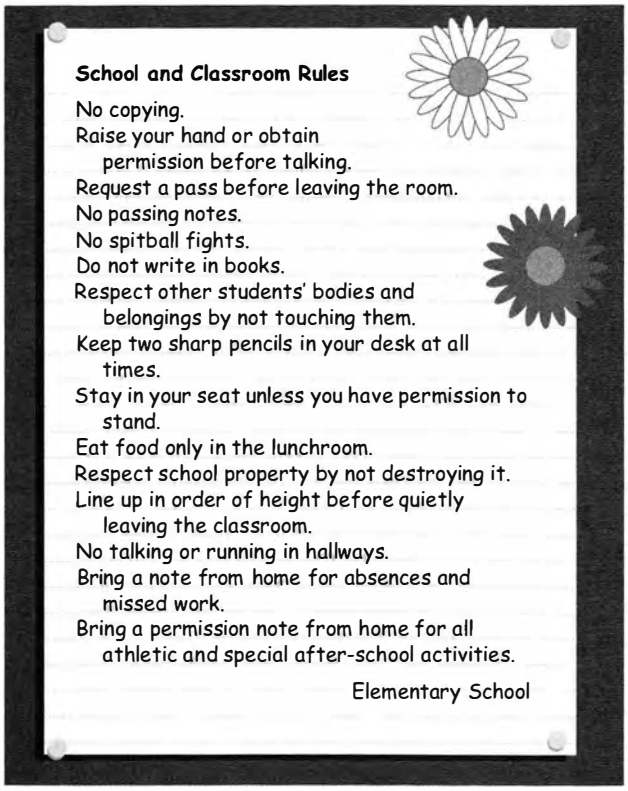
Emmer and colleagues (1997) list six general rules helpful in managing secondary school students:

1. Bring all needed materials to class.
2. Be in your seat and ready to work when the bell rings.
3. Respect and be polite to everyone.
4. Respect other people's property.
5. Listen and stay seated while someone else is speaking.
6. Obey all school rules.

As with younger students, clearly explain the rules and give and discuss examples openly in the classroom. Figures 11.3 through 11.5 display some typical rules and procedures for elementary, middle, and high school students.

■ **PAYING ATTENTION TO CULTURAL DIVERSITY WHEN DEVELOPING RULES** Consider cultural differences among children when developing and implementing rules. For example, as discussed in Chapter 6 on group differences, many teachers report that urban children tend to interrupt one another often while speaking and view such interruptions as a normal and natural aspect of communication. The urban culture may encourage this behavior. In contrast, rural children tend to wait until others are finished speaking to begin speaking, and they tend to tolerate long pauses in conversations. These pauses can make urban children very uncomfortable. The styles of these groups of children can be different enough so as to make you wish to change rules developed for use in one cultural group if you begin teaching children from another cultural group.

FIGURE 11.3 School and Classroom Rules: Elementary School Students

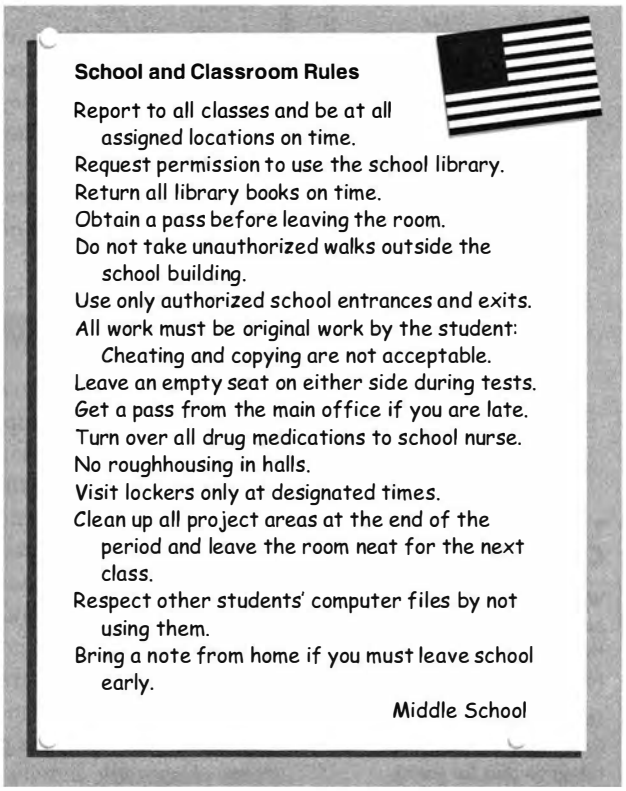


School and Classroom Rules

No copying.
Raise your hand or obtain permission before talking.
Request a pass before leaving the room.
No passing notes.
No spitball fights.
Do not write in books.
Respect other students' bodies and belongings by not touching them.
Keep two sharp pencils in your desk at all times.
Stay in your seat unless you have permission to stand.
Eat food only in the lunchroom.
Respect school property by not destroying it.
Line up in order of height before quietly leaving the classroom.
No talking or running in hallways.
Bring a note from home for absences and missed work.
Bring a permission note from home for all athletic and special after-school activities.

Elementary School

FIGURE 11.4 School and Classroom Rules: Middle School Students

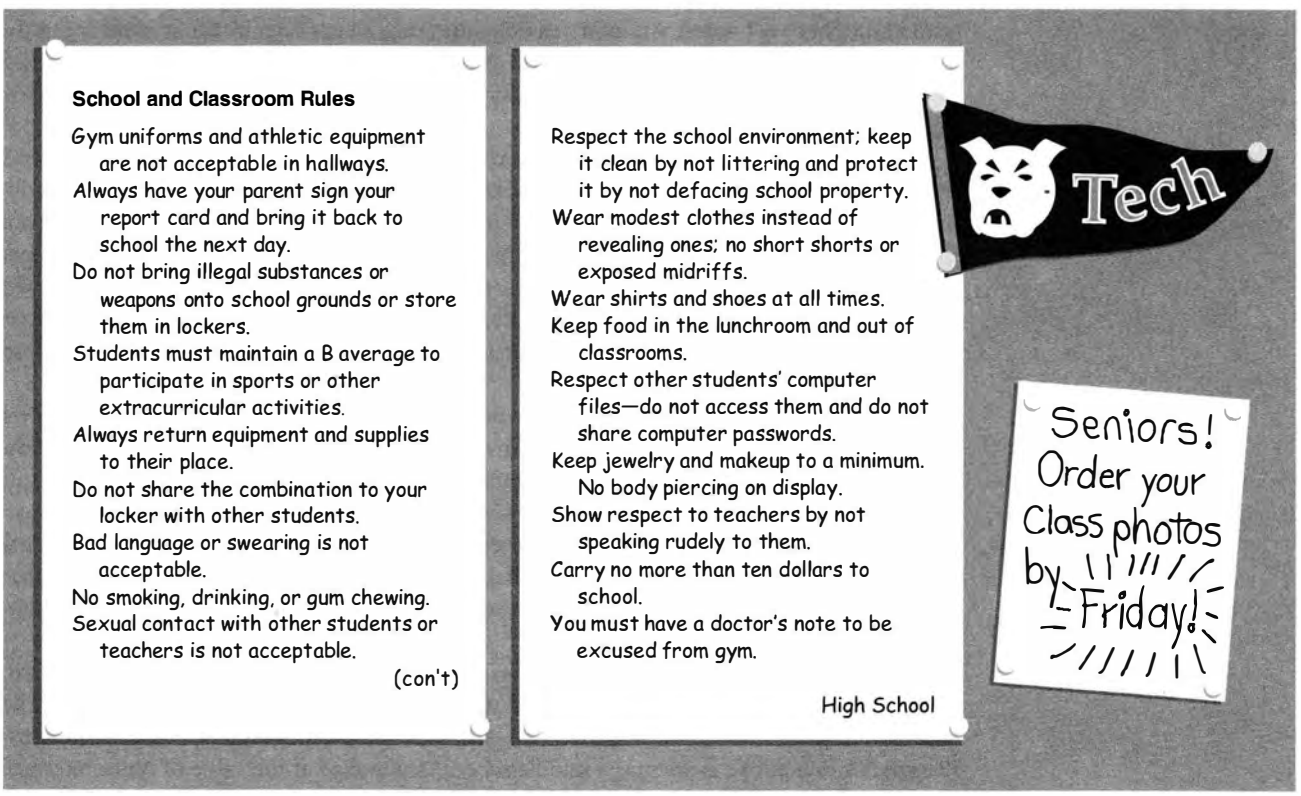


School and Classroom Rules

Report to all classes and be at all assigned locations on time.
Request permission to use the school library.
Return all library books on time.
Obtain a pass before leaving the room.
Do not take unauthorized walks outside the school building.
Use only authorized school entrances and exits.
All work must be original work by the student: Cheating and copying are not acceptable.
Leave an empty seat on either side during tests.
Get a pass from the main office if you are late.
Turn over all drug medications to school nurse.
No roughhousing in halls.
Visit lockers only at designated times.
Clean up all project areas at the end of the period and leave the room neat for the next class.
Respect other students' computer files by not using them.
Bring a note from home if you must leave school early.

Middle School

FIGURE 11.5 School and Classroom Rules: High School Students



School and Classroom Rules

Gym uniforms and athletic equipment are not acceptable in hallways.
Always have your parent sign your report card and bring it back to school the next day.
Do not bring illegal substances or weapons onto school grounds or store them in lockers.
Students must maintain a B average to participate in sports or other extracurricular activities.
Always return equipment and supplies to their place.
Do not share the combination to your locker with other students.
Bad language or swearing is not acceptable.
No smoking, drinking, or gum chewing.
Sexual contact with other students or teachers is not acceptable.

(con't)

Respect the school environment; keep it clean by not littering and protect it by not defacing school property.
Wear modest clothes instead of revealing ones; no short shorts or exposed midriffs.
Wear shirts and shoes at all times.
Keep food in the lunchroom and out of classrooms.
Respect other students' computer files—do not access them and do not share computer passwords.
Keep jewelry and makeup to a minimum. No body piercing on display.
Show respect to teachers by not speaking rudely to them.
Carry no more than ten dollars to school.
You must have a doctor's note to be excused from gym.

High School

CONSTRUCTING YOUR OWN LEARNING

Choose one age range on which to focus (elementary, middle school, or high school), and develop a list of class rules and procedures to use with students you teach. Think back to your own teachers and to teachers you may have observed in your fieldwork. Consider the rules and procedures they used. Which ones worked best, and why? Which rules and procedures were less effective? Try to develop a practical and reasonable list for the age of student you have chosen. Once you have developed your list, ask one or two friends or classmates to read and comment on it. Try to defend your choices, but feel free to revise your list as you see fit. Keep your list handy for future reference.

RESPONDING TO BROKEN RULES

What should you do when a student breaks a rule? For rules to be effective, broken rules must lead to specific and appropriate consequences. As discussed in Chapter 7, consequences and privileges are quite useful in shaping behavior. For minor rule infractions, students may simply be required to repeat the activity or action, but to do it correctly. For more serious infractions, more serious consequences will be necessary to uphold the integrity of the rule system with all students. Many teachers find that a graduated system is best. In such a system, students are managed by facing consequences appropriate to their misbehavior: You can ask yourself, "How serious was the infraction? How often has it happened in the past? What penalties were imposed in the past, and how well did they work?"

THINKING CREATIVELY

What unusual but reasonable punishments can you think of that would encourage students to obey the rules?

SUGGESTION: No bakery-fresh cookies that the teacher brings to class for young students who do not follow the rules; no field trips and no substitution of more for less enjoyable assignments for older students who disobey the rules.

A minor first-time infraction may require only an expression of disappointment by the teacher. Next, a teacher can try removing some privilege valued by the student—for example, the student can lose a free period or recess break or have extra work to do in place of an otherwise pleasurable activity. Some students are controlled effectively by being excluded from the group. For these students, being ostracized or ignored represents an effective consequence. For students old enough to write a letter, an assignment to write a letter explaining and atoning for their misbehavior may deter future misbehavior. Especially if the written letter is placed in the student's file, this consequence can be motivation not to repeat a mistake.

If unacceptable behaviors persist, or a serious misbehavior takes place, you may wish to send a student to detention. An informal detention might be to require the student to stay in the classroom and do quiet work while you grade papers and the rest of the class is enjoying free time. Formal detentions are held by schools after the normal school day, during lunch period, or during other free periods.

When rule infractions are serious, call in reinforcements to help manage the situation and the student. In some cases, you may need to involve the principal and/or the parents. A badly misbehaving student—for example, a student who has hit another student or stolen something—should be sent to the principal's office, where appropriate additional punishments will be meted out. Telephoning the student's parents is often a good idea, because they should be informed of any serious problems. If serious problems persist—such as when a knife or gun is carried to school—the student can be suspended from school or even expelled. These actions are taken by the principal.

The possibility that at some point you may need to apply extreme consequences shows why you must keep the school principal informed of serious misbehaviors. Sometimes, if you are convinced you can deal with the situation, you may fail to properly inform the principal. If the misbehavior then becomes more serious, you may require the principal's help and may need belatedly to inform the principal of the entire sequence of events. The principal at this point may justifiably feel she should have been informed sooner of potentially serious situations. Table 11.4 lists strategies for coping successfully with some common student behavior problems.

What do we know from research about the usefulness of office referrals? One study (Putnam, Luiselli, Handler, & Jefferson, 2003) found that these referrals are a common practice in public schools to address students' problem behaviors. In their report, the authors profile two descriptive studies in a public elementary–middle school that looked at the value of office referrals.

TABLE 11.4 Strategies for Coping with Student Behavior Problems

- Don't ignore problems: Try to create solutions before problems worsen. Conversely, don't overreact by making problems seem worse than they are.
- Reseat troublesome students to isolate them from others.
- Engage, rechannel, and redirect the energies of troublesome students: Assign peer tutoring and challenge students to help others; give problem students special tasks such as classroom pet care; challenge students to perform as well as others.
- Offer small rewards for good behavior; pay more attention to well-behaved students than to troublemakers; ignore troublemakers who seem to crave attention.
- Offer no homework on weekends, field trips, and other desired rewards for good behavior by the entire class—this will mean that peers will influence one another to behave well.
- Give time-outs to let students calm down and deescalate the situation.
- Be consistent in following through with rewards and punishments.
- Gain the cooperation of parents to help in managing major problems or issues. Send a brief, daily report card home to parents to keep them informed. Randomly call parents of well-behaving students to praise their children; this will secure parental cooperation in the future.
- Keep cool; avoid angry outbursts.
- Give praise for good behaviors; clarify for the class what the positive behaviors consist of, thereby ensuring this information will be clear to the whole class.
- Assign work and lead instruction that are relevant to the students' lives. Avoid teaching boring material in a boring fashion.
- Ask the school psychologist for help with particularly difficult students; speak to other teachers and the principal and request assistance.
- Model positive behaviors to make sure students understand what these behaviors consist of; talk often about people who became successful after rough starts in school.
- Rule out medical causes such as illness, poor eyesight, or hearing or other disability.
- Have problem students evaluated to determine whether they are gifted or have other special needs.
- Use the rule of successive approximations to shape students' behavior in small steps to create more positive behaviors (see Chapter 7).

Study I was a behavioral assessment of office referrals to determine the types of discipline problems confronting school personnel and the distribution of referrals among teachers, students, and grade level. In Study II, the fifth-grade class that had the most office referrals in the school received whole-class and individual-student interventions that produced a decrease in the number of referrals (see also Handler, Rey, Connell, Their, Feinberg, & Putnam, 2007; Luiselli, Putnam, Handler, & Feinberg, 2005). These findings support use of office referrals and whole-class/whole-school positive behavior support as a way to identify and deal with school discipline problems.

MANAGING STUDENTS FROM AGE 6 TO AGE 18: AGE-RELATED ISSUES

Even if you have almost no familiarity with managing a classroom, you know that managing 6-year-olds is very different from managing 18-year-olds. Brophy and Evertson (1978) believe that teachers need to use four different approaches to classroom management as a function of the students' age.

As children begin school and become accustomed to the school environment in kindergarten and grades 1 and 2, they need patient and constant immersion in and reminding of basic classroom rules and procedures. At this age, school is a frightening experience, and students need to get used to going to school and dealing with the environment away from home.

By the middle elementary years, students should have become accustomed to going to school and following school rules and procedures. At this level, teachers should focus on teaching the specific rules that apply to each activity. Because the students will have developed more school savvy, they will be able to spend more time learning material and less time simply being introduced to the rules and procedures of the school. Curwin (2003) emphasizes the importance of developing students' responsibility, respect, and self-discipline when they are within this age range, by teaching students the value of making good choices.

As students finish elementary school and begin adolescence, their peers assume greater influence over their lives. The problems of adolescence and changes associated with puberty may cause students to care less about pleasing their teachers. Some students may become defiant and difficult to manage. As a teacher of students at this age, you must concern yourself with motivating students who may be tuning out of school as the pressures of puberty place their minds on other concerns, and with handling disruptive and contentious students.

Once the biological aspects of adolescence are resolved and students have reached the last two years of high school, they often have a more adult-like focus and ability to discipline themselves.

THINKING ANALYTICALLY

Why should a teacher who instructs only secondary school children need to be familiar with the demands of teaching elementary school?

SUGGESTION: Understanding students' past school experiences is essential for a teacher wishing to teach students at the secondary level.

TABLE 11.5 Developmental Characteristics of Students That Influence Teachers' Management Styles

Ask yourself the following questions before deciding which management techniques to use:

- Can the student feel and understand what the teacher feels? (Capacity for empathy)
- Can the student understand what the teacher expects? (Vocabulary and intellectual capacity)
- Can the student understand how his or her behavior affects others? (Knowledge of consequences)
- Can the student see her or his role in her or his behavior? (Knowledge of causality)
- Can the student appreciate how symbols can be used to represent ideas? (Understanding of metaphors)
- Can the student understand responsibility to a larger group—the peer group, the class, the school community, or society at large? (Capacity for altruism)
- Can the student understand the values and goals of the school environment? (Practical knowledge of school environment)
- Can the student understand that parents' goals, values, and behaviors may differ from school values and behaviors? (Perspective on one's culture)
- Can the student understand that criticism and punishment can be meted out for the student's own benefit? (Knowledge of the necessity of consequences)
- Can the student understand that other people's goals, values, behaviors, and cultural views are important considerations? (Appreciation of the value of diversity)

Many students are honing in on academics and on their future education or careers after high school. Effective classroom management for these students involves teaching the right material to maximize learning, tailoring instruction to life and career goals, and helping students manage their own learning. Because students have developed elaborate scripts for rules and procedures by this point, much less time is devoted at this stage to teaching rules and procedures.

Table 11.5 summarizes the developmental characteristics of students that affect teachers' management styles.

FORUM

WHO SHOULD CONTROL LEARNING, TEACHERS OR STUDENTS?

Do middle school and high school students learn best in a tightly managed and highly disciplined environment in which the teacher is in control? Or does the best learning environment consist of an open classroom in which the teacher provides assistance to students but does not control events? How much discipline is necessary and desirable to bring about maximal learning?

Jefferson High School in Virginia has been the focus of a controversy regarding these questions. Jefferson graduates more National Merit Scholars than any other high school in the United States. Traditionally, students at Jefferson have had a significant amount of free time in which to talk informally about their work to other students and to teachers, and in which to work on projects of their own choice. Rigid discipline has not been stressed. In late 1996, following the arrest of several Jefferson students for minor incidents of vandalism, calls for increased discipline at the school began.

FIRST VIEW: Students learn best in a structured and highly disciplined environment. Proponents of this position argue that too much free time leads students astray from learning. According to this view, learning requires a disciplined mind, and a disciplined mind can be trained only through many hours of focused academic work over many years of schooling. Students must learn to enjoy academic work and must learn the pleasure of sticking with an activity and completing it—and they will learn these valuable lessons only if the school environment enforces strict discipline, rules, and procedures. In addition, too much freedom for students is seen as undermining the authority of teachers and other adult role models. Thus Jefferson students are seen as having been given too much of a say in how they spend their time, and the resulting discipline prob-

lems—albeit involving only a handful of students—are seen as the beginning of a more serious trend.

SECOND VIEW: Students learn best in an unstructured environment. People who believe that students prosper with less structure argue that the only learning that matters is active and engaged learning, initiated by the individual student. According to this view, enforced discipline leads to only a perfunctory performance of academic tasks and does little good in the long run. An open and free learning environment, in contrast, encourages students to seek out those activities and subjects that interest them the most. By causing students to equate learning with rigid discipline, a controlled environment serves to teach students that learning is not fun, and that it is something they are forced to do. Conversely, by equating learning with exploration, self-discovery, and fulfillment of personal influences, a student working in an unstructured environment internalizes the love of learning and carries this value into adult life. According to this view, the success of so many students from Jefferson High School clearly shows that less structure is better.

THIRD VIEW: A SYNTHESIS. Students need structure up to a point, but once they reach that point they will benefit from a less structured environment. The middle-ground position argues that teachers will not lose their authority with students by relinquishing tight control once the students have earned the privilege of working within a less structured environment. When students begin their academic careers, they need to learn good work habits and understand how to interact positively with teachers and classmates. Once these basic skills are mastered, responsible students with personal ambition and drive to excel in school may then be given a reasonable amount of freedom and unstructured time. The majority of students at Jefferson have earned this privilege and, therefore, should be rewarded with a less structured learning environment. Students who excel academically and who love learning do not need to be pushed to be made to work; in fact, often they need to be told to stop working to eat meals and attend to other tasks. Teachers of academically motivated students are freed to lead students by providing support and access to resources. As always, the structure of a discipline system should be based in part on students' maturity and developmental level.

*i*MPLICATIONS FOR TEACHING

- **Before developing a management plan, consider the developmental age, maturity level, and background of the students.** Do not simply draw up a plan that sounds good to you; instead, develop one that will work for the specific students in your classroom. To do so effectively, you must get to know your students.
- **Set reasonable procedures and rules, and make sure students are familiar with them.** Being overly punitive or overly lenient will backfire. Your goal is to manage students for optimal learning, not to control their every thought and movement, and not to allow the students to control you either.
- **When drafting the procedures and rules, consider the school's physical and cultural environment, and the advantages and disadvantages of each.** Each school has its own idiosyncrasies; get the facts before mapping out your plan. Consider alternatives before settling on a final plan.
- **Review other teachers' rules and procedures before drafting your own; discuss your plans with other teachers for input.** Never underestimate the value of peer feedback—and particularly that of your more experienced and effective peers. Be willing to borrow the best techniques from your colleagues.
- **Tailor punishments based on the severity of the misbehaviors that motivated the punishments.** Maintain your perspective on how bad the misbehavior is and which punishment is deserved. Too lenient or too harsh an approach will not extinguish misbehavior as effectively as a more appropriate reaction.

Maintaining Control and Preventing Problems

So far in this chapter, most of our discussion has focused on getting started with a new class. We have considered the role of classroom management in effective teaching; the importance of effective plans, rules, and procedures; and techniques for implementing these rules and procedures to make classrooms work. But many teachers consider the hardest part of classroom management to be maintaining order and control for the long haul—between October and May. Even after Charlie Grenda figured out how to get in control of his students, he still faced the challenges of maintaining control for the rest of the year. Let us assume that a teacher has established effective rules and has a generally well-behaved class. Problems will still occur, and when they do, the expert teacher is prepared to deal with them and to keep them from recurring. What are the key issues you must understand about maintaining control in the classroom?

THE IMPORTANCE OF GOOD COMMUNICATION

THINKING PRACTICALLY

How can you improve your own communication skills?

SUGGESTION: Ask people you admire to critique your skills and suggest methods for improvement; listen to yourself on tape; take a course emphasizing communication skills; and practice in front of a mirror.

In this text we have often emphasized good communication because it underlies successful teaching. Here we focus on good communication in terms of how it supports effective classroom management. Because rules and procedures are effective only if they are clearly understood, teachers who communicate effectively with students have better results in managing their students than do less effective communicators who implement the same rules and procedures. Communication with parents is also essential, because the students' home environment can either foster good study skills and appropriate classroom behavior or undermine the lessons you are working so diligently to get across. Much of being a good communicator consists of being a good listener who is able to empathize with others. Another key aspect of communicating effectively is practicing reflective thinking in which you mull over situations and work to understand them from each participant's perspective.

Communication is an intricate phenomenon. Much of what we communicate—whether intentionally or unintentionally—is nonverbal. What we say aloud is only part of the story. Our body language, tone of voice, and gestures all contribute to the picture of what we really mean. Part of effective communication involves identifying the real message behind what is directly stated.

For example, students who are frustrated at their inability to complete a task may simply stop working. As you approach the desk of such a student, the student may respond that the

Frank Siteman

A teenage student shows irritation through his body language as his teacher discusses a low grade on a paper.

assignment is meaningless, boring, repetitive, or stupid. Although you can easily interpret the message just as it sounds, the real underlying message—one picked up by the effective teacher—is that the student is upset by her own inability to accomplish the work. Getting to the root of why she had trouble starts with recognizing that what she says aloud does not tell the whole story. Her defiant stare, her body language, and her snippy tone might all signal that her emotions are out of control. Dealing with such situations effectively requires sensitivity to the range of emotions and thoughts that are sometimes buried beneath a simple verbal message.

RESPONDING TO STUDENT MISBEHAVIOR

Expert teachers have a variety of strategies at their disposal for dealing effectively with student misbehavior. Each student and each situation are unique, but in most situations certain strategies can be applied to correct the misbehavior and allow everyone to return to meaningful learning.

■ "I" MESSAGES

One approach to handling student misbehavior is to use an "I" message (Ginott, 1972; Gordon, 1974). An **"I" message** is a clear, direct, assertive statement about exactly what a student did that constitutes misbehaving. It states how the misbehavior affects the teacher's ability to teach, and how the teacher feels about the misbehavior. An "I" message is a first line of defense against misbehavior, in that it does not immediately demand or require a change in behavior on the part of the student. The goal of an "I" message is to effect a voluntary change in the student's behavior by appealing to the student's conscience and desire to do the right thing. For example, a teacher might say, "When you talk to another student during my lessons, it makes me feel as though you do not care about hearing what I have to say," or "When you fail to hand in your assignments on time, it makes me think that you do not believe the work we are doing is important."

As Kounin suggested in his techniques for effective classroom management, an "I" message tells students which behaviors they are engaging in that they should change without launching a personal attack on the character and personality of the student. The "I" message approach is based on the humanistic approach to education and motivation discussed in Chapter 10—that is, it assumes that students who can be made to understand the consequences of their actions will voluntarily change these actions. The premise of the "I" message approach is that the teacher's authority and ability to punish students should be used only when other methods, such as the "I" message, have failed to modify students' behavior.

■ ASSERTIVE DISCIPLINE

Another approach for handling student misbehavior, known as the **assertive discipline** program, was developed by Lee Canter (1989a, 1989b; Canter & Canter, 1992). Assertive discipline is a method of responding to misbehavior that is clear, firm, and direct. As the word *assertive* suggests, teachers who use this style make their expectations clear and firmly state the consequences for misbehavior. They then follow through with these consequences if appropriate.

Canter believes that teachers who fail at classroom management do so because they have one of two ineffective styles. The first ineffective style is the *passive* style. Passive teachers fail to label the problem behavior firmly and directly and tell the student what should have been done. These teachers may also simply ignore inappropriate behavior or fail to enforce the stated consequences for misbehaving. The second ineffective style is the *hostile* style. Teachers who act in a hostile manner may tell a misbehaving student that she is an inept or stupid person. Hostile teachers pronounce extreme punishments and then fail to follow through, or they attempt to undermine a student's sense of self-worth by telling the student that she seems to be incapable of performing better. Hostility can be communicated nonverbally as well as verbally—a hostile teacher can communicate through body language and other means that a student is inept or stupid without ever saying these words. Examples of such nonverbal cues include smirking, shaking one's head in a dissatisfied, sarcastic manner, rolling one's eyes, or making a dismissive hand gesture.

Canter advocates the assertive discipline approach as an effective method for dealing with student misbehavior. This program consists of three basic parts:

THINKING PRACTICALLY

How can you tell if you are being too passive or too hostile in your management style?

SUGGESTION: By observing student reactions and charting student achievement; by asking colleagues for feedback; by taking courses and reading books to hone your skills.

1. **The teacher teaches students how to behave.** To accomplish this, you as a teacher must establish clear and specific directions for each activity and make sure the students know how to behave. To check whether students know how to behave, rehearse the desired behaviors with the class, write the behaviors on the board, ask students to repeat the list, question students about what they are supposed to be doing, and watch carefully the first few times a new activity is performed, to ensure that all students understand the rules.
2. **The teacher provides positive reinforcement.** For example, you might comment when a student is doing a good job of following the rules. By drawing all students' attention to a desirable behavior, you enhance students' understanding of what desirable behaviors consist of and strengthen their resolve to perform these behaviors.
3. **The teacher invokes the discipline plan,** which consists of the programmatic approach to discipline problems you have developed ahead of time. The discipline plan entails negative consequences if students refuse to perform the desired behaviors. It should include different levels of negative consequences for misbehavior, in which each level of response is more severe than the previous one. Canter advocates no more than five levels of negative consequences.

Many teachers and school administrators report that they use assertive discipline with success in their classrooms. However, researchers in the educational and psychological communities have pointed out that the efficacy of assertive discipline has not been adequately demonstrated. In an overview of the literature, Render, Padilla, and Krank (1989) found that anecdotal reports, as opposed to empirical studies, were the basis for people's opinions about the success of assertive discipline.

Assertive discipline takes a behavioral approach to modifying student misbehaviors (see Chapter 7), linking student behavior to specific positive and negative consequences. What may be lacking is a true understanding, on the part of the student, about the reasons for certain rules. Thus researchers taking a cognitive perspective (see Chapter 8 on cognitive approaches to learning) argue that students need to understand the reasons for the rules that are used to manage classroom learning, rather than simply being told that an escalating series of punishments will be the consequence of a lack of conformity to those rules.

What if neither an "I" message nor the use of assertive discipline produces the necessary behavioral change? You must retain control of the class while imposing control on the disruptive student (or students). Anger is your enemy here, although it is often easy to become angry with a defiant student. Instead of losing your temper, initiate a positive reaction to the discipline problem. At times, such as when safety is an issue, it is best to simply state what is going to happen—or, in other words, give a direct order. More often, however, attempt a reconciliation and joint solution. Table 11.6 summarizes the "I" message and assertive discipline approaches for classroom management.

A teacher quietly disciplines an errant student—away from the classroom and his student peers.

Bob Daemmrich Photography, Inc.

■ **DECIDING WHO OWNS THE PROBLEM** Giving students choices is generally a very effective strategy. An analysis of how to proceed in this situation is provided by Gordon (1974, 1981). In his book *Teacher Effectiveness Training*, Gordon states that before deciding on a course of action in response to a problem, a teacher must decide who "owns the problem." Some student actions might trouble or even repel you, but they might still represent problems that are not your responsibility to solve. Start out by analyzing who owns the problem and why the problem is affecting you. If you own the problem, you must direct the student to solve the problem. If the student owns the problem, however, your role becomes one of providing a sympathetic ear and of helping the student find his or her own solution.

Let's assume that a student's misbehavior disrupts classroom instruction. In this case, you own the problem and must respond and take action to modify the stu-

TABLE 11.6 Methods for Responding To Student Misbehavior

"I" Messages

Clear, direct, assertive statement about how the misbehavior affects the teacher's ability to teach.

Examples: (1) "When you talk to another student during my lessons, it makes me feel as though you do not care about hearing what I have to say." (2) "When you fail to hand in your assignments on time, it makes me think that you do not believe the work we are doing is important."

Assertive Discipline

1. Explain, rehearse, and reinforce desired behavior.

   Examples: (1) "We line up quietly and move quietly through the halls on our way to lunch." (2)"We do not make noise because it disrupts other classrooms."

2. Recognize, reward, and reinforce desired behavior.

   Example: "The class was very quiet today as we walked to lunch. There will be 15 minutes extra free-choice time."

3. Progressively negative consequences for undesirable behavior.

   Examples: (1) "The class was not quiet today when we walked to lunch. There will be a shortened free-choice time today." (2) "There will no afternoon play activity today." (3) "There will be a time-out for every child who made noise on the way to lunch today."

dent's behavior. In this case, you must confront the student and direct the solution of the problem. However, if a student becomes angry or upset about something that happens in school (such as losing the lead in a school play), the student owns the problem (unless, of course, the student's anger causes her or him to become disruptive). If you respond with discipline to a student-owned problem, the student may be less able to find a solution. The expert teacher understands that student-owned problems are the student's responsibility to solve—not the teacher's. Too much teacher direction prevents students from solving their own problems and developing the skills needed to do so successfully.

The key is to consider whether the problem obstructs effective teaching and learning. If so, you own the problem. However, if the behavior simply annoys you but does not interfere with teaching or learning, the student probably owns the problem.

WHEN THE STUDENT OWNS THE PROBLEM: ACTIVE LISTENING. What should you do when a student is stuck on a problem that the student owns? Gordon recommends you try **active listening.** This approach consists of allotting enough time to listen to a student in an active and concerned manner and encouraging the student to state the problem fully. It involves paraphrasing what the student says and encouraging the student to work through the problem. For example, the teacher might say, in a concerned tone, "Sarah, I can see something is bothering you. I suspect you are upset about your parents' recent divorce. Your mother called to tell me that she is worried about you. How are you feeling about the situation? Would you like to talk about it? If so, I am here to listen and to do what I can to make you feel better so you can concentrate again on your schoolwork."

Active listening does not mean that you direct the student's words, tell the student how she should feel, or otherwise determine the outcome of the student's feelings about the problem. Your response is limited to acknowledging the student's feelings and opinions. During conversations with students, teachers often find it helpful to implement the **paraphrase rule,** which is designed to promote accurate communication. In following this rule, the teacher or student, before speaking, must first summarize in her or his own words what the other person said.

To be effective as an active listener, you must block out external stimuli—for example, do not take interruptions from other students—and listen carefully to both verbal and nonverbal messages being delivered by the student. Disentangle the emotional and intellectual content of the message, and make appropriate inferences regarding the student speaker's feelings (Sokolove, Garrett, Sadker, & Sadker, 1986). Empathize with the student by taking her position and showing her that you know how she feels. Sometimes being understood by an adult authority figure is all that is needed to make a student feel better.

TEACHER INTERVIEW

FOCUS ON: CLASSROOM MANAGEMENT STRATEGIES

TRACEY SABBATO: HICKORY MIDDLE SCHOOL, CHESAPEAKE, VIRGINIA—GRADE 8, ENGLISH

Tracey Sabbato has been teaching for twelve years. Before she gets to the subject matter, she has a routine in place and her eighth-grade students know exactly what to expect if they misbehave. This consistency is peppered with a good sense of humor to create a classroom atmosphere that works well for her and her students.

What are eighth-grade students like in the classroom?

In general, eighth graders are experiencing a highly emotional period in their young lives, and are in the process of learning how to manage these emotions. If something upsets them, they are quite vocal and/or reactionary. Many psychologists maintain that it is difficult during this period of young adolescence for eighth graders to concentrate on their studies for long periods of time.

Eighth-grade teachers frequently lament that daily they are confronted with young people in their classes who commonly disrupt class with excessive talking and bizarre noises. To cut down on these and other types of disciplinary issues, I establish a consistent classroom routine to follow. Without the predictability of a routine, student behavior may be more easily thrown off course.

What is the general routine you and your students follow? How do you introduce it to students at the beginning of the year?

One of the most difficult challenges is getting all students focused on the intended lesson at the same time. Once they become fully engaged in an activity, they generally participate positively in their learning process

I spend the first five minutes of class focusing their attention with some type of activity. An example is a journal topic. I use the journal to give them an opportunity to express an opinion about what we are reading in class. I use this time to check homework, talk to students individually, and take care of some paperwork. When they have had time to settle down and get prepared for the class, we start the lesson. This routine starts on the first day of school. They begin to expect and rely on this opportunity to get focused.

What strategies do you use to manage an emotional situation for students?

Two years ago, a middle school student was killed in a car accident. My students had never experienced the death of a friend, so understandably they were very upset and were having difficulty in expressing their grief over what was, to some, a devastating loss.

Some of my teaching colleagues chose not to discuss the tragedy with their classes, but I felt that it needed to be verbalized in an open forum to give the students an outlet and sounding board on how they were feeling. Furthermore, I felt that if I didn't allow discussion about such an issue, the students would have remained very unproductive in class.

I gave them the opportunity to share funny anecdotes about the student who had been killed. It not only resulted in a therapeutic practice for my students, but also succeeded in redirecting them to more of a learning mode afterward.

What strategies do you use to manage misbehavior?

The students in my class remain together for all their other classes—social studies, science, and math. The whole school works on the team concept model. A core team of four teachers works with a designated group of students. The teachers from my students' team decide on the discipline policy for the group. The approach ensures consistency in behavior

WHEN THE TEACHER OWNS THE PROBLEM: THE NO-LOSE METHOD. When you as a teacher own the problem and must create a change in the student's behavior, Gordon advocates use of a **no-lose method** to resolve the problem. The concept behind the no-lose method is that resolving conflicts will be easier and more productive if neither you nor the student feel you are losing. For example, if you tell a boy passing notes in the back row to stop or else go to detention, and if you are successful in halting the bad behavior, the boy loses. If you fail to control the boy and the misbehavior continues, you lose. Gordon believes the right solution is that you and the boy come up with a compromise that represents a no-lose option—that is, a solution that allows neither party to lose. For example, you engage the boy in the class discussion by asking him a question you know he is able to answer, thereby transferring the student's attention from note passing to learning. Later, you speak to the boy in private, stating that note passing is not acceptable and that you want him to remain actively involved in lessons.

management for each class that the students are in.

We have four levels of response to misbehavior in class—verbal warning, parental contact, detention, and ultimately a visit to the principal's office. Students receive a verbal warning for excessive talking, disturbing the class (making inappropriate noises, for example), or making inappropriate comments (such as sexual remarks or profanity). Other behaviors warranting a verbal warning include picking on someone (for example, "Shut up, you are stupid!"), throwing things in class, or physically touching students to provoke them.

I hand out a detention when I've given a student a verbal warning but he or she continues the behavior. If a student leaves class without permission, he or she receives a detention without a verbal warning. However, if a student leaves class to defuse anger, the student gets a warning, not a detention. More serious behaviors such as kicking someone or injuring another student result in an immediate trip to the principal's office.

These methods for managing behavior in our team's classes have proven to be effective. I had 130 students this year, and I've written 20 referrals to the principal's office, which is a relatively small number when you take into account the number of students and the time frame in which the referrals were handed out. Fortunately, we have not had major ordeals.

What role does a sense of humor play in classroom management?

A sense of humor, I believe, is an enormously important attribute. I use humor to control or redirect students' negative behavior. For me, it may be as important as being consistent. I maintain a good rapport with my eighth graders, even the "troublemakers," because I can view some of their behavior with a sense of humor. I can laugh at some of what they do. As young teens, they experiment with all types of behavior, and some of what they do turns out to be quite funny, in my opinion. I believe that if I reacted very seriously and sternly to every little behavioral "blip," I would not be able to reach them as effectively as I currently do.

There are teachers who barely smile at their students throughout the entire school year because they cannot find humor in what they sometimes do. I don't think that these teachers like going to work as much as I do. In addition, they are more often the target of students' bad behavior.

What advice do you have for new teachers?

Students want to be your friend, but you need to immediately establish that this is not the role that you will play, although it may be hard to do. If you are in your twenties, you are still someone who could have a relationship with a young person based on friendship. However, I believe that new, especially younger teachers, need to quickly establish their roles as teacher and, whenever necessary, disciplinarian. There is a fine line between being friendly and being friends.

One of the most difficult challenges is getting all students focused on the intended lesson at the same time. Once they become fully engaged in an activity, they generally participate positively in their learning process.

One of the most difficult challenges is getting all students focused on the intended lesson at the same time. Once they become fully engaged in an activity, they generally participate positively in their learning process.

The specific six-step procedure advocated by Gordon includes the following actions:

1. Define the problem.
2. Generate possible solutions.
3. Evaluate the solutions.
4. Decide which solution is best.
5. Determine how to implement the solution.
6. Assess the success of the solution.

AN EXAMPLE OF THE USE OF THE NO-LOSE METHOD. Suppose several students have been approaching their teacher repeatedly about wanting to have no homework on weekends. Because other teachers have instituted a no-homework-on-weekends policy, the students are resentful that their class does not have the policy. If the teacher simply says, "Too bad—in my class, there is homework on weekends," the students lose. If the

teacher simply responds, "Okay—we won't have homework on weekends," the teacher loses because she knows the material must be covered if the students are to perform well on the mastery tests in two months.

THINKING ANALYTICALLY

Name three additional problems with the no-lose method.

SUGGESTION: The no-lose method can be too time-consuming, can detract from the teacher's authority when used with some rebellious students, and can lead to solutions that the teacher feels compelled to endorse but that do not ultimately work.

In this scenario, a no-lose method might involve a negotiated compromise such as the following: The teacher states, "Here is a compromise. What if I give 30 minutes extra homework on Monday through Thursday nights? If you all do your homework and no one complains about having more homework on weekdays, I will stop giving homework on weekends." Alternatively, the teacher might ask the entire class to offer suggestions about how they can get the required amount of work done while still having no homework on weekends. There should also be a joint teacher/student-generated plan to evaluate the results.

One problem with the no-lose method is that negotiation is not appropriate in every situation, particularly with disruptive and unpredictable students who do not possess the goals of learning and achievement. If the student does not want to create a positive environment and is not motivated to learn and cooperate with the teacher, the no-lose method will probably not work.

GENERAL BEHAVIORAL INFLUENCE TECHNIQUES

In 1959, Redl and Wattenberg published a book that discussed techniques for influencing behavior. Although this list of techniques is almost 50 years old, teachers still find it quite useful. More recent research (Walker & Shea, 1991) has built and expanded on the earlier ideas. In addition, Emmer and colleagues (Emmer et al., 1997; Emmer & Stough, 2001) have suggested several methods for stopping student misbehavior.

■ **SUPPORTING SELF-CONTROL** One technique advocated by this group of researchers is called *supporting self-control.* Just as the name suggests, this approach aims to help students develop self-control and thereby minimize their misbehavior. You can help students develop self-control simply by ignoring inappropriate behaviors, as long as these behaviors are not disrupting other students' learning. You can also use proximity to the student as a cue to the student to halt the misbehavior. In this case, you simply stand close to the student and continue the lesson, or possibly even touch the student (for example, by placing your hand gently on the student's shoulder) if the behavior does not cease. You can also make eye contact with the student or give another nonverbal signal until the student stops the inappropriate behavior. Alternatively, you can help students develop self-control by using humor (not sarcasm) to halt the bad behavior.

THINKING ANALYTICALLY

Why might a student become hostile when she cannot complete a problem in her workbook? What might you do in this situation?

SUGGESTION: Insecurity about her failure might make the student hostile, as might fear of criticism and defensiveness. You can tell the student that such problems are often difficult for students—that they were difficult for you when you were first learning the material—and you can suggest that the student watch and work alongside you as you lead her through the solution.

■ **PROVIDING SITUATIONAL ASSISTANCE** Another general set of techniques for controlling a disruptive student involves providing situational assistance. First, you help the students over hurdles they are encountering. The idea of this technique is that students may not understand what they are supposed to do, or they may lack the ability to do it and, as a consequence, respond with poor behavior. Next, you can use rules and procedures to more effectively regiment and control what is going on in class. If the students are failing to follow a procedure correctly, restate the procedure and ask the students to start over. Alternatively, you can ask the misbehaving students to state the correct rule and then to follow it.

■ **TIME-OUT** Yet another technique is to give misbehaving students a time-out. If there are objects in the room that seem to be distracting students or encouraging misbehaviors, remove the objects rather than continually fighting a losing battle.

■ **REALITY AND VALUE APPRAISAL** A final set of techniques, referred to as reality and value appraisal, is designed to redirect students' behavior toward more constructive, useful, and intelligent outcomes. To use these techniques, first restate the rule that was broken and note the reasons why the rule was developed in the first place, clearly explaining the limits on students' behavior implied by the rule. Then use criticism and encouragement. In this case, as we have already discussed, the criticism should be constructive and aimed at the inappropriate behavior rather than at the person. Ideally, follow the criticism with encouragement to

change, in the form of a statement describing the right behavior and explaining how the student could engage in the right behavior.

After discipline has been administered, there is sometimes a tense atmosphere in the classroom as well as potentially bad feelings between you and the disciplined student. In this case, you can speak to the student privately about the incident and improve the atmosphere between you. You might also engage the class in a discussion about what happened and why, in an effort to put the event behind everyone. A teacher who is vigilant may even sense a situation that can become an opportunity for disruptive behavior. Sometimes, by commenting on the situation positively and by telling students what to expect, you can stop the misbehavior before it starts.

COPING WITH VIOLENCE IN SCHOOL

In addition to the typical types of management problems just discussed, teachers sometimes confront serious management problems (Garbarino, 2001a, 2001b; Garbarino, Hammond, Mercy, & Yung, 2004; Mayer, 2002). School violence is more likely to occur in large schools located in high-crime areas, in schools with weak administrators, and in schools with a high percentage of male students. Table 11.7 describes in detail the factors associated with school violence, based on the most current research and survey information.

Which students are more likely to engage in violent behaviors? Boys are more aggressive than girls on average (see Chapter 6), and consequently boys tend to become involved in more violent acts and situations. Low-achieving students are also generally more likely to be violent; the low achievement may not be a cause of the violent behavior, however, but rather a consequence of a negative attitude about school and learning. Violent acts are twice as frequent in junior high schools as they are in senior high schools. In addition, some schools are poorly designed and administered, and the atmosphere in these schools often contributes to student violence.

What can you as an individual teacher do to reduce the chances that your pupils will become violent? Through the consistent use of clear and fair classroom management techniques, you can help direct students' energies more productively toward meaningful achievement (Mayer, 2002; Rutter, 1983; Rutter, Maughan, Mortimore, Ousten, & Smith, 1979). In general, public schools that use punitive approaches to student discipline may actually promote violence and other antisocial behavior (Mayer, 2002). Students at risk for developing violent behavior do best in an environment that stresses incremental progress toward individual short-term goals. Given that violence-prone students may not excel academically, they often do best in an environment that emphasizes improvement and hard work rather than absolute levels of achievement. Other tactics for reducing violence include inviting students to participate in developing the rules and procedures that will govern them, as well as in choosing the emphasis of their curriculum. When students have a role in deciding what they are taught and which rules they must obey, these students are more likely to return to the learning experience. And, of course, all students benefit when teachers work to keep the material they teach both interesting and relevant to students' daily lives.

James Garbarino (1999, 2001a, 2001b, 2003, 2006; Garbarino et al., 2004), who has studied youthful offenders both in and out of prison, believes that violence can best be prevented by coordinated efforts to make the school environment more responsive to the special needs of high-risk children and youth. These efforts include provision of appropriate mental health services, character education initiatives, conflict resolution programs, small schools to promote active participation by all students, and a strong and active adult presence in every aspect of the school environment.

Garbarino advocates a perspective based on the development of children and youth within their families and communities. He views the accumulation of risk as a key to understanding how and when children suffer the most adverse consequences of exposure to community violence. Not only do the multiple risks of community violence (risks related to poverty and family disruption) compound the chances of negative outcomes for children in the most vulnerable populations, but they can also permanently distort children's beliefs about the steps they must take to ensure their personal safety and about the spiritual mean-

TABLE 11.7 Factors Related to Violence in School

Community Characteristics

- Unemployment and underemployment of adults and youth in the broader community
- Involvement of youth in violence in the broader community (perpetration and victimization)
- Involvement of youth in drug trafficking in the broader community
- Involvement of youth in gangs in the broader community
- Presence of "broken windows" (that is, homelessness, overcrowding, disorder, deteriorating infrastructure)

Family Characteristics

- Absence of parent (father or mother) from the home
- Family poverty
- Parents' education
- Means of resolving conflicts within families
- Effective discipline within the family
- Constructive parental involvement in school disciplinary infractions
- Parental support of appropriate school discipline policies
- Parental support of appropriate school discipline efforts
- Parental substance abuse
- Parental criminal activities or involvement with the justice system
- Presence of supportive extended family
- Sibling criminal activities or involvement with the justice system
- Sibling substance abuse
- Family involvement with community groups (religious institutions, community centers, youth groups)

Positive School Climate

- Safe and secure school environment
- Consistent and fair enforcement of school rules
- Consequences, penalties, and punishments appropriate to infractions
- Provision of due process with consistency
- Teamwork in disciplinary processes
- Degree to which students are insulted or humiliated by school teachers or administrators
- Consistent reporting of infractions
- Adequate training for staff
- Parent support and involvement
- Clear and frequent communication of school disciplinary code
- Student belief that teachers and administrators care about them

Substance Involvement

- Prevalence, frequency, and incidence of substance abuse
- Drug trafficking in schools and student involvement in drug trafficking in the community
- Possession of prohibited substances in schools

Positive Student Engagement at School

- Desire to do well or improve academically
- Extent of student alienation
- Involvement in extracurricular activities (e.g., sports, drama, community service)
- Student participation in school government and policymaking
- Desire to gain specific skills for future plans (college or vocation)

Occurrences That Instigate Violence

- Recent abuse
- Recent victimization
- Recent hassling or shoving
- Fight picked or started by another person
- Attempt by another person to boss the individual around
- Unfairness
- Someone cuts in front of the individual in line
- Criticism
- Insult
- Insult to a friend in the individual's presence
- Insult to a family member
- Disrespect
- Meanness
- Annoyance
- Bullying
- Teasing or making fun of the individual
- Bossiness
- Rumors spread by another person about an individual or someone the individual cares about
- Interpretation of a neutral interaction as negative
- Daring other children to do things
- Picking on someone the individual cares about
- Insulting someone the individual cares about
- Desire to fight with the individual on the part of another person
- Name-calling
- Theft of something from the individual
- Flirtation with someone the individual likes
- Purposeful destruction of the individual's property
- Hurting someone the individual cares about
- Not liking someone

Attitudes Favoring Violence

- Admiring people who know how to fight with their fists (no weapon)
- Admiring people who know how to fight with weapons
- Believing people should defend themselves or those they care about at all costs
- Believing that not defending oneself shows cowardice
- Believing that fighting is the only way to defend oneself or those one cares about
- Believing that involving adults in a dispute will make matters worse
- Believing one must be aggressive to establish the expectation that the individual will fight when necessary
- Believing fighting will impress others
- Thinking fighting makes one important or powerful
- Enjoying fighting and/or hurting others
- Believing that fighting has no negative consequences

Weapon Possession at School or on School Grounds

- Type of weapon
  - Knife
  - Brass knuckles
  - Shot gun
  - Handgun
  - Rifle
  - Club or bat
  - Brick
  - Board
  - Box cutter
  - Scissors
  - Explosives
  - Mace
  - Whistle
  - Pepper spray
  - Razor blade
  - Numchucks
  - Lead pipe
  - Taser
- Method of procurement
- Place of procurement
- Reason for obtaining or carrying
- Rounds held in handgun when fully loaded
- Size of gun barrel
- Frequency of carrying
- Location of storage
- Gang involvement in gun procurement
- Source of weapon
- Cost of weapon

Source: Adapted from Hamilton Fish Institute on School and Community Violence Web site, 2004; http://www.hamfish.org/

ing of their lives. If children do not believe that adults can keep them safe and if they lack a belief in a meaningful life, children can be lured into gang membership, gun cultures, and ongoing violence. Garbarino recommends public policies that support parents' capacities to move out of areas of violence and to protect their children, that improve access to early treatment for traumatized children, and that empower communities to create safe havens for children (particularly after school hours end) and to reduce violence.

When violent behaviors are displayed by members of racial and ethnic minorities, many researchers believe that these behaviors must be addressed within a context that is sensitive to the specific culture of these groups and that takes into consideration the multiple factors that uniquely affect these students (Cartledge & Johnson, 1997; Cartledge & Loe, 2001; Cartledge, Sentelle, Loe, Lambert, & Reed, 2001; Kea, Cartledge, & Bowman, 2002; Lo & Cartledge, 2006). In general, effective school violence prevention efforts must include a focus on the teacher and her or his skills and experiences, coupled with an emphasis on the supports available to teachers who deal with aggressive, challenging students (Keller & Tapasak, 1997).

Well-managed schools, which are free of violence, take many different forms and can cater to diverse types of students. For example, researchers have studied effective alternative schools for at-risk, troubled students; successful magnet schools that mix gifted and talented students from widely ranging socioeconomic and ethnic backgrounds; and successful vocational schools for students who are learning career-relevant skills in place of an all-academic curricular focus (McLaughlin & Talbert, 1990; Talbert & McLaughlin, 1999). What all of these schools had in common was an emphasis on personalized instruction. Teachers met and interacted frequently with students outside of the traditional classroom setting. They heard students' views, and they established a cooperative atmosphere and maintained it through daily interactions, school rules and procedures, daily meetings between small groups of students and the teacher, and after-school activities in which both teachers and students participated.

THINKING PRACTICALLY

How can schools reduce school violence? Is a get-tough approach better than a go-easy approach?

SUGGESTION: Unfortunately, there are no easy answers when the topic is combating school violence. In some cases, a tough approach is necessary; in others, a more relaxed approach may work. If the neighborhood is violent and the students are afraid, a tougher approach is probably indicated. If threats of violence are rare, a less stringent approach might work.

*i*MPLICATIONS FOR TEACHING

- **Cultivate good communication skills that can be applied in diverse educational settings.** Tell other teachers what has worked and why. Read articles and books about good communication skills, take a course or workshop, watch videos, and so on.
- **Use "I" messages to explain the consequences of students' misbehaviors in a nonjudgmental manner.** If students feel they are being attacked, they may respond by fighting back or withdrawing instead of by understanding their error and correcting it.
- **Be firm, clear, direct, and assertive when dealing with student misbehavior.** Do not allow yourself to be perceived as a pushover or a lightweight. At the same time, do not behave like an army drill sergeant, either.
- **Decide whether a problem is owned by you or the student before taking steps to solve it.** You cannot solve every problem students have: You are one individual doing a tough job, and you must learn to distinguish what is and what is not your responsibility.
- **When the student owns the problem, use active listening to express concern and to give support.** Some students may have no one in their lives who listens to them. You can help these students simply by caring enough to share your time and by offering a sympathetic ear.
- **When you own the problem, use the no-lose method to achieve a solution.** This approach makes every party to the problem feel positive about the situation. If time permits, involve students in the solution—the result will last longer and be more effective than your unilateral response would have been.
- **Respond immediately to potential threats of violence; involve other teachers and administrators or other appropriate authorities in solving the problem.** Never assume that you are overreacting when students' and teachers' safety is at issue. Never take risks with threats of violence.

Special Approaches to Classroom Management

Researchers and practitioners have developed several formal systems for classroom management (see Chapters 7 and 10). These systems are best suited to specific types of classrooms and situations.

THINKING CREATIVELY

Design three group consequence systems for use in second-, sixth-, and tenth-grade classrooms, respectively.

SUGGESTION: Second grade: Students must amass points as a group to earn a day trip to a nearby zoo. Sixth grade: Students must earn "perfect attendance" points (with allowances made for illness documented by a doctor's note) for a class trip to an amusement park. Tenth grade: Students must raise money for muscular dystrophy or another charitable organization or cause by walking a designated number of miles (summed for the class) in a walkathon.

GROUP CONSEQUENCE SYSTEMS

The first of these formal systems for classroom management is called a **group consequence system.** In this system, which also has been used with adults in business settings, the teacher keeps track of students' behaviors by adding points to a total. The class can work toward earning a desired privilege by trying to amass a given number of points. For example, the teacher may promise a field trip, extra free time, or a class party. Charlie Grenda used a group consequence system to encourage his students to accumulate points toward an overnight camping trip to a wildlife preserve.

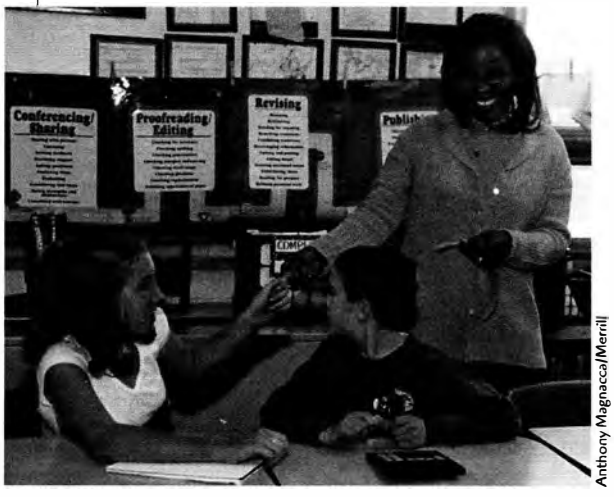
A group consequence system works best when students are motivated to retain the approval of their peers. Sometimes, one wise-cracking student who is a real troublemaker can be quieted by pressure from his peers when they perceive he is losing points for the entire class toward a desired objective. Students in these situations may become more cooperative and may unite to reach a group goal. Unfortunately, there is another side to using a group consequence system, and it can lead to problems. If a class troublemaker does not care about the opinions of his peers, punishing the other well-mannered students because of her behavior is unfair and can lead to resentment. This resentment can be directed by all the students toward the teacher, and by the well-behaving children toward the troublemaker, thus worsening her problems. For these reasons, when using a group consequence system, remain alert to the specific class dynamics and ensure that this system is fair and is helping to improve the students' behavior.

Also remember that young students often have trouble waiting a long time for desired rewards. As we discussed in Chapter 7, a teacher should choose a schedule of reinforcement that provides rewards to students in a meaningful and effective way. Young students, in particular, can become frustrated if they have to wait more than a few days to receive a reward; such frustration can be counterproductive and can undermine motivation and hinder performance.

TOKEN REINFORCEMENT SYSTEMS

The second formal system for classroom management is a **token reinforcement system** in which students earn tokens—points, stars, or other tangible items—for good behavior or classroom achievement (Self-Brown & Mathews, 2003). The students collect tokens and later exchange them for a reward, such as a gift or privilege. The rewards that work best depend in part on the age of the students. Young students can be motivated to receive stuffed animals or other small toys. Older students may value free time or the opportunity to substitute a paper topic of their choice for a teacher-generated topic.

Daily points for good behavior help motivate this teacher's students and encourage good classroom behavior.



Anthony Magnacca/Merrill

To acquaint students with the token system, use it aggressively at the start, by handing out tokens often and giving frequent opportunities for their redemption. Later, scale down the number of tokens you give out and make the rewards somewhat more difficult to earn. By gradually scaling down the frequency of use of the system, the system will become more manageable in the long run. If parents are willing to help out, they can be involved in the token economy by providing rewards at home for tokens earned.

You may think that developing and maintaining a token economy is a lot of work for the teacher, and you are right. For this reason, you should use such a system only in specific and complex situations, such as when a group of students is entirely out of con-

trol, when students do not care at all about their work, or when students have had a history of failure. Token systems have sometimes worked well to shape behavior with challenged populations, such as students with learning disabilities, students with severe behavior problems, and students who have been out of the academic mindset for some time (Kehle, Bray, Theodore, Jenson, & Clark, 2000; Mottram, Bray, Kehle, Broudy, & Jenson, 2002). The extrinsic motivation provided by a token economy is often more effective than intrinsic motivators with such populations.

CONTINGENCY CONTRACT SYSTEMS

The third type of formal classroom management system is the **contingency contract system,** an agreement between the teacher and each individual student regarding the exact goal the student must accomplish to earn a reward. Both students and teachers can decide on the behaviors to be tallied and on the nature of the rewards to be earned. For example, you might enter into a contract with a student regarding the student's promise to complete assignments at a certain rate over the school year. The reward for successful completion of assignments is a grade of A for a job well done, a positive note sent home to the parents, and even a special purchase or privilege provided by the parents in recognition of the child's good performance. You must be clear about the quality of work that constitutes the successful completion or performance of a task, and make such specific criteria a part of a contingency contract system.

Each of these three types of formal management systems has its own advantages and pitfalls. Given this fact, you should not implement these systems without paying thorough attention to the possible negative consequences of their use. Recall from Chapter 7 that extrinsic motivators can sometimes undermine intrinsic motivation; in other words, children motivated to win points or tokens are often less apt to learn to enjoy the experience of learning. These systems also have other potential problems. For example, if the teacher cannot purchase small rewards for students with school reserve funds, or if parents do not hold up their end of the bargain by rewarding children at home, you can find yourself dealing with even more problems rather than happy students. For these reasons, if you are considering using a token economy or contingency system, speak to other teachers and your principal—and to the school or district psychologist, if available—to work out potential problems before they arise.

THINKING PRACTICALLY

How would you feel about participating in a contingency contract system for work in your educational psychology course? Place yourself in the shoes of a student participating in such a system, and ask yourself how you would perceive the experience.

SUGGESTION: Many students like the control that comes with such a system, because it puts them in charge of their own destiny in a course. Only you can answer how you would react to this approach, however.

*i*MPLICATIONS FOR TEACHING

- **Try group consequence systems.** These management techniques can help unite a class in achieving a common goal and harness the power of peer pressure to gain the cooperation of every student. They will also help you instill an attitude of cooperation among students and an atmosphere of enthusiasm.
- **For younger students, and for students with physical, behavioral, or learning challenges, use token reinforcement systems.** These reward-based systems can often help get students on track. Have a variety of management techniques at your disposal and choose the ones that best fit each situation. Be willing to switch if an approach is not working. Phase these systems out over time.
- **For older students, use contingency contracts to keep motivation high and attention focused on meaningful learning goals.** By showing students they are in charge of their own learning and rate of progress, you can empower them to do their best.

SUMMING IT UP

WHY UNDERSTANDING CLASSROOM MANAGEMENT IS IMPORTANT TO TEACHERS

- Because of societal violence, drug use, teenage sex, and a decline in students' respect for authority, managing students has become increasingly difficult for teachers.

Classroom management is defined as a set of techniques and skills that allow a teacher to control students effectively so as to create a positive learning environment for all students.

- The key goal of classroom management—to create an environment that maximizes student learning—generally means creating as much quality learning time as possible and helping students gain in maturity so they learn how to manage themselves effectively. Allocated time is the time a teacher earmarks and plans to use for learning. Engaged time is the time that is actually spent on learning.

HOW EFFECTIVE TEACHERS MANAGER THEIR STUDENTS

- The most effective teachers are "with it"—that is, they are attentive to everything going on around them in the classroom. They are also able to supervise several activities at once, and they create momentum in classroom activities, ensuring smooth transitions from one activity to the next. Effective teachers make an effort to involve every student in the class in what is going on and to generate enthusiasm for learning.
- Effective teachers criticize constructively, focusing on inappropriate behaviors rather than criticizing the person performing them. Effective teachers also are well prepared the first day of class and develop rules and procedures ahead of time.
- Good plans for classroom management take into account the developmental age and maturity level of the students. Elementary school students are less familiar with school demands, but generally more compliant, than older children. Middle school children require special attention because of the biological and social ramifications of puberty. High school students are generally easier to manage because they have completed puberty and are familiar with the requirements of schooling.

DEVELOPING AND IMPLEMENTING RULES AND PROCEDURES

- When drawing up rules and procedures, teachers should consider the general school environment as well as the relevant histories of the students. When students disregard the rules, teachers should respond with progressively more serious consequences.

MAINTAINING CONTROL AND PREVENTING PROBLEMS

- Teachers should strive to develop communication skills and work to see themselves as their students see them. "I" messages are a method for responding to student misbehavior by stating how the misbehavior affects the teacher's ability to do her job and how the teacher feels about the misbehavior.
- Assertive discipline is a technique for dealing with misbehavior in which teachers make their expectations clear, firmly state the consequences for misbehavior, and then follow through with these consequences. The assertive style is preferable to either a hostile style or a passive style. To invoke assertive discipline, a teacher should make sure the students know how to behave, provide positive reinforcement for good behavior, and use a discipline plan to respond to misbehavior. The paraphrase rule involves summarizing in the person's own words what the previous speaker said.
- Before deciding on a course of action for dealing with a problem, a teacher must decide who owns the problem—the teacher or the student. Student-owned problems are not the teacher's responsibility to solve, but active listening by the teacher can help the student come to terms with the problem. Teacher-owned problems can be resolved through the use of the no-lose method, in which both student and teacher work out a compromise solution that blames neither party.
- Coping with violence in school is a major challenge for teachers. Use of fair and clear rules and procedures will help, as will allowing students to have input into setting rules and procedures.

SPECIAL APPROACHES TO CLASSROOM MANAGEMENT

- Group consequence systems can help with managing certain classes, particularly those containing children with physical, behavioral, or learning challenges. In this type of system, points are amassed by the entire class, based on the behavior of individuals, and the class wins a desired goal when a certain number of points is earned.
- Token reinforcement systems allow students to earn tokens individually and then exchange them for rewards.
- Contingency contract systems are agreements between students and teachers that promise specific rewards for a given set of accomplishments—such as an A for a certain quantity of work done well and on time.

KEY TERMS AND DEFINITIONS

- **Active listening** Type of listening in which a teacher encourages a student to state his or her problems fully and listens in an active and concerned manner. Page 417
- **Allocated time** Time a teacher earmarks and plans to use for learning. Page 395
- **Assertive discipline** Method of responding to misbehavior that is clear, firm, and direct; it involves stating the consequences for misbehaving and following through with those consequences as appropriate. Page 415
- **Classroom management** Set of techniques and skills that allows a teacher to control students effectively so as to create a positive learning environment for all students. Page 392
- **Contingency contract system** Agreement between a teacher and each individual student regarding exactly what the student must accomplish to earn a reward. Page 425
- **Discipline** Teacher-initiated actions designed to minimize student behavior problems and distractions so as to create a maximally effective learning environment. Page 393

- **Engaged time** Time that is actually spent on learning. Page 395
- **Group consequence system** System in which the teacher keeps track of students' behaviors by adding points to a total, or through some other method. Page 424
- **"I" message** Clear, direct, assertive statement about exactly what a student did that constitutes misbehaving, how the misbehavior affects the teacher's ability to teach, and how the teacher feels about the misbehavior. Page 415
- **No-lose method** Method of resolving conflicts in which teacher and student work out a compromise solution that allows neither party to lose. Page 418
- **Overlapping** Supervising several activities at once. Page 397
- **Paraphrase rule** System designed to promote accurate communication in which, before speaking, the teacher or student summarizes in her or his own words what the other person said. Page 417
- **Procedures** Methods for accomplishing classroom activities in an orderly manner. Page 407
- **Rules** Statements that specify acceptable and unacceptable behaviors in the classroom. Page 407
- **Token reinforcement system** System in which students earn tokens—points, stars, or other tangible items—for good behavior or classroom achievement. Page 424
- **With-it-ness** Quality of being observant and attentive to everything going on around the teacher in the classroom. Page 397

BECOMING AN EXPERT: QUESTIONS AND PROBLEMS

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

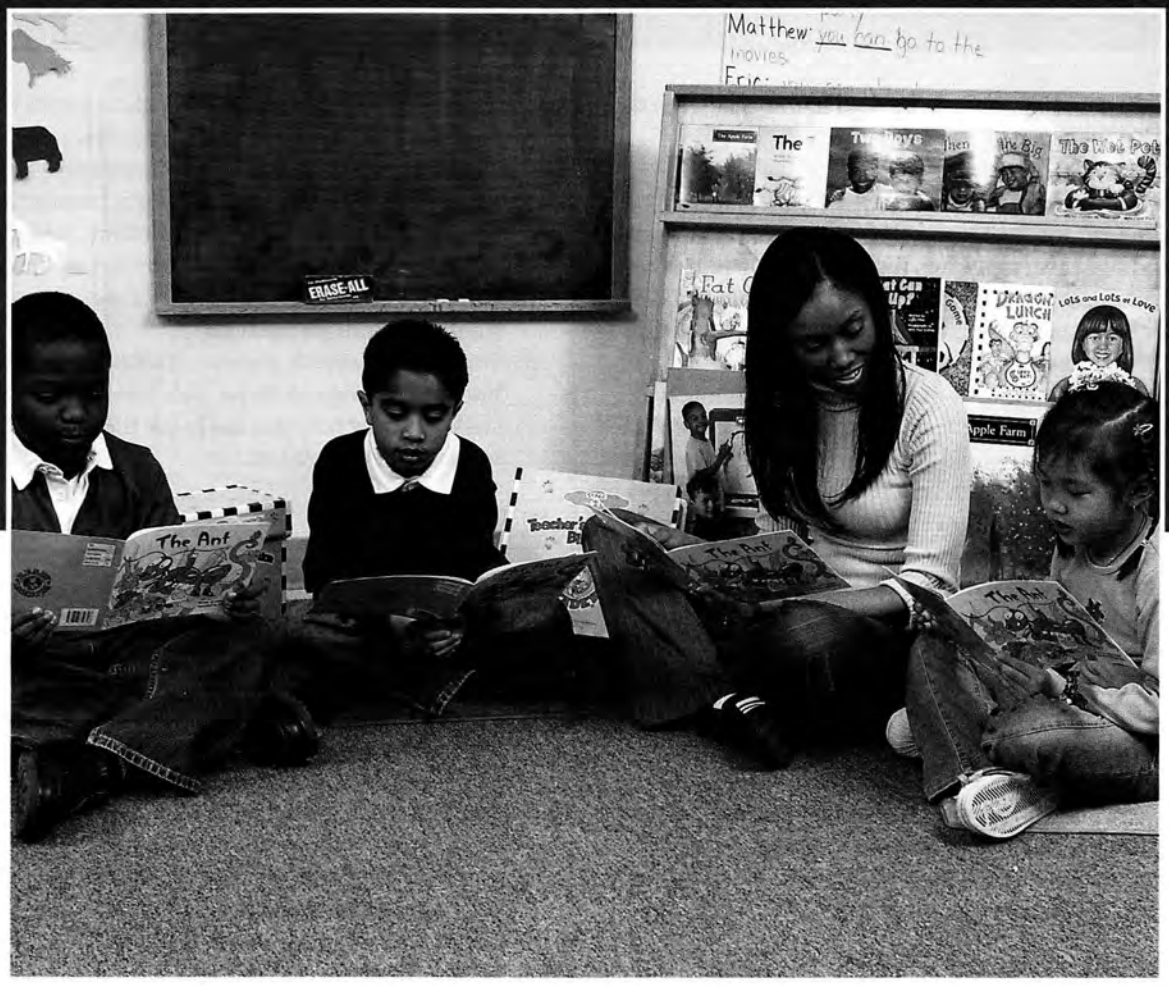
1. How can you deal with a first-grade student who cries and acts distressed when his parents drop him off at school every morning? Which steps might you take with the student and with his parents to make being left at school less traumatic for him?
2. You are a new fourth-grade teacher. When might a token economy be effective with your students? Which types of tokens would you consider using? How would you determine which type of token and which types of reward would be most effective with your students?
3. One of your second-grade students is acting withdrawn and upset over her parents' divorce. What can you do to ensure that her schoolwork does not suffer?
4. Your room full of third graders is overly excited about a field trip, and you are having difficulty calming them so they can collect their belongings and board the bus. Which specific steps might help in this situation?
5. You are a trained fifth-grade teacher who has been assigned unexpectedly to a first-grade class. You have a definite idea about the rules and procedures you would like to implement. Which steps might you take to make implementation go smoothly?

IN MIDDLE SCHOOL

1. What should you do about a student who acts out often and threatens other children in your seventh-grade social studies class?
2. A girl in your seventh-grade language arts class has developed a disabling crush on another student and has started to daydream all of the time. You recognize that this behavior is normal, but you want to keep the girl on-track. What should you do?
3. How can you help a new entering class of sixth graders at your school, who must get used to switching classes for the first time? Which steps might you take to make these students feel comfortable with this and other major changes in the school environment?
4. One of your classes of eighth graders contains a particularly belligerent and unruly student. How should you respond to defiant behavior by this student, after you have tried and failed on several previous occasions to control the student?
5. One of your seventh graders completely ignores his homework assignments for your foreign language class. Describe how you might use the no-lose method to deal with this student.

IN HIGH SCHOOL

1. You are teaching chemistry and physics to four classes of tenth graders. How might you use a contingency contract system to enhance the amount of time students spend studying and to increase their exam grades and frequency of participation in class?
2. Describe how you could use assertive discipline to cope with a belligerent student who continually talks out of turn in your eleventh-grade social studies class.
3. You are a tenth-grade teacher with four classes of fairly tough students who cause you to be exhausted at the end of the day. Name three situations in which you should call your students' parents in response to student misbehavior. Name three situations that do not require parents to be called.
4. Your eleventh-grade science class contains three very bright students who are becoming bored and tuning out school. How can you make your science instruction more challenging for these students? Which steps might you take to help these students?
5. Which steps might you take to help a group of urban twelfth-grade students whose lives are marked by violence at home and in their communities? What role can school play in breaking the cycle of poverty for these students?


Matthew you can go to the
movies.
ERASE-ALL
The Ant
Dragon Lunch
Lots and Lots of Love
Apple Farm

Classroom Teaching 12

Why Understanding Classroom Teaching Is Important to Teachers

Characteristics of Expert Planning

The Role of Flexibility in Planning

Principles of Teacher-Centered Teaching

The Role of Planning in Teacher-Centered Instruction

Direct Instruction Methods

Teaching and Reaching Every Student

Limitations of Direct Instruction

Principles of Student-Centered (Constructivist) Teaching

Constructivism: A Focus on Diversity and Motivation

Creating Constructivist Learning Environments

Learner-Centered Psychological Principles

The Role of Planning in Student-Centered (Constructivist) Teaching

Methods for Teaching Constructively

THE BIG PICTURE

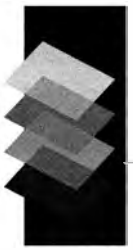
To help you see the big picture, keep the following questions in mind as you read this chapter:

- How can educational psychology help teachers decide how to present material most effectively? What practical, useful information can this book provide to a teacher for day-to-day teaching?
- How important to effective teaching are specific plans and learning objectives? What is the precise role of learning objectives in classroom teaching?
- Which age-related considerations should teachers be aware of when planning their instruction?
- What are the strengths and weaknesses of the direct-instruction approaches to teaching? When is the use of individual project work, small-group activities, and whole-class discussion appropriate, and what are the strengths and weaknesses of each approach?
- How can a teacher use homework as an effective teaching tool? How should homework assignments differ across grades?
- What role can computers play in effective instruction?
- What does the concept of student-centered or constructivist teaching mean? What are the strengths and weaknesses of group discussions, whole-group activities, small-group work, and peer instruction?
- How can peer instruction be used effectively? How should it be structured for classes for a range of students?

Lauren Hodges contemplated the rough draft of her syllabus as she prepared for her first day in a new job as a high school language arts teacher. She understood what material she was supposed to cover, and she had a good idea of what the students were expected to know to do well on the statewide mastery tests, an important goal of their English instruction. But Lauren was not so sure about *how* to teach the students the material: Should she lead standard lectures, assign whole-class activities and discussions, or even break the students up into small groups to do their work? Most of her time in college and graduate school had been spent learning about the English language and literature. Although she had taken a few courses that covered hands-on aspects of teaching, she was having trouble applying much of what she had learned. Now, as Lauren tried to recall how her teachers had presented material to their classes, she found it was tough to transform memories based on her own experiences as a student into a practical plan for teaching her own classes.

Lauren telephoned Amina, an experienced teacher from her school, and asked for advice. Amina suggested that Lauren start the first class with a group discussion and finish up with an individual activity that the students could start during class and finish for homework. She also recommended that, the next day, Lauren begin with a lecture and then assign small-group project work. For each day of the week, Amina had another suggestion about how to structure the presentation of material so as to keep the class mentally involved in the learning experience. Lauren was impressed and asked Amina where she had gotten this invaluable information. Amina answered that, over the years, she had intentionally experimented with a variety of approaches in her high school and middle school classes, and she had found which ones work best for students of each age group. Although she was really confident about the content she was supposed to teach, Lauren realized she still had a lot to learn about how best to structure her teaching.

What would you do if you were Lauren? Deciding on the best way to present material to students can be a confusing prospect. The topics covered in this chapter will help you structure your teaching appropriately and creatively, so your students remain interested and motivated to learn. In this chapter, we review a variety of teaching methods, explaining the strengths and weaknesses of each approach. You will see that what you have been learning so far this term about educational psychology will help explain why some methods work better than others. The science of educational psychology provides the foundation for effective classroom teaching. When you have finished your study of the chapter, you will be acquainted with a whole array of techniques you can use in your own classroom teaching.



Why Understanding Classroom Teaching Is Important to Teachers

In our discussion in Chapter 1 about the characteristics of effective teachers, we noted that expert teachers share three qualities that differentiate them from novice teachers. First, experts have more knowledge: Expert teachers know more strategies and techniques for teaching, and compared to novices they use their knowledge more effectively to solve problems. Second, experts are more efficient: Expert teachers do more in less time than novices. Third, experts have more insight: Expert teachers are more likely to arrive at novel and appropriate solutions to problems than novices.

CHARACTERISTICS OF EXPERT PLANNING

When you think about the characteristics of expert teachers you have known, most of the examples that come to your mind probably involve teachers leading a class. This is not surprising: After all, teaching classes is at the heart of what teachers do. In fact, most of the topics covered in this textbook have focused on how teachers can improve the processes involved

in student learning and comprehension—and student learning begins with teachers teaching. As Lauren Hodges has learned, a key aspect of becoming an expert teacher is understanding the psychology of teaching and learning, and developing knowledge, efficiency, and insights relevant to classroom teaching (see, for example, Berliner, 2004). Lauren has also learned that there is more to teaching than instruction—she needs practical skills to help her interact with students, parents, administrators, and other teachers (Stemler, Elliot, Grigorenko, & Sternberg, 2006).

A solid understanding of the many ways to conduct a class will improve your efficiency and flexibility, allowing you to accomplish more with students in less time. In addition, knowing a variety of teaching techniques will help you hone your teaching instincts and develop more insightful solutions to problems.

In this chapter, we discuss the principles of learning presumed to underlie the success of different approaches. Teacher-centered learning approaches, such as direct lecturing and recitation (questioning of students), are related to a behavioral view of learning (see Chapter 7). According to this view, students are passive recipients of knowledge imparted to them by teachers. For some subjects and students, direct instruction works very effectively. Student-centered learning approaches, such as activity-based learning, project work, and peer instruction, are related to a cognitive view of learning (see Chapter 8). According to this view, students come to the learning experience with their own knowledge, ideas, and values that cause them to construct what they are learning in their own minds, so that different students will learn different things from the same lesson. For some situations, student-based learning works best.

THINKING ANALYTICALLY

How does your current view of teaching expertise compare to your view at the beginning of this course? How have your ideas about teaching expertise changed, and what about this course has changed them?

SUGGESTION: Think back to your views at the beginning of the semester, and ask yourself how what you have learned in this course and read in this book have influenced your thinking about teaching. For example, perhaps you now recognize that teaching requires hours of careful planning and preparation. Or perhaps only now you recognize how many different techniques teachers consciously use every day.

THE ROLE OF FLEXIBILITY IN PLANNINNG

As you read this chapter, making mental lists of techniques you can use in planning your own instruction, remember that planning is wise, especially for novice teachers, but flexibility is also important in meeting student needs. An overly rigid instructional plan can be worse than no plan at all.

An important characteristic of expert teachers is that they rely heavily on planning (see Chapter 1). Experts differ from novices in their tendency and ability to plan what to do, monitor their progress, and evaluate their performance. When expert teachers plan how to present a lesson, they think carefully before starting to solve the problem: They think about which approach is more likely to work, or about how one approach compares to another one they tried before that failed. An expert science teacher deciding on an approach for a lesson on photosynthesis is likely to review past years' approaches and evaluate how these approaches worked, asking questions such as these: Which approach got students most interested? Which led to the best understanding and performance, and why? What can I do to make this year's lesson the best ever?

In general, experts spend more time than novices on trying to understand the problem to be solved and then on planning effectively (Sternberg, 1981b, 1981c). Expert teachers rely on their base of accumulated knowledge and experience, and consequently they think about curriculum planning, instruction, classroom management, and communication issues differently from less experienced teachers (Hogan, Rabinowitz, & Craven, 2003). In one study of how expert and novice mathematics teachers plan their lessons, researchers found that the expert teachers did much more long-term planning than the novices, and the experts' plans fit the day's teaching into the overall goals and organization of a given chapter and the course in general (Borko & Livingston, 1989). Experts' plans were more flexible and responsive to the different directions the class discussion might take; novices' plans were more rigid. As a result, novices became flustered when events in the classroom did not exactly follow their plans.

The lesson for the developing teacher is that you must understand the array of available techniques and plan for their use while allowing room for changes if your plans fall short. Another lesson is to pay attention to this textbook and to your teachers now, because research has shown that the education received by teachers-in-training is useful when they begin their career at the front of a class (Borko et al., 2000). Today's teachers-in-training have many tools at their disposal when learning how to plan lessons, including computer programs designed for this purpose (Wild, 2000).

THINKING ANALYTICALLY

Based on your own experiences and what you have learned so far in your educational psychology course, name three ways students can use planning to enhance their learning.

SUGGESTION: Students can plan their study time to take place when they are best able to learn without distractions, they can plan study groups with other students, and they can plan and tailor current instruction to meet future goals, including their career goals.

Principles of Teacher-Centered Teaching

When most of us think about teaching and about our own experiences as students, we remember examples of teachers giving lectures, asking questions, leading discussions, and generally controlling events in the classroom. This traditional perspective on teaching views the teacher as the person with the knowledge to impart, and the students as the people who learn the knowledge imparted by the teacher. This approach is aptly referred to as **teacher centered.** In this section, we first discuss how to organize and plan effective teacher-centered instruction and then consider specific teaching methods to use in the classroom.

THINKING CREATIVELY

Can you think of any other ways to conceptualize the teaching and learning process, in addition to the teacher-centered approach?

SUGGESTION: One way is to consider how students can best comprehend what they learn and how they can become active creators of knowledge, such as during project-based and other student-centered learning approaches.

THE ROLE OF PLANNING IN TEACHER-CENTERED INSTRUCTION

Exactly what do your teachers do as they sit at home, like Lauren Hodges, planning tomorrow's lesson? How do they know which topics to cover, and in what degree of depth? How do they decide which information to teach and which to leave out? Do they follow a syllabus, and if so, where does this semester-long instruction plan come from?

■ **INDIVIDUAL DIFFERENCES IN PLANNING** Good teaching depends on good planning—planning that is done long before a teacher ever steps in front of a class to lead a discussion or give a demonstration. Individual teachers' preferences often influence how they plan their instruction. One teacher we know confided that he spends more than twice the allotted time on science with his sixth-grade class because he has always particularly loved science. His students may be getting terrific instruction in science, but they are losing out on language arts, a subject he has never enjoyed. Although it is human nature to enjoy teaching some subjects more than others, effective planning and time allocation help teachers avoid short-changing their students on certain subjects.

THINKING PRACTICALLY

How might students' preferences for some subjects over others influence what a teacher covers in class?

SUGGESTION: If students are interested and engaged in a topic, teachers often spend more time on it in class because the students actively participate in classroom discussions and are more motivated to learn.

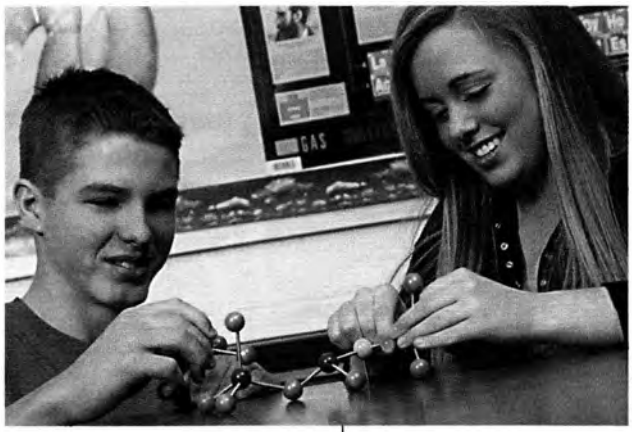
What time frames do teachers' plans occupy? First, you must decide which general topics to cover. Sometimes, schoolwide or districtwide policies about curricular content take precedence when you are making this decision. At other times, you have more discretion in deciding what to cover. Once you decide on a general topic, you must then develop teaching plans that chart instruction over the months and weeks of the school year. Next, based on this level of information, you plan what to teach from Monday through Friday. Obviously, if the general plans at the semester or month level are ineffective, it is difficult to create coherent instruction on a day-by-day basis that serves the overarching goals of instruction in each discipline.

■ **LIMITATIONS OF PLANNING** Like Lauren Hodges, you may find yourself persuaded by the value of good planning. Before you plan your next year of teaching, however, bear in mind that expert teachers recognize the limitations of plans as well as their strengths. Suppose you have crafted a lesson plan that fits a lecture, a demonstration, and a group discussion into one class period. You know that as long as you make good progress with your plan, the students will make it through all of the material, just in time for next week's test. The pressure is on: You talk quickly, holding the students' attention as you introduce the topic and set up your demonstration. But several students in the back of the room start passing notes and whispering to one another. Students in the front row appear confused. Suddenly you realize your lesson plan is not working.

Wise teachers change their tactics at this point, even if it means abandoning the plan. They might decide to cover only half the material in one lesson and spend more time elaborating the introduction. They might attempt to relate the topic to the students' daily lives, or ask a few open-ended questions about the topic to involve the students. Ineffective teachers tend either not to notice their plans are failing or press on with the plan anyway because they feel they must. Their students may become completely lost, but as long as the plan is accomplished, the teacher feels successful.

Research has shown that students learn more when their teachers remain flexible in their planning and in their allocation of time instead of adhering rigidly to their plans (Schwartz, Lin, Brophy, & Bransford, 1999; Shavelson, 1987). The issue of flexibility is key. Effective teachers recognize when they must change their plans, regroup, and move on, rather than sticking with a plan that is obviously not working (Zimmerlin & Nelson, 1999).

The process of planning instruction evolves as you grow in competence and experience. At the beginning of your teaching career, you may feel more secure when you create detailed teaching plans. By comparison, expert teachers, who tend to create more succinct and flexible plans, draw on their extensive content knowledge, pedagogical knowledge, and pedagogical-content knowledge (as discussed in Chapter 1). There is no one right way to approach planning. Each person has her or his own approach, and there are many ways to plan successfully. We next review two types of planning approaches that you can use as the basis of your own instructional system.



Index Open

An imaginative first-year teacher explains complex concepts to her students with the use of simple manipulatives.

■ **LEARNING OBJECTIVES** Every chapter of this book has opened with a list of questions—that is, specific learning objectives—to guide you as you study the chapter. **Learning objectives** are clear descriptions of educational goals. They may be written in the form of questions or statements about goals to be achieved. Like the list of items to be purchased that you carry to the supermarket or the list of chores that you draw up on Saturday morning, lists of learning objectives structure how the teacher and student will spend their time so as to accomplish what is on the list.

SPECIFIC OBJECTIVES. Robert Mager (1975) defined one classic, still popular system for teachers to use in writing instructional objectives. Mager's perspective is that instructional objectives should be action oriented and specific. He believed that objectives should describe, first, specifically what students should do to demonstrate their achievements and, second, how teachers can recognize student success in demonstrating their achievements. Mager thought of objectives as ideally containing three aspects:

1. The objective should describe the behavior the student is supposed to engage in—for example, "Memorize a list of 20 vocabulary words."
2. The objective should describe the conditions under which the student will perform the behavior—for example, "Complete this assignment by next Monday morning."
3. The objective should define what behaviors constitute evidence that the objective has been mastered—for example, "Attain a score of 18 correct on the quiz."

These specific types of objectives can take a long time to develop, but once defined they can assist motivated students in mastering the material.

GENERAL OBJECTIVES. Norman Gronlund (1991, 1993) tackled the problem of defining good objectives from the opposite perspective. Instead of seeing good objectives as action oriented and specific, Gronlund sees them as general, focusing on cognitive goals such as "compare and contrast," "understand," and so on. The student should recognize that the goal is to understand and reason with overarching concepts and ideas. To make the goal more concrete, and to create a method for charting student progress toward the goal, the teacher describes which types of student behaviors demonstrate the essential understanding and reasoning. Students should understand that the specific tasks they are accomplishing are just a subset of many similar tasks they could tackle with the ability to think and reason in a new domain.

USING OBJECTIVES. The likelihood of achieving learning objectives depends, not surprisingly, on their appropriate use. Highly organized texts and teaching aids may reduce the need for teacher-defined objectives, as students will get all the objectives they need from

THINKING CREATIVELY

Describe three different types of plans you might create for teaching the same lesson.

SUGGESTION: For a lesson on evolution, you can: (1) begin with pictures of museum specimens long since extinct, asking students what they think happened to the animals and why; (2) ask students to scan the Web for information on horse evolution because the fossil record for horses is unusually well preserved; or (3) bring to class plastic replicas of human skulls from various evolutionary stages and ask students to arrange them in order from oldest to most recent.

THINKING PRACTICALLY

What are your general and specific learning objectives for this course?

SUGGESTION: Think about your ultimate goals, including your goals for this semester and your goals over the next few years. How will you use what you are learning in this course? Think about your objectives in terms of your planned use of the material.

Anthony Magnacca/Merrill

Two elementary students conduct a study on a field trip.

the printed material. But what about a class trip to a museum? Here, the objective is far from obvious. If a teacher defines a specific objective, or a general objective with specific behaviors that demonstrate it, the fun experience can become a learning experience. Consider the case in which the teacher distributes a handout that asks students to find, sketch, and label at least two animals that display convergent evolution. A scientist we know was given just this assignment before a class trip to the American Museum of Natural History. The lessons learned about biology and evolution that followed remain clear 30 years later.

One point to bear in mind is that effective objectives can be expressed as simple statements or as questions. Either format works fine as long as the learning goals are made clear. Questions can *sometimes* work better with relatively younger students who might become confused by more complex statements in sentence format.

LIMITATIONS OF OBJECTIVES. Although objectives are useful, they are not without critics. Poorly written objectives can needlessly confuse students before they have a chance to master a concept: For example, the objectives "Use the following formula whenever you can to solve 20 mathematics problems" and "Write an essay about two eras in American history" are hard to understand—and even harder to achieve. Because it is easier to write short objectives describing basic tasks and learning goals, it is tempting to ignore the real goals of learning in favor of the simpler goals that more easily translate into objectives: "Memorize these 10 mathematical formulas" or "List all the main characters in *Moby-Dick*." If students simply memorize lists of objectives and a few examples of each objective in action, they may accomplish little meaningful learning. Also, some students master the material quickly and will be ready to move past such objectives early on in the school year.

Whether they specify objectives or not, most teachers will have some guidelines about what constitutes acceptable, good, and excellent student performance. Students will infer their teachers' objectives by examining which types of classwork, seatwork, and homework they are assigned; which types of tests they are given; and how their grades are computed. Unfortunately, students often infer objectives too late to be optimally useful; thus, as a teacher, you should always state your objectives early and often.

Objectives obviously play important roles in student learning. How can objectives be made as effective as possible? First, make sure students understand the objectives presented. Expert teachers ask students to repeat the intent of objectives and to provide examples of behaviors that indicate accomplishment of the objectives. Expert teachers also work with students to make objectives authentic to the learning experience—and to ensure that measuring them focuses on meaningful behaviors. In writing objectives, experts avoid phrases that are trite or clichéd, such as "Students should do their best," "Students should work hard," and "Students should do what they are told by the teacher." And, as we discuss in the final two chapters of this book, expert teachers make sure that any tests they administer mirror the objectives. If they do not, students will question their use: "Why did I bother studying that? It wasn't even on the test!" Table 12.1 displays examples of well-written and poorly written objectives.

■ **TAXONOMIES** **Taxonomies** are systematic or hierarchical classifications of learning objectives. The point of a taxonomy is to take a collection of learning objectives and organize or group them sensibly. Ideally, a taxonomy helps you understand the higher-order concepts and skills represented by learning objectives (Moseley, Baumfield, Elliott, Higgins, Miller, Newton, & Gregson, 2006).

Benjamin Bloom developed an approach to organizing educational objectives that involves sorting these objectives into three domains: **cognitive** (focused on thinking),

TABLE 12.1 Examples of Well-Written and Poorly Written Learning Objectives

Well Written	Poorly Written
Compute the volume of a sphere.	Know how big a sphere is inside.
Name the countries of Western Europe and describe their locations relative to one another.	Know the countries in Europe.
Memorize 20 Spanish vocabulary words.	Learn more Spanish vocabulary words.
Describe the role of mythology in the development of the plot in Homer's *Odyssey*.	Describe the myths in Homer's *Odyssey*.
Describe five species of North American bats and state their habitats and habits.	Describe different types of bats.
Complete Chapter 12 of the text and work through the end-of-chapter questions.	Study educational psychology.

affective (focused on feeling and emotion), and **psychomotor** (focused on physical action). The cognitive domain is of primary interest to most teachers. We discussed Bloom's six objectives within the cognitive domain in Chapter 9 on thinking; this material is also relevant to lesson planning.

COGNITIVE OBJECTIVES. Bloom and his colleagues (Bloom, Engelhart, Frost, Hill, & Krathwohl, 1956) suggested that thinking occurs within six distinct levels, phrased in terms of cognitive objectives for education:

Level 1, *knowledge*, consists of remembering or recognizing something, either with or without true understanding of it.

Level 2, *comprehension*, consists of understanding something, without necessarily being able to relate it to other things.

Level 3, *application*, consists of being able to use a general concept in the solution of a particular problem.

Level 4, *analysis*, consists of breaking a concept down into its constituent parts.

Level 5, *synthesis*, consists of creating a new idea by combining other ideas.

Level 6, *evaluation*, consists of judging the worth or value of something, particularly as it applies in a particular situation.

Teachers often think of these levels of learning as being organized from least complex to most complex. However, they are not strictly a hierarchy (see, e.g., Pring, 1971; Seddon, 1978), nor do they represent the only taxonomy that you might use for classifying aspects of thought. In fact, many teachers believe that younger children should be challenged to perform at relatively higher levels of mental operations in Bloom's taxonomy. Nevertheless, this taxonomy is useful for understanding the process of thinking, because its terminology is clear and it describes different types and goals of thinking.

In the past, Bloom's taxonomy has been used as a metacognitive framework for student-centered college-level management classes, in which student behavior is used to infer students' level of cognitive achievement (Athanassiou, McNett, & Harvey, 2003). Use of these taxonomic levels has also been shown to promote higher-level learning and achievement in rural high school students in India (Sharma, 2000). Bloom's basic taxonomy has even been revised to reflect the demands of thinking that will be required in our society in the future (Passig, 2003). Table 12.2 shows how a social studies teacher might use this taxonomy to generate objectives for a course and to evaluate whether her test questions measure a range of different types of thinking about colonial America.

Today, Bloom's taxonomy is less influential than it used to be. Some teachers view it as simply suggesting how students think, rather than as being a true psychological model of how

TABLE 12.2 Examples of Bloom's Taxonomy and Test Questions Assessing Each Element

1. Knowledge
Betsy Ross sewed the first American flag in what year?
What was thrown overboard in protest at the Boston Tea Party?
What was the name of the monarch in England at the time of the American Revolution?

2. Comprehension
Why did Betsy Ross sew the first American flag?
Why did the Boston Tea Party take place?

3. Application
Describe the role of human feelings such as jealousy, loyalty, and desire for autonomy in the American Revolution.

4. Analysis
Describe each stage of the American Revolution and relate each stage to what happened before it and after it.

5. Synthesis
What did the French Revolution and the American Revolution have in common? How did they differ?

6. Evaluation
Analyze how the American Revolution both helped and hindered the development of culture and daily life in the newly emerging country.

THINKING ANALYTICALLY

What are the advantages and disadvantages of taxonomies? How might you use taxonomies to improve your teaching? How might taxonomies interfere with good teaching?

SUGGESTION: Taxonomies organize teaching and learning; however, they may unnecessarily limit the way students naturally think about the material by creating artificial distinctions between different aspects of the same topic. Taxonomies can give students a useful idea of the breadth of what they are expected to master; however, they can also encourage students to learn only the stated aspects of the question, instead of exploring the topic more deeply and creatively.

students think. Other teachers believe that Bloom's taxonomy is still useful, but that students of today must apply their understanding differently than did students of two or three decades ago—for example, by emphasizing integration of ideas, concepts, and material. There also exist other, newer, and more detailed taxonomies of thinking (Baron & Sternberg, 1987).

In 1995, a group of educational researchers began work on revising Bloom's taxonomy. The result of their thinking is a matrix of six cognitive processes (based on Bloom's six cognitive objectives)—remembering, understanding, applying, analyzing, evaluating, and creating—that can be applied to four kinds of knowledge—factual, conceptual, procedural, and metacognitive (Anderson & Krathwohl, 2001). Not only did these researchers slightly change the order of Bloom's terms, but they also added a new emphasis on what each of the cognitive processes acts upon—specifically, any one of the four kinds of knowledge. Table 12.3 lists the categories contained in the revised taxonomy.

The social studies teacher mentioned earlier might use this revision of Bloom's taxonomy to generate objectives such as the following for her unit on colonial America:

- After reading the historical novel *My Brother Sam Is Dead* by James Lincoln Collier and Christopher Collier, students will be able to describe the emotional impact of the American Revolution. (Analyzing conceptual knowledge).
- Each student will write a fictional account of an incident that occurred during the American Revolution. (Creating conceptual knowledge—using creativity to explore and develop knowledge of the important concepts relating to and explaining the basis of the American Revolution).

TABLE 12.3 Revision of Bloom's Taxonomy

Cognitive Process Dimensions	Knowledege Dimensions
1. Remember	A. Factual knowledge
2. Understand	B. Conceptual knowledge
3. Apply	C. Procedural knowledge
4. Analyze	D. Metacognitive knowledge
5. Evaluate	
6. Create	

Source: Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives.* New York: Longman.

AFFECTIVE OBJECTIVES. Within the affective, or emotional, domain are five specific objectives that relate to different levels of commitment (Krathwohl, Bloom, & Masia, 1964):

Level 1, *receiving*, consists only of being minimally aware of something going on in the environment (for example, listening begrudgingly).

Level 2, *responding*, consists of displaying some new behavior as a result of experience (for example, smiling and laughing or otherwise showing interest).

Level 3, *valuing*, consists of showing some involvement or commitment (for example, offering to participate in the activity).

Level 4, *organization*, consists of changing one's value system to accommodate a new value (for example, joining a club or team).

Level 5, *characterization by value*, consists of behaving consistently in keeping with the new value (for example, regularly attending an activity and discussing it openly with others).

Table 12.4 shows examples of behaviors that demonstrate each of the five affective objectives.

THINKING PRACTICALLY

Early in a course, which should you emphasize more heavily—affective objectives or cognitive objectives? Why?

SUGGESTION: If students are not affectively engaged in learning (or are tuned out completely), there is no point in stressing cognitive objectives.

PSYCHOMOTOR OBJECTIVES. The last of the three domains, the psychomotor or physical ability domain, has not been as well studied as the cognitive and affective domains. Taxonomies for it do exist, however (Harrow, 1972; Simpson, 1972). These taxonomies progress from basic reflexive actions to highly skilled movements.

Despite the fact that psychomotor objectives have not received the same attention as cognitive and affective taxonomies, the mastery of psychomotor skills is relevant to effective performance in many areas. Consider, for example, the rapid and skilled use of a modern computer and mouse, a laboratory apparatus, and a calligraphy pen or charcoal sketching crayon, or the understanding of the structure of proteins or complex molecules in general. All of these types of physical actions require trained, skilled performances. Consider also the skills involved in playing tennis, skiing, soccer, and other sports. Skilled performances in the psychomotor domain are central to many life activities and accomplishments. For a teacher interested in helping students master psychomotor skills, it is important to focus on incremental improvements in skills over time.

TABLE 12.4 Examples of Behaviors That Demonstrate Each of the Five Affective Objectives

Level 1: Receiving
- Making occasional eye contact.
- Showing slight changes in expression or response to the teacher's effort.
- Continuing another activity (reading newspaper) while occasionally stopping to listen.

Level 2: Responding
- Raising one's hand in response to a question.
- Making verbal comments to another student.
- Laughing or reacting at appropriate points.

Level 3: Valuing
- Offering to participate or help.
- Offering to tutor another student.
- Requesting help or clarification; caring about one's grade.

Level 4: Organization
- Changing school behavior, such as arriving earlier or staying later to participate in an activity.
- Taking new courses or pursuing new subjects previously not pursued (e.g., joining drama club, chorus, or art club).
- Encouraging other students to participate in activities.

Level 5: Characterization by Value
- Showing improvement in behaviors criticized in past.
- Consistently showing up for activities and participating.
- Making sacrifices to continue with activities (forgoing recess to practice an instrument).

Each of the three types of objectives—cognitive, affective, and psychomotor—is relevant to instruction at every level. However, student differences may mean that for any individual student, some types of objectives are more important than others. For example, affective objectives may be particularly important to a student who is experiencing an abusive home environment, or who is emotionally labile or disturbed. Affective objectives are also important for gifted students. Cognitive objectives may be most important for a gifted student, whereas psychomotor objectives may be most important for students who are highly adept at working with their hands but not as skilled at taking traditional tests. As a guide to planning students' instruction and assessing their learning, expert teachers think in terms of objectives within each of these domains, tailored to students' individual needs and learning profiles.

DIRECT INSTRUCTION METHODS

Now that you have learned general approaches to planning what you are going to teach, your next question is, "Exactly how should I present the material?" Lauren Hodges grappled with precisely this issue in planning her lessons. Suppose your plan states that you must present a lesson on colonial America in social studies class tomorrow. How might you conduct this class? Methods of **direct instruction** include lecturing, recitation and questioning, and seatwork and homework. Expert teachers always use a combination of teaching techniques to vary their approach and keep their students actively involved in learning. We consider the strengths and weaknesses of each of these teaching techniques. First, however, let us review what research has shown about the success of direct instruction.

Barak Rosenshine (1979, 1986, 2002, 2006; Rosenshine & Stevens, 1986; see also Adams & Carnine, 2003) studied the conditions associated with achievement gains in the classroom, with an emphasis on methods of direct instruction. Rosenshine showed that high levels of learning result when students spend more time on academic tasks and, consequently, cover more content (see also Bloom, 1976). Learning occurs best in classrooms that are academically focused and directed by a teacher who presents structured content. Rosenshine found that high achievement is possible even when teachers lead large groups of students. He also found that direct instruction can bring low-income students up to grade level in reading (Rosenshine, 2002). In fact, researchers have found that for low-income students, teachers often recognize the benefits of and use direct instruction to enhance these students' performance (Demant & Yates, 2003).

Rosenshine sees the ideal learning environment as one in which, first, the teacher is in charge and, second, there are clear goals, sufficient time for instruction, monitoring of student performance, questioning by the teacher with responding by students, immediate feedback, warmth, democracy, and an atmosphere of cooperation. By definition, expert teachers meet all of these criteria in their direct instruction. Let us see how they accomplish this feat.

■ LECTURING AND EXPLAINING

All of us have had the experience of listening in rapt attention to a wonderful lecture. We have also had the opposite experience—drifting off to sleep or counting the ceiling tiles as the teacher droned on.

STRENGTHS OF LECTURING. Lecturing is a good method to use to communicate an overview of a topic to students, to describe detailed examples, and in general to tell a story about a sequence of events. A good lecture piques students' interest. Students learn through practice to sit and listen attentively. For young students with shorter attention spans, it is essential to keep lectures brief. For high school students, lectures can be far longer, even occupying an entire class period. During lectures, students are necessarily more passive than they are during other methods of instruction, such as discussions or group activities. Given this fact, you should use lectures to introduce students to topics and ideas that they can then further explore with your assistance through other teaching techniques.

WEAKNESSES OF LECTURING. The drawbacks of lecturing are obvious: Some students find it difficult to sit and listen for long periods of time, and they may become disruptive. Lecturing can leave behind students who are less prepared and who are unable or unwilling to interrupt the teacher with questions, and lecturing requires you to speak convincingly and clearly for long stretches of time. This teaching technique also demands that you be well pre-

pared and organized. If you cannot invest the necessary amount of time to prepare an effective lecture, consider other methods because badly presented lectures can turn off students to potentially interesting topics. Also, learning through listening to lectures is relatively passive.

SPECIFIC LECTURING TECHNIQUES. Always helpful are the big three rules of effective speaking: "Tell them what you are going to tell them, tell them, and then tell them what you told them." First, in giving a good lecture, begin by stating your objectives in giving the lecture and providing necessary context (in other words, a solid introduction; Brophy, 1982). Second, present the content one step at a time, using body language that conveys enthusiasm, and using slides, overheads, or other tools to increase the students' interest level (Williams & Ceci, 1997). Third, review what was presented and show how it relates to other material that students have studied or will study. Follow lectures with teacher-supervised practice, then independent practice (seatwork), and finally appropriate homework.

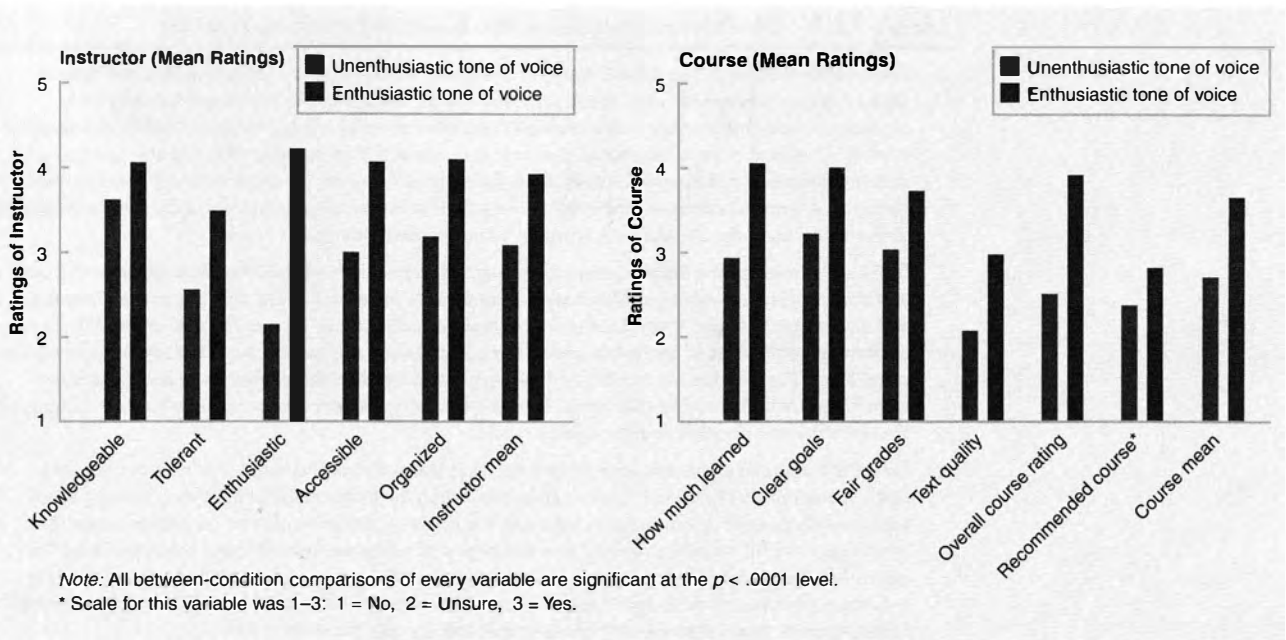
A study by Wendy Williams and Stephen Ceci (1997) demonstrated just how essential it is to lecture using an enthusiastic tone of voice. This study compared college students' ratings of their instructor and the course as a whole for two groups of students who were taught identical material in an identical format, using the same textbook, and evaluated with the same tests. One group was taught with an "enthusiastic" tone; the second group was taught by the same instructor in a more subdued speaking style. Williams and Ceci found that student ratings of various aspects of the instructor and course increased considerably when the instructor used an enthusiastic tone of voice. Students gave higher ratings for the instructor's knowledge, tolerance, organization, and accessibility, as well as for the fairness of the grading policy, the clarity of the course's goals, and the quality of the (identical) textbook. Overall, the "enthusiastically" taught course was rated considerably higher and students reported that they learned much more in it. The test results, however, showed nearly identical performance by both groups of students. Thus, even though students may learn from less enthusiastic teachers, they dramatically prefer more enthusiastic teachers and courses. Figure 12.1 shows the differences in student ratings for the two courses in this study. Other researchers have also documented the beneficial effects of an enthusiastic teaching style (Patrick, Hisley, & Kempler, 2000; Ryan & Frederick, 1997).

THINKING CREATIVELY

Based on personal experience and what you have learned in your educational psychology course, name four unusual or innovative ways a teacher might make a lecture more interesting.

SUGGESTION: Relate the lecture to current events; relate the lecture to students' daily lives; use creative props or visual aids; open with a reading from a work of fiction related to the topic.

FIGURE 12.1 Students' Evaluations as a Function of Professor's Voice Pitch



Note: All between-condition comparisons of every variable are significant at the $p < .0001$ level.
* Scale for this variable was 1–3: 1 = No, 2 = Unsure, 3 = Yes.

David Ausubel (1977) believes that meaningful verbal learning should be the goal of an effective lecture. His **expository teaching** approach suggests that well-presented verbal information and ideas, when received and digested by the listener, result in meaningful learning. Ausubel suggested that teachers speak from the general to the specific—in other words, begin with the rule and proceed to examples. Lessons begin with advance organizers—such as the objectives we placed at the beginning of every chapter—to provide an overview of what is to come and to orient students in the right direction. Advance organizers should describe in clear language what is to come, so students can activate their relevant prior information and help themselves learn. Next, teachers describe the content they wish to cover, stressing similarities and differences between the new material and what students already know. Students themselves may be asked to supply examples of such similarities and differences. Teachers often repeat the goals of the lesson, linking these goals back to the advance organizers. Because of the types of information processing it requires, expository teaching works best with students at the fifth-grade level or above. Table 12.5 shows a direct instruction lesson plan based on the expository teaching approach.

Robert Gagné (1977) stated that instruction should be based on the information processing model of learning (described in detail in Chapter 8). For present purposes, Gagné states that there are phases of learning and specific types of instructional events that support each phase. The period of *preparation for learning* involves three phases:

1. *Attention and alertness*, during which you as the teacher must seize students' attention
2. *Expectancy*, during which you inform students of the objectives of the lesson and motivate the students
3. *Retrieval from working memory*, during which you encourage students to recall prior knowledge relevant to the lesson

The period of *acquisition and performance* includes four phases:

1. *Selective perception of stimulus features*, during which you present the new material and say what is new about it
2. *Encoding and storage in long-term memory*, during which you scaffold students as they learn
3. *Retrieval and responding*, during which you lead students to answer questions
4. *Reinforcement*, during which you provide meaningful feedback

TABLE 12.5 Direct Instruction Lesson Plan Based on Expository Teaching

1. Tell students that today's lesson will focus on the theme of humankind's struggle against the natural world. Give an overview of what this struggle has meant, describing the challenges faced by early explorers in new lands as they vied with nature and tried to make a living for their families. Ask students what they remember from their social studies lessons about the importance of being able to cope with nature if people were to survive. Ask students if they have ever had any experiences of being at the mercy of nature—for example, being lost in the woods during a camping trip. Bring up the recent plights of hurricane, tornado, and volcanic eruption victims around the world.
2. Begin a discussion of the book students were assigned to read for today: *Moby-Dick*. Describe the plot and the characters, involving students as much as possible in the discussion. Talk about the similarities and differences between *Moby-Dick* and a book they read recently, such as *The Call of the Wild*. Have students generate a list of similarities and differences between the two books. Ask students to nominate other books the class has—or they alone have—read, and describe the similarities to and differences from *Moby-Dick*. Discuss Melville's goals in telling this story, and encourage students to think in terms of the main theme—people's struggle against nature.
3. Revisit the advance organizers—the themes stated at the outset of the lesson. Ask students how the original description of the topic can be elaborated on. Which new material have they learned about humankind's struggle against nature? How can the opening discussion now be recast into a new light? Which new insights have been gained into the plights of hurricane, tornado, and volcano victims, for example? What can students conclude about the personalities of men involved in America's whaling industry a century and more ago? Open a broad discussion related to the original theme, and attempt to get students thinking along multiple lines that link up with the main theme.

Finally, the period of *transfer of learning* involves two phases: cueing retrieval and generalizing, during which you assess performance.

ADAPTING LECTURING FOR DIFFERENT LEARNING STYLES. As we have emphasized, students have individual learning and thinking styles (see Chapter 4) that influence how well they learn from the lecture format. For some students, who are auditory learners, material presented in a spoken format works well. Visual learners prefer to take in information by reading it or by seeing it displayed in charts and graphs; these students do better in a lecture if the teacher uses visual aids. Some learners are kinesthetically oriented—that is, they learn best by touching, feeling, manipulating, and working with objects and props. These students tend to have more trouble learning from traditional lectures, even those with good visual aids. Such students do well in laboratories or in classes based on activities. Expert teachers are aware of the diversity of learning styles in their classrooms and do everything possible to broaden instruction in order to reach a range of students.

■ **RECITATION AND QUESTIONING** Moving beyond pure lecturing to lecturing combined with discussion raises students' retention, develops higher-order thinking, and enhances attitudes and motivation (McKeachie & Kulik, 1975)—one of the reasons that Lauren Hodges worked so hard to incorporate several different approaches in her teaching. Combining lecture and recitation gives students the best of both techniques. You may not recognize the term *recitation*, but you have actually been involved in recitation many times. **Recitation** is a teaching method in which teachers ask questions and students provide answers. Good teacher questions are organized or generally planned in advance to lead students to develop key understandings. When the students provide answers, the teacher responds to these answers with yet more questions to further develop the lesson.

Given their diverse learning styles, some students adapt better to the recitation and questioning approach. Some students learn as they verbalize their thoughts—ideas and concepts take shape as the students talk about them. Others are good speakers, comfortable thinking on their feet and speaking in front of others; here recitation and questioning are effective. Conversely, recitation and questioning may be a poor fit for quiet or reticent students and students who prefer to absorb information through their eyes or by working with props. Expert teachers recognize these differences, and develop and diversify their instructional approaches to meet the needs of diverse students.

THINKING ANALYTICALLY

Name three aspects of effective versus ineffective recitation.

SUGGESTION: Well-defined versus poorly defined questions; an encouraging approach when asking questions versus a demoralizing one—"I know you will be able to figure this out if you think about it" versus "This is probably too tough for you"; the allotment of adequate versus inadequate time for students to think and answer.

ASKING THE RIGHT QUESTIONS. Although asking good and appropriate questions that develop students' thinking is both a skill and an art, you can certainly learn the technique through practice. Bloom's cognitive taxonomy—knowledge, comprehension, application, analysis, synthesis, and evaluation—can be used to categorize your questions. To be effective, think about distributing questioning across different objectives so as to create a well-rounded learning experience. For instance, consider our example of the teacher planning a lesson on colonial America. The lesson plan incorporates the types of questions about colonial America that the teacher might ask to tap cognitive abilities and thinking relevant to each stage of Bloom's taxonomy.

Which student-related factors should you consider when developing and asking questions? Lower-level questions are obviously more appropriate for younger students and for more basic learning experiences, although even very young students can sometimes answer higher-order questions. Higher-level questions tend to be better for older students and for students ready to move beyond basic learning (Gall, 1984). In general, younger and lower-ability students do best with simple questions that they can often answer correctly, so you can create an atmosphere of encouragement and success. For higher-ability students, Berliner (1987) found that the best learning occurs when teachers use hard questions from each of the levels coupled with critical teacher feedback. Nevertheless, all students need a variety of question types and a chance to use their higher-level abilities at some point.

METHODS OF QUESTIONING. We can all remember examples of fairly meaningless teacher questions from our own school experiences. One chemistry teacher asked the first student in each row to state the name, atomic number, and atomic weight of each of the

elements in the row of the periodic table that matched the row in which the students were sitting. But even well-formulated questions can be poorly used—for example, if the teacher asks the question, calls on a student, grows frustrated at the lack of response or at an inadequate response, and blurts out the correct answer. **Wait time** is the period of silence both before and after a student answers a question that gives all students an opportunity to think. Appropriate wait times give students a chance to process questions and think about answers, and possibly even raise their hands.

As teachers, we should work hard at eliciting the correct answers from our students. We should allow students time to think and then call on several students and tolerate pauses if necessary to draw out reticent students (Berliner, 1987). Avoid calling on volunteers, as this approach gives other students encouragement not to listen because they know they will not be called on. In fact, call on every student at fairly regular intervals (Weinstein & Mignano, 1993). Sometimes, with adept questioning, even a student who believes he knows very little about a subject can be led to answer low-level questions accurately. This student may then experience growing feelings of competence and may pay more attention in class and work harder. In this way, teachers promote positive expectations on the part of their students and themselves (Weinstein, 1998).

THINKING PRACTICALLY

What might you do to monitor your ability to ask good questions that most benefit your students?

SUGGESTION: Ask students to complete anonymous feedback forms giving you comments; videotape or audiotape yourself and analyze the tape; ask a teacher you admire to observe you and critique your performance.

ENCOURAGING STUDENTS' QUESTIONS. Ask good questions, but also respond to student questions appropriately to encourage further learning and questioning. In fact, it is often more important that students learn which questions to ask, and how to ask them, than what the answers to the questions are (Sternberg, 1994). Sternberg believes that it can sometimes be a mistake for a teacher to encourage students to view the teacher as the person who should ask questions and the students as the individuals who should answer them. Teachers must realize—and make sure the students realize—that what matters most is not the "facts" students know, but rather their ability to use those facts. Often, schools tend to emphasize the *answering* of questions, rather than the *asking* of them. The good student is perceived as the one who usually furnishes the right answers, preferably rapidly. The expert in a field thus becomes the extension of the expert student—the person who knows a lot of information and can recite it from memory at will.

THINKING PRACTICALLY

At what level do your teachers respond to your questions? Describe seven examples of teacher-student interactions that can be characterized as representing each of the seven levels in Sternberg's model.

SUGGESTION: The teacher might state:

Level 1: "I do not have time for this now."

Level 2: "Because that's just the way it works."

Level 3: "That's a good question; I don't really know the answer offhand."

Level 4: " I'll check the Web for information tonight and get back to you tomorrow."

Level 5: "Let's think about it . . . several possibilities that come to mind include . . ."

Level 6: "Here are a few possibilities . . . we could test each one by doing the following . . . this way we could see which is most likely."

Level 7: "Here are a few possibilities . . . Let's make it a project to collect information about which one is most likely to be accurate . . . Why don't you do this by tomorrow, and I will do that, and we will compare notes and see what happens."

Contrary to this view, many cognitive and educational psychologists are returning to the thinking of John Dewey (1910), who realized that *how* we think is often more important than *what* we think. Dewey believed that teachers should place more emphasis on the teaching of how to ask questions, and how to ask the right questions (good, thought-provoking, and interesting ones), and less emphasis on the simple retrieval of the correct answers to whatever questions we might pose. The ability to ask good questions and to know how to ask them is an essential part of intelligence—it may even be the most important part (Arlin, 1990; Getzels & Csikszentmihalyi, 1967; Sternberg & Spear-Swerling, 1996). Good questions also promote student engagement (Shernoff, Csikszentmihalyi, Shneider, & Shernoff, 2003).

When students seek teacher engagement by asking questions, teachers have several different characteristic ways of responding. We believe that how teachers respond to children's questions is important because the types of responses are differentially helpful to children in developing their intelligence. Sternberg (1994a) has proposed a seven-level model of teacher–child interaction in the questioning process. (The seven levels of responding are reviewed in Table 12.6.) The basic idea is that mediators who respond at higher levels better foster their children's intellectual development. As teachers move up the levels, they go from rejecting children's questions, at one extreme, to encouraging hypothesis formation and testing, at the other extreme. Students move from no learning, to passive rote learning, to analytic and creative learning. The higher the teacher's level of response, the more the teacher communicates an interest in students' questions.

Of course, teachers may not always have the time or resources to respond to children's questions according to level 7. Nor are higher levels of response equally appropriate for children of all ages—responses need to be developmentally appropriate to be maximally useful. Nevertheless, the more teachers use higher levels of questioning, the more they encourage students to develop their cognitive skills.

TABLE 12.6 The Seven-Level Model of Teacher Response to Student Questions

Consider a question a student might pose after visiting Holland, seeing a documentary about Holland on television, or reading a book about Holland: Why are people in Holland so tall? Consider various ways a teacher might respond to this question. The higher the level of the response, the more the teacher is doing to enhance the student's intellectual development.

Level 1. Rejection of questions: "Don't ask so many questions!"—"Don't bother me!"—"Don't ask stupid questions!"—"Be quiet!"

When teachers respond at this level, the basic message to the student is to shut up. Questions are seen as inappropriate or irritating. Students learn to be seen and not heard, and to keep their place. The result of consistent punishment for question asking, of course, is that students learn not to ask questions and, therefore, not to learn.

Level 2. Restatement of questions as responses: "Because they are Dutch, and Dutch people are very tall," or "Because they grow a lot."

At this level, teachers answer students' questions, but in a wholly empty way. Their response is nothing more than a restatement of the original question.

Level 3, Admission of ignorance or direct responses: "I don't know" or "Because ...," followed by a reasonable answer (say, about nutrition or genetics).

At this level, teachers either say they do not know or give a response based on what they do know. Students are given the opportunity to learn something new or to realize their teachers do not know everything. When teachers answer at this level, they can do so either with or without "reinforcement": They can either reward students for asking the question or not reward them. Examples of rewards would be "That's a good question" or "I'm glad you asked that" or "That's a really interesting question." Such a response rewards question asking and is likely to increase its frequency, which fosters further opportunities for students to learn.

Level 4. Encouragement to seek response through authority: "I'll look it up in the encyclopedia" or "Why don't you look it up in the encyclopedia?"

At level 4, the question-answering process does not end just with an answer or admission of ignorance. Students are taught that information not possessed can and often should be sought out. Notice, however, the difference in the two responses. In the first, the teacher takes responsibility for seeking the information. Students thereby learn that information can be sought, but also that someone else will do it for them. Thus the learning ultimately accomplished is passive learning. In the second response, the student is given the responsibility, and not only learns but learns how to learn—by means of active learning. Through active learning, students develop their own information-seeking skills, rather than becoming dependent on others.

Level 5. Consideration of alternative explanations: "People in Holland might be tall because of the food, the weather, genetics, hormone injections, killing of short children, wearing of elevator shoes, and so on."

Here, the teacher says she or he does not know, but suggests the student explore some possibilities. Ideally, the student and teacher generate possibilities together. The student thus comes to realize that even simple questions can invite hypothesis formulation and testing.

Level 6. Consideration of explanations in addition to means of evaluating the explanations: "How might we go about deciding which of these explanations is correct?"

Here, teachers not only encourage alternative explanations, as in level 5, but also discuss ways of evaluating the validity of the alternative explanations. "For example, if genetics were responsible for the high average height of the Dutch, what might we expect to observe? How might we discern whether food or weather is responsible? How can we quickly rule out the possibility that the Dutch kill short children?" Students can learn via the responses of their teachers not only how to generate alternative hypotheses, as in level 5, but also how to test them.

Level 7, Consideration of explanations, in addition to means of evaluating them and follow-through in evaluations: "Let's try getting some of the information we need to help us decide among these explanations."

Here, the teacher actually encourages the student to perform the experiments by gathering information that could distinguish among the alternative explanations. Students learn not only how to think, but also how to act on their thoughts. Although it may not be possible to test every explanation of a phenomenon, it will often be possible to test several of them. For example, students can gather information about whether taller Dutch parents tend to have taller children, whether there are reports of missing short children, and so on.

■ **SEATWORK AND HOMEWORK** Students work independently when they do both homework and **seatwork,** the quiet independent work students do at their desks. Obviously, the uses of homework and seatwork are many and varied, and both types of work can be either effective or ineffective at helping children learn, depending on the types of work assigned. Ideally, seatwork gives students an opportunity to practice what they have just learned, generally by working through practice problems at increasing levels of difficulty. You should not use this type of work to teach students completely new material, however. Seatwork or homework may involve **programmed instruction,** consisting of structured lessons that students work on by themselves and at their own pace.

MAKING SEATWORK AND HOMEWORK EFFECTIVE. For either type of assignment to be effective, students must understand both the directions and the task you are asking them to complete. Often, expert teachers work out a sample question or problem on the chalkboard to show students generally what is expected. This type of scaffolding is especially important in classes with students who may have joined the class, the school, or even the

country only recently—although it certainly is helpful to all students. Express openly the many implicit rules for doing homework and seatwork to help children unfamiliar with the rules and to refresh other students' memories. For example, does using a calculator represent cheating on math seatwork or homework? Do students have to acknowledge written sources? Is checking each other's work permitted? Can they consult dictionaries or textbooks during exams? Table 12.7 shows several ways to help students overcome homework difficulties and to make homework assignments interesting and even enjoyable.

HOW MUCH AND WHAT KIND OF HOMEWORK? Homework is a common source of complaints from both students and their parents alike (Van-Voorhis, 2004). A recent composite analysis of many independent studies conducted around the world found no obvious relationship between the amount of homework assigned and the amount students learn, as measured on standardized tests (Third International Mathe-

TABLE 12.7 Lesson Plan for Helping Students Overcome Homework Difficulties

Central Themes

Knowing Self

Knowing Process

Knowing Differences

Synopsis

An experience (three different possibilities are described) to expose students to the materials and methods available to help them with homework difficulties.

What to Do

Choose one of the following three activities.

A. Homework Fair

1. Designate a period of time as a "homework fair" devoted entirely to helping students figure out ways to overcome difficulties that they have with homework.
2. Ask students to identify important areas to consider by reviewing their homework questionnaires and their plans for improvement. Students' homework questionnaires contain information about each student's personal strengths, weaknesses, preferences, dislikes, and general styles of doing homework.
3. Set up (or have students set up) homework displays around the room—for example, exhibits of helpful homework materials (trapper keepers, daily-planner notebooks, pocket folders); motivational displays (a chart showing how many hours each basketball star practices free throws); demonstrations of personal progress (before-and-after stories). Because good displays require much preparation, you might rely on students to do the work. Preparation for the fair can be a class project; alternatively, you might ask individual students to prepare displays or presentations that explain their particularly successful ideas.
4. Walk students through the displays, explaining whatever may be unclear (or have students do so for displays they've created). Allow students to talk to one another about their reactions. If it is difficult to have students walking around the room, you might pass materials around as you discuss them.
5. Include a "workshop" as a part of the fair. Have a table or some space for students to make their own materials, or to personalize purchased materials.
6. Require that each student write down at least two new ideas he or she learned from the fair. At the end of the fair, have students read the ideas aloud and tell how they can be used to solve their own problems.

B. Field Trip to a Supply Store

1. Arrange for students to visit a school- or office-supply store. If possible, arrange for a store representative to present some of the materials available there that can help students with homework (notebooks, resource books, thesaurus and dictionary, folders, pencils, pens, highlighters).
2. Let students know that they'll be going to a store to see some of the materials that can help them better handle homework. Ask students to prepare by reviewing their homework questionnaires and lists for improvement.
3. Visit the store with your class.
4. Sometime around when you visit the store, include time in class for students to make their own materials or to personalize purchased materials.
5. Require that each student make a note of at least two new and useful things (strategies or materials) she learned. At the end of the trip, have each student share the things he noted (reading aloud) and tell how these things can be used to solve his own problems.

C. "Dear Abby"

1. Ask students to review their homework questionnaires for ways in which they get stuck or have difficulty doing homework.
2. Have students write letters in the style of "Dear Abby" to ask for advice on how to handle a particular difficulty. For example, a student might write, "Dear Abby, the teacher always tells us to show our work on math problems. So I do, but then she complains that she can't find my answers because the paper is too messy. Is this fair? What should I do?" Another student might write, "Dear Abby, I always think I understand my writing assignment until I get home and try to do it. Then it doesn't make any sense. Help!"
3. Have students exchange letters and write responses to one another.
4. Have students read their letters aloud and comment on the advice they get from their partners: How useful is it? Will they try to use it?

Note

Whichever option you choose, make sure that students consider whether their solutions to homework difficulties are appropriate for different kinds of homework (long-range assignments, overnight math worksheets, defining vocabulary).

Follow-Up Activity

Have students record in journals the new and useful ideas, tips, or materials that they discover. Later they can revisit what they've written and consider how they've used what they learned or (if appropriate) why they haven't used what they learned.

Source: From *Practical Intelligence for School* by W. M. Williams, T. Blythe, N. White, J. Li, R. J. Sternberg, and H. I. Gardner. Copyright © 1996. Reprinted by permission of Addison-Wesley Publishers, Inc.

matics and Science Study [TIMSS], 1996). In some schools, much homework is assigned, but it does not appear to do much good. In other schools, a lot of homework is assigned, and the students clearly benefit from this practice. In still other schools, little homework is assigned, and students do well, presumably because classwork and seatwork are effective and students' home lives foster good study habits and encourage reading. Then there are schools that assign little homework and shortchange their students.

[redacted] found that homework coupled with high expectations for student performance were characteristic of the most effective secondary schools in the United States. There is no simple relationship between giving more homework and getting better performance out of your students: The homework you assign must be appropriate, challenging, and relevant to meaningful aspects of student performance. In general, frequent, smaller assignments are better than less frequent, larger ones (Cooper, 1989a, 1989b). Effective homework reinforces classroom learning, enables students to succeed (by not being too difficult), is used as a normal part of instruction, and is graded and returned to students promptly (Berliner, 1988; Berliner & Calfee, 1996).

An interesting finding about homework is that Japanese students actually spend less time doing math homework than do American students (TIMSS, 1996). Why, then, do Japanese students outperform their U.S. counterparts in math? The answer has to do with differences in the style of instruction in the two countries. Japanese teachers spend far less time on drill than do American teachers, and more time on helping students understand and explore both their errors and their correct answers. This more thoughtful approach to teaching improves math performance. Thus giving more homework by itself is not the answer to improving performance; the entire teaching approach—homework included—must be evaluated.

Carefully and thoughtfully designed homework can be more than just a collection of exercises mirroring those done in class. Good homework piques students' attention and causes them to reason with the concepts they learned in class. It differs enough from classwork that students need to read and follow the directions carefully.

As we discussed in Chapter 11 on classroom management, an expert teacher develops an appropriate system to ensure that students actually complete their homework on time. Expert teachers also consider a broad range of homework assignments and mechanisms for giving homework (Epstein & Van-Voorhis, 2001). Consider the examples of creative and interesting types of homework assignments listed in Table 12.8.

THINKING CREATIVELY

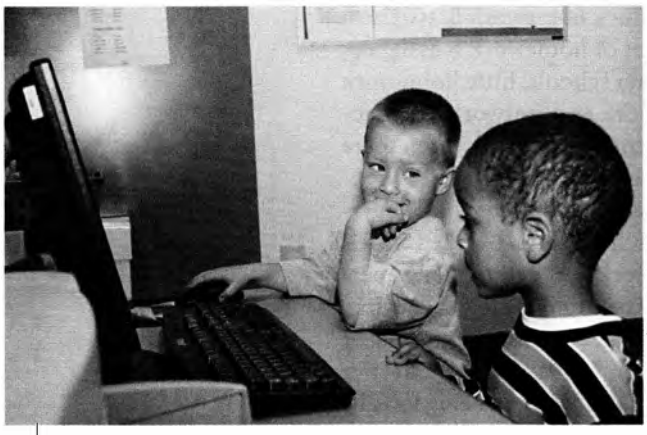
Name five ways you might design an interesting homework assignment for your students.

SUGGESTION: Have students write a story or play about the material learned in class. Design a costume about a historical period studied in class. Interview a person who is knowledgeable about a topic under study. Create a folder of materials gathered from the Web. Write an exam that could be used to test the information covered in class.

ASSIGNING EFFECTIVE SEATWORK. Although you should assign seatwork as carefully as you assign homework, often the former will have to resemble more closely what you actually taught in class: follow-up exercises, additional problems of the kind completed during instruction, and so on. Especially with young students, you should not assign extended periods of seatwork; it is preferable to rotate between lecturing and demonstrating problems on the board and assigning a few sample seatwork problems that help students process what they have just learned. While students are working quietly at their seats, expert teachers make themselves available by walking around the room. Students should not have

TABLE 12.8 Models of Effective Homework Assignments

1. **Grade 1:** Under adult supervision, using just the items in your refrigerator and cupboard, make a dye you could use to color clothes. Color a small kerchief or piece of cloth and bring it to class.
2. **Grade 3:** With the help of an adult, get a newspaper or magazine flyer and cut out the coupons for 20 items of different types (such as meat, canned goods, and paper products). Figure the total savings if all coupons are used, and then figure out how much is saved on each category of item.
3. **Grade 5:** Inflate a round balloon, get a tape measure, and measure its circumference. Place the balloon in the freezer for an hour and measure it again. Place the balloon in warm water for a half hour and measure it again. Write an essay explaining your findings.
4. **Grade 8:** Take a stack of newspapers for an entire week and go through each front-page story. Record whether the story is about a man or woman, and record how many times men versus women are quoted or described. Rate the role played by each person mentioned in each story as positive or negative. Tally the results and explain.
5. **Grade 12:** Read Joseph Conrad's *The Secret Sharer* and write a new ending for the story.



Laura Bolesta/Merrill

Students can use home computers for exercises to reinforce classroom learning or to research class projects on the Internet.

to work hard to get your attention; otherwise, some students may be embarrassed to ask their questions. Expert teachers provide a few moments of contact to every child in the class, even if just to look over her or his shoulder and say, "Good work!" (Brophy & Good, 1986).

For both homework and seatwork, avoid creating situations in which students simply copy material to finish work quickly. Sometimes students feel too much pressure to get the right answer, and ineffective teachers may give assignments that provide an easy way out for these students. If students are not expected to show their work and explain their reasoning, it may become tempting to take a shortcut by copying or even cheating. In such cases, little meaningful learning takes place. Tell students clearly the reasons for the work they are assigned, and hold them accountable for displaying actual understanding and the ability to reason with the concepts and information they learn.

Effective teachers also tailor homework and seatwork to different students' learning styles, so that each student plays to her or his strengths: Auditory learners might be asked to listen to a tape and work through questions, visual learners might be asked to read and view diagrams, and kinesthetic learners might be asked to design models or projects or work with colorful manipulatives.

THINKING ANALYTICALLY

How can you use seatwork to enrich the work assigned to a gifted child?

SUGGESTION: The student might tackle more advanced exercises while the rest of the class works at their own pace, or read additional materials or sources to gather more information about a topic.

TEACHING AND REACHING EVERY STUDENT

This book has returned often to issues of diversity among students and the resulting need for you to broaden your portfolio of instructional approaches so that you can meet the needs of every student. As the student population becomes more ethnically and socioeconomically diverse, teachers face greater challenges in reaching their students. Lauren Hodges recognized these challenges and was determined to meet them by designing broad and interesting instructional approaches. In Chapter 5 (on exceptional children) and Chapter 6 (on group differences), we stressed the differing demands of teaching students from widely differing backgrounds. We return briefly to this topic to stress the importance of teaching—and reaching—every student, regardless of her or his special needs.

■ **APTITUDE-BY-TREATMENT INTERACTIONS** Beginning many years ago, researchers such as Richard Snow (1966, 1989) observed that children learn different things from instruction depending on their level of ability and their personality. This effect, called an **aptitude-by-treatment interaction,** indicates that individual students learn different things from the same instruction because of differences in the students' background, abilities, and prior experiences. Understanding why some students learn better than others in given situations is extremely complex. The effect is real, however, so we cannot expect all students to be able to learn from the same approach. That a child fails to perform may not be due to willfulness or stubbornness, but rather may reflect a mismatch between the teaching method and the child's needs. In such cases, another approach is the best answer. Trying new ways to reach students who are not performing can yield impressive results. Sometimes, this field of research goes by the name "learning styles" and considers not only the match between teaching styles and student learning, but also the match between assessment styles and student performance (see, for example, Sternberg, Grigorenko, & Zhang, in press).

Sternberg has studied the importance of a match between instruction and a student's pattern of abilities. In general, analytical abilities tend to be the most important in school performance because of the way that most instruction and assessment emphasize factual recall. If courses are taught primarily to emphasize other abilities, such as creative and practical ones, these abilities will become more important in course performance (Sternberg, 1994a, 1996; Sternberg & Clinkenbeard, 1995; Sternberg, Ferrari, Clinkenbeard, & Grigorenko, 1996; Sterberg, Torff, & Grigorenko, 1998; see also Grigorenko, Jarvin, &

Sternberg, 2002). Sternberg designed an introductory, college-level psychology course that was taught and evaluated in a way that allowed for expression of creative and practical as well as analytical abilities. Students in this course performed at a higher level if their pattern of abilities was at least partially matched to the abilities emphasized in instruction and assessment.

In general, Sternberg has advocated teaching to promote the development of diverse types of abilities, and teaching from different perspectives to reach students with diverse types of learning styles (Sternberg, 1996; Sternberg & Spear-Swerling, 1996). He has focused on three abilities:

- *Analytical abilities*—used to compare and contrast, analyze, and evaluate
- *Creative abilities*—used to invent, discover, and generate
- *Practical abilities*—used to apply, utilize, and implement

Indeed, much of the pedagogy in this textbook is based on the analytical, creative, and practical focus, as you have probably noticed when you addressed the questions throughout each chapter. The abilities you have used to answer these questions differ, depending on the type of question—analytical, creative, or practical—you answer.

■ ADAPTING INSTRUCTION FOR DIVERSE STUDENTS Expert teachers remember that certain teaching approaches and activities benefit certain types of students. For example, a particularly artistic and creative student might do better than other students with classroom discussion questions such as "Imagine you wrote this poem—what might have motivated you to write it?" and with homework assignments to write alternative endings to poems. An analytically gifted student in the same class might do better when classroom discussions ask, "Compare and contrast this poem to the poems we read last week," and when homework assignments ask students to diagram the form of a poem's rhyme and meter.

Students' differential patterns of abilities are an important—yet often overlooked—aspect of teaching dynamics (Sternberg, 2006). One study showed that students can experience substantial stress when their learning style does not match the instructional style of their teachers (Mahlois, 2001). Another series of studies conducted in the continental United States, Alaska, and Kenya showed that instruction geared to the cultural skills and cultural knowledge of students improved academic achievement (Sternberg, 2006). Recently, a study found meaningful interrelationships among students' perceptions of the learning environment, students' personalities, and the learning strategies employed (Nijhuis, Segers, & Gijselaers, 2007). A more commonly recognized distinction among students affecting how they learn concerns students' prior knowledge (Cronbach & Snow, 1977; Dochy, Segers, & Buehl, 1999). Specifically, students with the benefit of prior knowledge are able to profit from many forms of instruction; in contrast, students who lack prior knowledge often hit roadblocks in their learning and need more scaffolding and generally more responsive teaching (Rosenshine & Stevens, 1986). Richard Snow (1977, 1992, 1995) argued that when students lack necessary background knowledge, the learning process must be designed to assist them in recognizing and learning the most important points so their attention is focused on what matters most. Thus one way to understand the importance of matching teaching approaches to abilities is to think of the match as a way to help students capitalize on their prior knowledge and strengths when learning new material.

THINKING CREATIVELY

Name three ways you might customize instruction for an ethnically diverse class. Name three ways that would work with a very intellectually diverse class.

SUGGESTION: Ethnically diverse: Each child does a project on the customs of her or his upbringing; each child writes a story about family life in his or her native culture; each child writes an essay describing how his or her parents or forebears came to the United States. Intellectually diverse: Students with more hands-on abilities build models or mobiles about the era in which a book was set; students with more creative abilities write poems, songs, or plays about the story; students with more analytical abilities write in-depth book reviews.

LIMITATIONS OF DIRECT INSTRUCTION

Direct instruction has been criticized as limiting the types of thinking students engage in (Marshall, 1992). Although in theory this need not be the case, in practice it often is. Expert teachers develop lecture and recitation plans that induce students to integrate and think critically about material, and they assign seatwork and homework that demands higher-order processing of what students have learned (see the examples in Table 12.8). Of course, accomplishing these objectives is challenging and requires careful planning. It is easier merely to rely on a lower-level approach that follows the textbook and workbook. One unfortunate

result of direct instruction is that it sometimes emphasizes performance over understanding: If students give the right answers, you feel you have accomplished the goals of teaching the students, despite the students' lack of meaningful understanding of what they said or wrote (Stodolsky, 1988).

Direct instruction has also been criticized as placing students into passive roles (Marshall, 1992). Because students often remain passive as the teacher controls the learning events, they sometimes avoid deep cognitive engagement. Teachers may both praise and prefer students who sit and listen quietly and take good notes, and who are able on a test to repeat what the teacher originally said. Independent thinking or questioning of the teacher's views and assumptions is often not a part of direct instruction approaches. One study comparing teacher-led versus student-led instruction showed that students' beliefs showed greater change when they were taught by other students, but that their knowledge increased more when they were taught by teachers (Alexander et al., 2002).

Some critics argue that direct instruction, which is grounded in a behavioral view of learning (see Chapter 7), views teaching and learning as a process of mechanical transmissions of knowledge from teacher to student. Knowledge is transferred from teacher to student in incremental portions, and the task of the student is to sit and absorb the knowledge, watch the teacher complete problems on the chalkboard, and then mimic these behaviors during seatwork and homework assignments. Just as cognitive views of learning eventually began to replace behavioral ones, so a view of learning as a student-centered activity has broadened the more traditional emphasis on teacher-centered instruction.

THINKING ANALYTICALLY

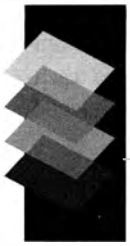
Which method of instruction best matches your abilities?

SUGGESTION: Ask yourself about past experiences in which you learned material quickly and easily—how was the material taught? This method of instruction undoubtedly well matches your abilities.

Cognitive views of learning (see Chapter 8) stress what is going on inside the mind of the learner: They see the learner as a complex package of prior learning and experiences that influence current learning. Similarly, student-centered views of instruction view the student as the creator of his or her own learning, and the teacher as the catalyst who enables and encourages that learning. We turn now to a consideration of methods of student-centered instruction.

*i*MPLICATIONS FOR TEACHING

- **Carefully plan your instruction.** Expert teachers draw on the experiences of other effective teachers. They also recognize that plans must be flexible so that teachers can adapt their teaching approaches to students' changing needs. Although effective teachers know that planning is helpful, they realize they cannot predict every situation that may arise. Sometimes plans must be abandoned and new approaches tried on the fly in the classroom.
- **Familiarize yourself with a wide range of direct instruction techniques.** These possibilities include lecturing, recitation and questioning, and seatwork and homework. Having a variety of instructional techniques at your disposal enables you to better cope with rapidly changing classroom environments and student needs. On the job, it can be difficult to master a teaching technique when you have little familiarity with it. Practice various techniques before leading a class, either during student teaching time or in mock teaching experiences with friends and fellow teachers.
- **Remain attentive to issues of diversity in learning styles.** Expert teachers make learning effective for *all* students by tailoring their approaches to students' different learning and thinking styles. Effective teachers rehearse ahead of time several ways of communicating a point they wish to make during a lesson: They may practice oral presentation (speaking in a traditional lecture format) and visual presentation (displaying relevant props); they may work to teach from analytical, creative, and practical perspectives (illustrated by the "Flexible Expert" feature that appears throughout this text).



Principles of Student-Centered (Constructivist) Teaching

In recent years, researchers have shifted from viewing the teacher as belonging at the center of the learning process, to viewing the student as having a more central and active role (Davis, 1997; Manges & Wigle, 1997; Nuthall, 1999, 2005; Nuthall & Alton-Lee, 1992, 1993; Pintrich & Schunk, 1996; Windschitl, 2002). Consistent with the **student-centered approach** is a view sometimes called **constructivism,** because it sees students as constructing their own understanding (see Chapter 8) (Hannafin, 2006; Land & Hannafin, 2000). Lauren Hodges recognized the importance of her students' roles in learning and consequently planned to teach in a way that would both involve and excite her students.

CONSTRUCTIVISM: A FOCUS ON DIVERSITY AND MOTIVATION

In the eyes of teachers and students, student-centered approaches involve very different types of classroom instruction and activities. With the constructivist perspective comes an increased awareness of the role of individual differences in learning—which includes all of the types of individual differences discussed in Chapters 5 and 6 of this book: ability level, learning style, ethnicity, gender, socioeconomic status, and so on. The constructivist perspective also includes a renewed emphasis in learning on the role of student motivation, prior experiences and knowledge, and interpersonal skills.

What does it mean to place students at the center of the learning process? In one sense, it means teachers' jobs are more demanding (Windschitl, 2002), because it is often more difficult to make student-centered approaches work than it is simply to stand at the front of the room and give a lecture. Student-centered approaches require thorough planning, appropriate tools and equipment, and in-depth knowledge of the students. Placing students at the center of the learning process also means your goal must be to impart meaningful, useful, and deep understanding, rather than just to obtain a certain number of correct responses on a quiz (see, for example, Richardson, 2003).

Despite the greater challenges this approach poses, the rewards of student-centered approaches are many. When these techniques are implemented appropriately, students can experience great benefits. Student-centered teaching has been the foundation of so-called **open schools,** a term often used to describe schools in which students are actively involved in deciding what and how they will study.

THINKING ANALYTICALLY

Name three similarities and three differences between teacher-centered and student-centered views of instruction.

SUGGESTION: Similarities: Involves organized learning; requires motivation to succeed; can result in long-term retention of material. Differences: In teacher-centered instruction, the teacher generally controls the rate of learning, leads the direction of the lesson's development, and determines the ending point of instruction in a lesson. In student-centered instruction, it is the student who makes these determinations.

CREATING CONSTRUCTIVIST LEARNING ENVIRONMENTS

What are some of the ways expert teachers think about creating student-centered learning situations?

■ **ACCEPTING COMPLEXITY** When engaging in student-centered learning, expert teachers create complex learning environments instead of deliberately simplified ones, as is often the case for traditional methods of instruction. Student-centered teaching involves giving students real-world problems to solve, with all of the confusion inherent in such problems. The idea is that students should work on ecologically meaningful problems (in other words, problems they might encounter in their daily lives, and that have some personal meaning for them), the solutions for which represent workable real-world solutions, rather than simply being expected to memorize and then restate correct answers on tests.

■ **LEARNING THROUGH SOCIAL INTERACTION** Student-centered learning often involves social interactions with other students in varied formats, including **group instruction,** in which students learn, process, and discuss material in groups. Group discussions are conversations among students in which students pose and answer their own questions; the teacher does

not play the dominant role. Thus learning becomes a socially mediated and facilitated activity. In Chapter 2, we discussed views of cognitive development that place social interactions at the center of a child's developing representation of knowledge about the world. Student-centered teaching acts in concert with this view, and many student-centered techniques require students to work effectively with others if they are to succeed on tasks.

■ **PRESENTING CONTENT IN SEVERAL CONTEXTS** Student-centered approaches involve using multiple representations of content to help students generalize and transfer what they learn. This richer and more varied approach attempts to give students information they can use. It is also intended to help students develop realistic, flexible, and useful mental representations of knowledge that are not artificially limited as a function of having been learned in a particular context.

■ **USING PSYCHOLOGICAL PRINCIPLES TO STRUCTURE TEACHING** Student-centered teaching requires teachers to use the principles and findings of cognitive and educational psychology to structure instruction so it best enhances the intellectual development of the student. Teachers must be aware of what it really means to learn as well as how the process of learning is affected by different factors. As this point suggests, student-centered teaching places high demands on the teachers who use this approach.

One study found that teacher-guided discussions were a more efficient means of attaining higher-level reasoning and higher-quality explanations, but that peer discussions tended to be more generative and exploratory (Hogan, Nastasi, & Pressley, 1999). Peer discussions also gave rise to more varied student discourse. Thus the benefits of peer discussions differ from the benefits of teacher-guided discussion; clearly, both teaching approaches have an important place in today's classrooms.

When administered correctly, student-centered learning activities can promote the development of higher-order skills such as critical thinking and problem solving. To be effective, student-centered learning requires the use of appropriate teaching aids, or scaffolds—that is, tools, strategies, and guides that support students in attaining a higher level of understanding than would be possible if students worked on their own (Brush & Saye, 2001).

■ **RECOGNIZING MEANINGFUL LEARNING** At first inspection, some novice teachers might be tempted to conclude, "This student-centered approach sounds great! It means less work for the teacher—let the students teach themselves and each other." In reality, this view misses the main point. By giving students more leeway in their learning, you relinquish the tight control you have when standing before a group of 30 students who sit quietly and attentively taking notes. Now you must come up with activities and benchmarks for measuring performance, and you must watch over students as they work in groups—remaining available to handle difficult situations, yet not butting in too often. If you lack clear goals for instruction, the students will learn nothing from this approach, and you will be held responsible.

THINKING ANALYTICALLY

Name three ways you can tell whether students are engaging in meaningful learning rather than simply having an animated discussion.

SUGGESTION: Clues to meaningful learning: If students are making connections between different topics, suggesting methods for researching and developing ideas, or critiquing each other's thinking.

It is also difficult to recognize when meaningful learning is taking place—sometimes students may talk animatedly about a subject and be learning nothing. At other times, students take the opportunities of group work to gossip or joke around. You have less control, and it can be difficult to monitor what is going on. Thus the responsibilities for using student-centered methods are many and demanding. But the rewards are many, too, as we shall see.

Fortunately, a formal set of guidelines can help you use a student-centered perspective. Before describing actual in-class techniques, we first review these principles.

LEARNER-CENTERED PSYCHOLOGICAL PRINCIPLES

Some years ago, the American Psychological Association assigned a task force the goal of developing a collection of learner-centered psychological principles. These principles were intended to serve as guidelines for school redesign and reform (Work Group of the American Psychological Association Board of Educational Affairs, 1997). The members of the task force created a list of 14 principles that describe the foundations of the student-centered

learning approach. Although these 14 principles have not been uniformly well received, they effectively express the perspective of their authors, who are advocates of the learner-centered approach. Table 12.9 on pages 452 and 453 lists the 14 principles, which will provide you with an overview of the tenets of student-centered teaching. (Because of space limitations, we do not discuss these principles in the main text.)

THE ROLE OF PLANNING IN STUDENT-CENTERED (CONSTRUCTIVIST) TEACHING

Good planning is always important to good teaching. But exactly what is being planned differs for student-centered methods of teaching as compared to teacher-centered methods? As we discussed earlier in this chapter, teacher-centered planning focuses on your overarching learning goals for your students and on the specific steps you plan to take to help students achieve these goals. The perspective is that the individual possessing the knowledge designs a process that best imparts this knowledge to the students.

Planning from a constructivist approach, however, has different goals. It is still necessary to define the main topic and overarching goals of the learning experience. Rather than drafting a precise lesson plan, however, teachers taking a student-centered approach may choose to involve their students in the process of planning instruction. The teacher and students can discuss issues such as these: What are the reasons for studying this topic? Which information about the topic is relevant? How will the class learn the topic—which types of activities will take place? What will be the respective roles of the teacher and the students? How will students demonstrate their learning? Which types of assignments or projects will they complete? How will these assignments be graded?

Expert teachers are adept at choosing, as the basis for these discussions, topics that lend themselves to broad and relevant learning by students. They also define the starting point by stating the focal topic and area. There is both a skill and an art to selecting topics that energize and motivate students. For example, less effective teachers might ask students to participate in planning a unit on pollution. More effective teachers might ask students to design a project that measures pollution in the community around the school and alerts relevant agencies and the general public to areas in need of improvement. Carefully focused goals allow students considerable leeway in planning precise activities, but these goals ensure that certain types of learning experiences are included in instructional experiences—in this case, experiences such as experimental design and data collection, familiarity with the roles of governmental agencies, and persuasive communication and letter writing. Table 12.10 on page 454 shows a sample teaching plan based on a constructivist perspective.

THINKING CREATIVELY

Design three questions that would lead to constructivist activities resulting in meaningful learning.

SUGGESTION: Conduct an experiment on animal behavior using your own or a friend's pet, and report on the results. Compare the weather forecasts of different news stations in your area for three days and comment on their variability and possible reasons for it. Write a new ending for the novel assigned in class and defend why your ending is more likely than the real ending.

METHODS FOR TEACHING CONSTRUCTIVELY

Some methods for teaching from a constructivist perspective are actually adaptations of more traditional, teacher-centered approaches. Other methods are new and unique in their applications and goals. As was the case with direct instruction, good teaching from a constructivist perspective depends on the effective combination of specific techniques to reach the widest possible audience. We review the most useful methods here, with tips for selecting and applying these methods in daily teaching.

■ **INDIVIDUALIZED INSTRUCTION** In Chapter 5 on exceptional children, we noted that by law, each student with special needs must have an individualized education program (IEP). This program consists of a detailed description of the specific student's goals, educational activities and requirements, and incremental plans for meeting these requirements. The point of the IEP for a child with special needs is that the child's needs differ from the needs of the "average" child; consequently, this child requires an educational program specially designed just for her or for him.

By recognizing that some children do not fit typical profiles of learning and ability, the response of education professionals who advocated the use of IEPs foreshadowed the student-centered teaching movement, which views each child as a special case. **Individualized**

THINKING PRACTICALLY

How would an individualized instruction program you designed for yourself in this course differ from what you have actually done?

SUGGESTION: Ask yourself what rate of progress you would have made had you challenged yourself with goals and milestones that were personally meaningful to you and your career goals. Also ask yourself which aspects of educational psychology interested you the most and, therefore, you might have have concentrated on more intensively.

TABLE 12.9 Learner-Centered Psychological Principles

The following 14 psychological principles pertain to the learner and the learning process. They focus on psychological factors that are primarily internal to and under the control of the learner rather than conditioned habits or physiological factors. At the same time, the principles attempt to acknowledge external environment or contextual factors that interact with these internal factors.

The principles are intended to deal holistically with learners in the context of real-world learning situations. Thus they are best understood as an organized set of principles; no principle should be viewed in isolation. The 14 principles are divided into those referring to cognitive and metacognitive, motivational and affective, developmental and social, and individual difference factors influencing learners and learning. Finally, the principles are intended to apply to all learners—to children, to teachers, to administrators, to parents, and to community members involved in our educational system.

Cognitive and Metacognitive Factors

Principle 1. Nature of the learning process. The learning of complex subject matter is most effective when it is an intentional process of constructing meaning from information and experience.

There are different types of learning processes—for example, habit formation in motor learning; and learning that involves the generation of knowledge, or cognitive skills and learning strategies. Learning in schools emphasizes the use of intentional processes that students can use to construct meaning from information, experiences, and their own thoughts and beliefs. Successful learners are active, goal directed, and self-regulating, and assume personal responsibility for contributing to their own learning. The principles set forth in this document focus on this type of learning.

Principle 2. Goals of the learning process. The successful learner, over time and with support and instructional guidance, can create meaningful, coherent representations of knowledge.

The strategic nature of learning requires students to be goal directed. To construct useful representations of knowledge and to acquire the thinking and learning strategies necessary for continued learning success across the life span, students must generate and pursue personally relevant goals. Initially, students' short-term goals and learning may be sketchy in an area, but over time their understanding can be refined by filling gaps, resolving inconsistencies, and deepening their understanding of the subject matter so that they can reach longer-term goals. Educators can assist learners in creating meaningful learning goals that are consistent with both personal and educational aspirations and interests.

Principle 3. Construction of knowledge. The successful learner can link new information with existing knowledge in meaningful ways.

Knowledge widens and deepens as students continue to build links between new information and experiences and their existing knowledge base. The nature of these links can take a variety of forms, such as adding to, modifying, or reorganizing existing knowledge or skills. How these links are made or develop may vary in different subject areas, and among students with varying talents, interests, and abilities. However, unless new knowledge becomes integrated with the learner's prior knowledge and understanding, this new knowledge remains isolated, cannot be used most effectively in new tasks, and does not transfer readily to new situations. Educators can assist learners in acquiring and integrating knowledge by a number of strategies that have been shown to be effective with learners of varying abilities, such as concept mapping and thematic organization or categorizing.

Principle 4. Strategic thinking. The successful learner can create and use a repertoire of thinking and reasoning strategies to achieve complex learning goals.

Successful learners use strategic thinking in their approach to learning, reasoning, problem solving, and concept learning. They understand and can use a variety of strategies to help them reach learning and performance goals, and to apply their knowledge in novel situations. They also continue to expand their repertoire of strategies by reflecting on the methods they use to see which work well for them, by receiving guided instruction and feedback, and by observing or interacting with appropriate models. Learning outcomes can be enhanced if educators assist learners in developing, applying, and assessing their strategic learning skills.

Principle 5. Thinking about thinking. Higher-order strategies for selecting and monitoring mental operations facilitate creative and critical thinking.

Successful learners can reflect on how they think and learn, set reasonable learning or performance goals, select potentially appropriate learning strategies or methods, and monitor their progress toward these goals. In addition, successful learners know what to do if a problem occurs or if they are not making sufficient or timely progress toward a goal. They can generate alternative methods to reach their goal (or reassess the appropriateness and utility of the goal). Instructional methods that focus on helping learners develop these higher-order (metacognitive) strategies can enhance student learning and personal responsibility for learning.

Principle 6. Context of learning. Learning is influenced by environmental factors, including culture, technology, and instructional practices.

Learning does not occur in a vacuum. Teachers play a major interactive role with both the learner and the learning environment. Cultural or group influences on students can impact many educationally relevant variables, such as motivation, orientation toward learning, and ways of thinking. Technologies and instructional practices must be appropriate for learners' level of prior knowledge, cognitive abilities, and their learning and thinking strategies. The classroom environment, particularly the degree to which it is nurturing or not, can also have significant impacts on student learning.

Motivational and Affective Factors

Principle 7. Motivational and emotional influences on learning. What and how much is learned are influenced by the learner's motivation. Motivation to learn, in turn, is influenced by the individual's emotional states, beliefs, interests and goals, and habits of thinking.

The rich internal world of thoughts, beliefs, goals, and expectations for success or failure can enhance or interfere with the learner's quality of thinking and information processing. Students' beliefs about themselves as learners and the nature of learning have a marked influence on motivation. Motivational and emotional factors also influence both the quality of thinking and information processing as well as an individual's motivation to learn. Positive emotions, such as curiosity, generally enhance motivation and facilitate learning and performance. Mild anxiety can also enhance learning and performance by focusing the learner's attention on a particular task. However, intense negative emotions (e.g., anxiety, panic, rage, insecurity) and related thoughts (e.g., worrying about competence, ruminating about failure, fearing punishment, ridicule, or stigmatizing labels) generally detract from motivation, interfere with learning, and contribute to low performance.

Principle 8. Intrinsic motivation to learn. The learner's creativity, higher-order thinking, and natural curiosity all contribute to motivation to learn. Intrinsic motivation is stimulated by tasks of optimal novelty and difficulty, is relevant to personal interests, and provides for personal choice and control.

Curiosity, flexible and insightful thinking, and creativity are major indicators of the learners' intrinsic motivation to learn, which is in large part a function of meeting basic needs to be competent and to exercise personal control. Intrinsic motivation is facilitated by assignment of tasks that learners perceive as interesting and personally relevant and meaningful, appropriate in complexity and difficulty to the learners' abilities, and on which they believe they can succeed. Intrinsic motivation is also facilitated by assignment of tasks that are comparable to real-world situations and meet needs for choice and control. Educators can encourage and support learners' natural curiosity and motivation to learn by attending to individual differences in learners' perceptions of optimal novelty and difficulty, relevance, and personal choice and control.

Principle 9. Effects of motivation on effort. Acquisition of complex knowledge and skills requires extended learner effort and guided practice. Without learners' motivation to learn, the willingness to exert this effort is unlikely without coercion.

Effort is another major indicator of motivation to learn. The acquisition of complex knowledge and skills demands the investment of considerable learner energy and strategic effort, along with persistence over time. Educators need to be concerned with facilitating motivation by strategies that enhance learner effort and commitment to learning and to achieving high standards of comprehension and understanding. Effective strategies include purposeful learning activities, guided by practices that enhance positive emotions and intrinsic motivation to learn, and methods that increase learners' perceptions that a task is interesting and personally relevant.

Developmental and Social

Principle 10. Developmental influences on learning. As individuals develop, there are different opportunities and constraints for learning. Learning is most effective when differential development within and across physical, intellectual, emotional, and social domains is taken into account.

Individuals learn best when material is appropriate to their developmental level and is presented in an enjoyable and interesting way. Because individual development varies across intellectual, social, emotional, and physical domains, achievement in different instructional domains may also vary. Overemphasis on one type of developmental readiness—such as reading readiness, for example—may preclude learners from demonstrating that they are more capable in other areas of performance. The cognitive, emotional, and social development of individual learners and the way in which they interpret life experiences are affected by prior schooling, home, culture, and community factors. Early and continuing parental involvement in schooling, and the quality of language interactions and two-way communications between adults and children, can influence these developmental areas. Awareness and understanding of developmental differences among children with and without emotional, physical, or intellectual disabilities can facilitate the creation of optimal learning contexts.

Principle 11. Social influences on learning. Learning is influenced by social interactions, interpersonal relations, and communication with others.

Learning can be enhanced when the learner has an opportunity to interact and to collaborate with others on instructional tasks. Learning settings should allow for social interactions, respect diversity, and encourage flexible thinking and social competence. In interactive and collaborative instructional contexts, individuals have an opportunity for perspective taking and reflective thinking that may lead to higher levels of cognitive, social, and moral development, as well as self-esteem. Quality personal relationships that provide stability, trust, and caring can increase learners' sense of belonging, self-respect and self-acceptance, and provide a positive climate for learning. Family influences, positive interpersonal support, and instruction in self-motivation strategies can offset factors that interfere with optimal learning, such as negative beliefs about competence in a particular subject, high levels of test anxiety, negative sex role expectations, and undue pressure to perform well. Positive learning climates can also help to establish the context for healthier levels of thinking, feeling, and behaving. Such contexts help learners feel safe to share ideas, actively participate in the learning process, and create a learning community.

Individual Differences

Principle 12. Individual differences in learning. Learners have different strategies, approaches, and capabilities for learning that are a function of prior experience and heredity.

Individuals are born with and develop their own capabilities and talents. In addition, through learning and social acculturation, they have acquired their own preferences for how they like to learn and the pace at which they learn. However, these preferences are not always useful in helping learners reach their learning goals. Educators need to help students examine their learning preferences and expand or modify them, if necessary. The interaction between learner differences and curricular and environmental conditions is another key factor affecting learning outcomes. Educators need to be sensitive to individual differences, in general. They also need to attend to learner perceptions of the degree to which these differences are accepted and adapted to by varying instructional methods and materials.

Principle 13. Learning and diversity. Learning is most effective when differences in learners' linguistic, cultural, and social backgrounds are taken into account.

The same basic principles of learning, motivation, and effective instruction apply to all learners. However, language, ethnicity, race, beliefs, and socioeconomic status all can influence learning. Careful attention to these factors in the instructional setting enhances the possibilities for designing and implementing appropriate learning environments. When learners perceive that their individual differences in abilities, backgrounds, cultures, and experiences are valued, respected, and accommodated in learning tasks and contexts, levels of motivation and achievement are enhanced.

Principle 14. Standards and assessment. Setting appropriately high and challenging standards and assessing the learner as well as learning progress—including diagnostic, process, and outcome assessment—are integral parts of the learning process.

Assessment provides important information to both the learner and teacher at all stages of the learning process. Effective learning takes place when learners feel challenged to work toward appropriately high goals; therefore, appraisal of the learner's cognitive strengths and weaknesses, as well as current knowledge and skills, is important for the selection of instructional materials of an optimal degree of difficulty. Ongoing assessment of the learner's understanding of the curricular material can provide valuable feedback to both learners and teachers about progress toward the learning goals. Standardized assessment of learner progress and outcomes assessment provides one type of information about achievement levels both within and across individuals that can inform various types of programmatic decisions. Performance assessments can provide other sources of information about the attainment of learning outcomes. Self-assessments of learning progress can also improve students' self-appraisal skills and enhance motivation and self-directed learning.

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TABLE 12.10 Sixth-Grade Science Class: Constructivist Perspective

1. Open with a brief overview of the concept of plate tectonics. Ask students if they think the continents ever moved. Ask students why continents might move and what this move would mean to life on Earth. Ask students what they find most interesting about the concept of plate tectonics.
2. Have students trace an outline of each major continent using a large globe. Next, ask students to use colored construction paper to make cutouts of each continent.
3. Ask students to form groups of three to four, and then work together to come up with various positions the continents may have once occupied. Ask the students to show their ideas to the others in their group and discuss why they think the continents might have been located in those positions.
4. Have a class discussion about the concept of plate tectonics. Show the class a large picture of how the continents drifted apart. Distribute a handout identifying the continents at different periods in geological history. Talk about climate trends and implications for animal and plant life. Ask students their ideas and opinions about what might have happened as the continents drifted. Encourage each student to contribute to the discussion and show her or his own representation of how the continents might have looked.
5. For homework, ask students to research and write an essay about the effects of plate tectonics on the evolution of animals living in the large landmasses when the continents were joined.

instruction is a form of instruction tailored to meet the needs of individual students. Of course, expert teachers have always taken steps to individualize instruction—for example, by assigning different levels and numbers of math problems to students of different ability levels, by allowing artistic students to spend relatively more time than nonartistic students on drawing and painting, and by accelerating the pace of gifted students. According to proponents of student-centered approaches to teaching, individualized instruction should be done for every student, so as to capitalize on individual patterns of strengths and interests.

MAKING INDIVIDUALIZED INSTRUCTION WORK. How do expert teachers systematically create individualized instruction plans for their students? They use three basic aspects of instruction that can vary from student to student.

- The expert teacher gives the students differing amounts of time to complete learning objectives. In all classrooms, high-ability students tend to need less time than do lower-ability students to accomplish a learning objective. Teachers in the past dealt with this situation by providing extra challenges and by assigning extra work to higher achievers.
- The expert teacher varies the actual learning activities that students engage in from one student to the next. All teachers follow this principle of student-centered teaching when they allow students a choice not only of which specific topic to write about for a project, but also of the mode the project will take—for example, a play or script, a short story, or a report comparing two works by the same author.
- The expert teacher varies the actual instructional materials used with each student. Some students can be taught with standard school books, others with relevant works of fiction, and still others with videos or computer programs. The precise materials would vary as a function of the specific student's needs and objectives.

LIMITATIONS OF INDIVIDUALIZED INSTRUCTION. Students' responses to individualized instruction vary, depending on who uses it, why, and how effectively. Like other educational approaches, individualized instruction can be done either well or poorly. If frequent assessments are not built into the program, students may lack motivation to push themselves and may not learn as much as they ought to (Good & Brophy, 1994). Individualization also encourages students to pursue what they are already proficient in and enjoy, because these are the types of activities students tend to choose. Thus this approach is better for certain types of learning experiences than others: Complex thinking skills are unlikely to develop as students work on their own. Finally, individualized instruction (like most forms of instruction) is most effective for highly motivated students who are willing to push themselves (Bangert, Kulik, & Kulik, 1983).

■ **DISCOVERY APPROACHES** **Discovery learning** is a process in which students use information supplied to them to construct their own understanding (Bruner, 1971).

Unstructured discovery occurs when students make discoveries on their own. **Guided discovery** occurs when the teacher assists the students in making the discoveries. Guided discovery is more practical and effective; unstructured discovery often leads students to become confused and frustrated and may result in students' drawing inappropriate conclusions (Brown & Campione, 1994). Guided discovery as a process also works in concert with research on children's cognitive development (Brown & Campione, 1994). During guided-discovery instruction, teachers and students tend to follow the 14 learner-centered principles of student-centered teaching summarized in Table 12.9 (Work Group of the American Psychological Association's Board of Educational Affairs, 1997).

Liz Moore/Merrill

This student is using a computer to analyze the data he has collected from his chemistry experiment.

Guided discovery works well for science lessons, in which the students can be an integral part of the questioning and learning process and can construct knowledge for themselves with the assistance of their teacher. Different props and manipulatives can often be used to help students reason with newly learned concepts. Students can also explore the limitations of what they are learning by conducting small experiments with equipment or tools you provide. As a teacher, you should always remain available and direct the process to make it as fruitful for your students as possible. Table 12.11 shows sample topics and questions on which guided-discovery lessons can be based.

THINKING CREATIVELY

Propose a lesson that successfully uses guided discovery.

SUGGESTION: Use the examples in Table 12.11 to come up with a related idea for a lesson using guided discovery.

■ **GROUP DISCUSSION** **Group discussion** from a student-centered approach is an extension of recitation from a teacher-centered approach. As we have discussed, recitation takes place when the teacher leads the class by asking questions, tolerating pauses, and eliciting student answers. The goal with this approach is to build on basic student understanding to create more complex forms of understanding. Group discussion from the student-centered perspective, by contrast, places you more on the sidelines as the students take center stage. In group discussions, students do not just respond to teacher-initiated questions; they also respond to one another's questions in an open discussion format. Students can enter into animated debates and even have heated exchanges in which they express opposing opinions. Expert teachers remember to set up ground rules to create a workable atmosphere. For example, students are expected not to interrupt one another, which would undermine learning.

MEETING THE GOALS OF GROUP DISCUSSION. One of the advantages of group discussions is that they allow students to interact with one another directly, thereby enabling them to develop interpersonal skills. The general goals of effective group discussions are to encourage students to learn how to listen to and understand one another, to accept

TABLE 12.11 Guided-Discovery Science Lesson: Sample Topics/Questions

1. Give students a small seesaw and a set of weights. Ask them to stack five 1-pound weights 24 inches from the fulcrum. Then ask them to figure out how many weights placed at the end of the opposite side, 36 inches from the fulcrum, will balance the seesaw. The students' goal is to induce the rule for balancing the seesaw and write it down.
2. Give students various objects and a tank of water and ask them to determine the rules and principles that describe which objects float.
3. Give students five jars of brightly colored water (tinted with food coloring). Ask them to determine how much colored water from each jar is needed to create the new color in a jar on the teacher's desk.
4. Give students a selection of actual animal skulls, models of skulls, or pictures of skulls representing various small mammals. Ask students to determine each animal's diet and defend their answers by referring to the types, location, and shape of the animal's teeth.

THINKING ANALYTICALLY

Describe two situations in which you should interrupt a group discussion.

SUGGESTION: If students are shouting or using foul language, or making deliberately abusive or insulting statements, it's appropriate to interrupt.

different points of view, and to evaluate the opinions, beliefs, and attitudes of themselves and others. How do expert teachers ensure that these goals are met?

First, expert teachers define specific-enough questions to bring about a discussion in which students explore the issues deeply. They also assess whether students have the necessary prior knowledge to engage in a meaningful discussion: If not, another learning activity should precede the group discussion to even out students' levels of knowledge of the topic. One unfortunate outcome of discussions among students lacking necessary background is that students express opinions and take sides on issues they know little about. Discussions should never be allowed to turn into shouting matches, arguments, or other unproductive verbal exchanges.

Expert teachers also keep discussions on track by asking questions that encourage students to stay focused on central aspects of the issue or relevant controversial aspects of the issue. Discussions function best when they promote deep exploration of topics about which students already possess some basic knowledge and understanding. Discussions are perfect for taking on higher-level learning objectives, such as evaluation and synthesis of ideas. In discussions, the cursory types of understanding that result from more shallow types of learning can evolve into deeper and more meaningful forms of understanding.

Simply organizing students in small groups does not mean they will automatically participate in collaborative discussion, of course. Explicit and unambiguous teacher guidance is essential. Effective teachers encourage critical and open discussions within a structured framework (Corden, 2001).

THE RESULTS OF GROUP DISCUSSIONS. Effective discussions teach more than the content of the discussions: Properly held, they provide students with scripts for handling disagreements and for airing competing views in an open forum. Some students may come from homes or family backgrounds in which such discussions do not take place. For these students in particular, the experience of participating in an open discussion can be a valuable growth experience.

Group discussions also allow students to see that their peers share certain questions and confusions about issues. By exploring these issues together, students may feel less isolated or somehow "different." Two problems that can arise are the situations in which one eager student dominates the entire discussion, and the converse situation in which some students say nary a word. In such situations, you must act to establish a better dynamic, by limiting the input of some students and soliciting more input from other students.

Other techniques for maintaining good dynamics in discussions are that you (1) refrain from actually answering questions if there is a student who could do so, (2) help students clarify their statements, (3) ask students to elaborate when it is possible that they have more of relevance to say, (4) keep the discussion on track, and (5) remain attentive to the reactions of other students and work constantly to monitor events.

■ **INQUIRY METHODS** Earlier in this chapter we described how teachers can enhance student learning by encouraging students to ask the right kinds of questions. This approach is based on the work of John Dewey (1910), who stressed the importance of how students think in their intellectual development. Dewey advocated what is known as the **inquiry method** of teaching. With an inquiry method, the teacher first asks students a question. Students, in turn, formulate various hypotheses that represent possible answers, gather actual information to evaluate the rival hypotheses, and come to appropriate conclusions. Finally, students revisit the processes they followed and evaluate them.

Table 12.6, shown earlier (Sternberg's seven-level model) presents an example of the inquiry method (see level 7): The mediator encourages the child to perform the experiments by gathering information that can distinguish among the alternative explanations. To be effective, inquiry methods of teaching must be preceded by careful and thorough preparation. Although the experience of inquiry learning can be deeply meaningful for students, it will work only when you choose good starting questions and develop practical ways for the students to evaluate rival hypotheses.

■ **GROUPWORK** Guided discovery, group discussions, and inquiry-based instruction often involve every student in the class. However, for some learning activities, it can be effec-

tive to break the class up into several smaller groups. Use of such smaller groups allows for more in-depth communication among students. **Student groupwork** entails small groups of students working together on tasks in relatively informal settings. One of the main advantages of student groupwork is that it forces every student to become an active participant—shy students do not easily fade into the background. By participating in small-group settings, shy students can learn to gain confidence.

For the student groupwork experience to be effective, you must plan carefully when to use it. Specify goals of groupwork clearly and hold students accountable for reaching these goals. Choose tasks to ensure that two or more students work together to accomplish them; in particular, tasks should require student interaction. You will also need to develop a finely tuned system for getting students smoothly into their groups without disruptions or arguments. Deciding which students to assign to a given group is also important, because who is in a group partially determines group learning outcomes.

One study of this method of instruction examined the determinants of effective student team performance (Koppenhaver & Shrader, 2003). The researchers looked at the effect of teacher-controlled factors on the use and functioning of student teams. To do so, they collected information about 500 undergraduate college students' aptitude, diversity, instability, motivation, personality style, size, and performance. The researchers found that team motivation and instability, both of which are partly controlled by the instructor, are particularly important in determining a team's performance. Thus instructor decisions about team make-up and incentives for performance can have significant implications for student achievement.

Expert teachers introduce their students to groupwork with a quick and simple task that takes only a short time to complete ("Work together to build a plastic dog out of the plastic body parts in your kit"). Expert teachers make the rules of participation clear, including the rules for assembling into groups. They describe tasks clearly and specify both performance goals (resulting in meaningful products) and the amount of time students have to complete their tasks. Expert teachers also remember to watch students closely and remain available to answer questions while students are in groups. Table 12.12 describes some sample groupwork goals and shows examples of products demonstrating goal achievement.

■ **COOPERATIVE LEARNING** A meta-analysis of 46 studies published between 1929 and 1993 concluded that members of cooperative teams outperform individuals competing with each other on four types of problems (linguistic, nonlinguistic, well defined, and ill defined) (Qin, Johnson, & Johnson, 1995; see also Mitchell, Johnson, & Johnson, 2002). This "strength in numbers" effect is one idea behind **cooperative learning,** a teaching approach in which structured groups of students use specific strategies for enhancing learning and interpersonal development (Johnson & Johnson, 1985, 1991; Slavin, 1995a, 1995b; Slavin & Cooper, 1999).

Cooperative learning is similar to groupwork, except that it is more highly structured by the teacher and the mechanisms involved are under tighter teacher control. Robert Slavin

TABLE 12.12 Five Groupwork Goals, with Examples of Goal-Achievement Products

Goal	Product
1. Make a diorama of an event in ancient Greece (for example, the first Olympics).	1. Diorama and explanation by students who built it
2. Write a short story, with each group member contributing one portion.	2. Story
3. Design a computer environment or hyperstudio (series of computer screens on related topics often containing visual aids) on a science topic (for example, geothermal energy).	3. Computer environment and presentations by students about designing it
4. Design a large poster convincing teenagers not to smoke.	4. Poster and students' descriptions of why they made it the way they did
5. Write and perform a skit about good and bad study habits.	5. The skit, both written and performed

and his colleagues (Slavin, Hurley, & Chamberlain, 2003) argued that "research on cooperative learning is one of the greatest success stories in the history of educational research." The authors point out that studies of the achievement effects of cooperative learning have involved every major subject, all grade levels, and all types of educational settings in numerous countries.

Most cooperative learning groups contain three to five students; four is considered the best number (Slavin, 1995a, 1995b). Advocates of this approach suggest that groups be balanced with regard to gender, ethnicity, and ability factors. This balancing is supposed to increase cooperation among students who might not otherwise have had the opportunity to work with one another. Of course, with this intermixing can come interpersonal difficulties or failures in communication; thus you must remain vigilant as to what is going on in each group to prevent interpersonal problems.

EFFECTIVE COOPERATIVE LEARNING APPROACHES. Robert Slavin (1995a, 1995b) is a leading proponent of cooperative learning. He and other researchers have pointed out several important features of effective cooperative learning situations.

- Cooperative learning groups develop students' interpersonal skills, and these skills are directly taught by the teacher. Interpersonal skills are a key aspect of why students are placed into cooperative learning activities in the first place.
- When cooperative learning is successful, it increases the achievement of every student in the group.
- Effective cooperative learning situations require students to interact so as to accomplish the goal (the teacher ensures that the chosen and stated goal meets this condition). As a way to facilitate student interaction, students can be given different components or tools that must be combined or used in tandem to reach the final solution or create the final product. As a consequence, students are forced to work together.

Slavin's (1995a, 1995b) research shows that cooperative learning increases students' tolerance for others from differing backgrounds and of the opposite sex. He has also shown that cooperative learning increases student achievement across content areas on both standardized tests and custom-designed assessments.

THINKING ANALYTICALLY

Why is it important to give quizzes to students individually when they have learned in a cooperative group?

SUGGESTION: Teachers must distinguish students who are really learning from those who just seem as though they are, to ensure that meaningful learning occurs for everyone. Individual quizzes are necessary to make such a judgment.

Slavin's method is sometimes referred to as **Student Teams Achievement Divisions (STAD).** STAD is a formalized system for cooperative learning that creates learning situations most likely to result in desired outcomes. Teachers using STAD begin with direct instruction and then follow it with team study. Students complete exercises and compare and discuss their answers, reconciling differences on their own. When all members of a team understand the completed questions, the team study concludes. Next, students take quizzes to assess their learning. Teams can be rewarded for total points amassed by all team members, a system that gives all team members the incentive to help one another to achieve. Teams do not necessarily compete with one another—rewards are sometimes given for points earned, even if every team earns the points.

Another cooperative learning approach is called **Jigsaw** (Aronson, 2001; Aronson, Blaney, Stephen, Sikes, & Snapp, 1978), a method that encourages the interdependence of group members. In the original method, known as Jigsaw I, the teacher assigned each group member one portion of the material to be learned. That team member would then attempt to become an expert on her or his topic, and group members would then teach one another, leading to everyone's learning about all team members' topics. More recently, Jigsaw II (Slavin, 1995a, 1995b) has added expert meetings of all students in the class who have been assigned the same topic. At these expert meetings, the students compare notes, go over material, and plan how to teach their group members. Back in their groups, the students teach others the material. Finally, students take individual tests to ensure that they have learned the material. Teams can compete for highest total points or for other types of rewards.

The defining feature of the Jigsaw cooperative learning environment is that every student becomes an "expert" on one aspect of the topic, which he or she then teaches to teammates. In one study, Jigsaw was tried in third- and fourth-grade classes and was compared with traditional science instruction in other classes. The researchers hoped that children in the cooperative learning classes would show greater increases in knowledge than their traditionally

learning counterparts in the other science classes, even after controlling for the children's level of prior knowledge. Within the cooperative learning classes, the influence of being an expert or listener on achievement was assessed. Results showed greater increases in declarative knowledge in the cooperative learning classes, with these differences persisting even after four months. Children at all levels of prior knowledge profited from the cooperative learning method. Experts in the cooperative learning teams achieved better results with their sections of the topic than did their listeners, but listeners outperformed traditionally instructed children in most of the topics (Borsch, Juergen-Lohmann, & Giesen, 2002).

In general, cooperative learning is used to promote prosocial outcomes. One study looked at the nature of the interaction experienced by the students, and linked this interaction to learning outcomes. The students were classified as being low performing academically and at risk for destructive health habits. Students whose cooperative learning experience encouraged challenging one another about the health-related subject matter significantly improved their knowledge about AIDS, developed healthier attitudes toward safe sex and cigarettes, developed higher academic self-esteem, generated greater social influence, and improved their constructive conflict skills (Mitchell, Johnson, & Johnson, 2002).

CRITICISMS OF COOPERATIVE LEARNING. A review of 122 studies of cooperative learning (Johnson & Johnson, 1991) supported the value of the cooperative learning approach. Some researchers, however, are not convinced of the value of cooperative learning, and have shown that this technique works best if used in conjunction with other teaching techniques. Some disadvantages of cooperative learning include the possibility that group interactions will negatively affect learning: For example, peer pressure may give popular group members unwarranted influence over the other group members; controlling and dominant students may use group interactions to serve their own purposes rather than to create meaningful learning; and nonmainstream students may be ignored. According to McCaslin and Good (1996), cooperative learning can also encourage students to place more value on processes and procedures—doing it quickly, finishing the product—than on meaningful learning, which can result in reinforcement of student misconceptions, place peer relations and friendships in a more important role than learning, and encourage some students not to do their share of the work.

■ **RECIPROCAL TEACHING** **Reciprocal teaching** is a method used to increase students' understanding of what they read (Brown & Campione, 1990; Brown & Palincsar, 1989; King & Johnson, 1999; Palincsar, 1986; Palincsar & Brown, 1984). Students are taught four strategies to enhance reading understanding:

1. They summarize what they have read.
2. They ask a question about an important point in the text.
3. They clarify the difficult portions of the material.
4. They predict what is likely to come next in the material.

As a teacher, you describe these strategies to the students; then, over the course of several days, you demonstrate how to use them, gradually building one on the others. You and the students complete a reading together and analyze it together, following the four steps. Finally, the students learn to follow the steps on their own, with your guidance. Students can take turns teaching and leading the class or their group.

One review of 16 studies of reciprocal teaching found that this technique is effective both when standardized tests are used to gauge learning and when customized comprehension tests are used to measure learning (Rosenshine & Meister, 1994). Palincsar and Brown (1984) showed that reciprocal teaching works best with young adolescents who can read words accurately but who are not proficient in reading comprehension. However, reciprocal teaching works with students of all ages and has even been shown to be effective with students with learning disabilities (Lederer, 2000).

Teachers who decide to use this approach must follow a three-step plan: First, they shift gradually from showing the students how to use the techniques to having the students take control and work on their own. Second, they match the task difficulty to students' levels and abilities. Third, they diagnose the students' thinking to reveal which types of further

THINKING ANALYTICALLY

How might reciprocal teaching be used in an area other than reading instruction?

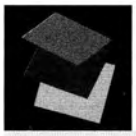
SUGGESTION: Students could borrow the techniques and apply them with slight modification to mathematics learning. In this case, the techniques might include basic computation, error checking, explanation of the process involved in determining correct answers, and generation of new sample problems.

instruction would best serve each student. A review of the evidence on 19 studies of reciprocal teaching concluded that the approach works best when the comprehension strategies are taught explicitly before the actual reciprocal teaching begins (Rosenshine & Meister, 1992).

When one set of researchers studied how teachers deal with obstacles they encounter during reciprocal teaching, they found that teachers modify their use of this technique through strategy use, dialogue, and scaffolded instruction (Hacker & Tenent, 2002). A slightly different approach—tape-assisted reciprocal teaching—has been shown to work well with students showing poor comprehension. This approach enabled poor readers to escape the cycle of reading failure and engage more meaningfully in the process of reading (Le Fevre, Moore, & Wilkinson, 2003). Reciprocal teaching has also been shown to be effective with Taiwanese students learning English as a second language (Fung, Wilkinson, & Moore, 2003).

■ **THE ROLE OF COMPUTERS** Home and classroom computer use is growing faster than the statistics can keep up with. For example, in 2004, 79 percent of U.S. elementary and secondary schools had high-speed computer access and 34 percent had access to wireless networks (Department of Education, 2005); these figures are undoubtedly much higher now. In 2004, there were on average 3.9 students for every school computer. In the 2004–2005 school year, 75 percent or more of students were in schools where they had access to computers. In a number of states, almost all students had access to computers within their classrooms or in computer labs or media centers.

An in-depth survey of computer use in mathematics revealed that, in 2004–2005, approximately 25 percent of fourth-grade students and slightly more than half of eighth-grade students had teachers who used computers at least once a week to develop mathematics curricula or assignments, though fewer students had teachers who used computers to look up information on the Internet or on DVDs for mathematics curriculum planning (Department of Education, 2005). Only 10 percent of fourth- and eighth-graders were in classrooms in which teachers used technology once a week or more, often to present mathematics concepts to them, and more than 30 percent of students were in mathematics classes that did not make use of computers at all. Interestingly, in mathematics classes, technology was more likely used by students than by their teachers. Thirty percent of fourth-grade students and 11 percent of



THE FLEXIBLE EXPERT

TEACHING AND LEARNING ABOUT CLASSROOM TEACHING

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Before class, Amina carefully reviews the material she will cover and then chooses the ideal approach to use in presenting this material.

THE CREATIVE TEACHER: To vary her students' classroom experiences and maintain their interest level, Amina chooses a different teaching approach for each day of the week.

THE PRACTICAL TEACHER: Amina watches carefully to see whether her students are becoming confused by or losing interest in their classroom lessons. When she senses a problem, she changes her approach to one that should work better.

THE ANALYTICAL STUDENT: Edward recognizes and understands the different methods he should use to prepare for class as a function of the teaching methods his teachers prefer.

THE CREATIVE STUDENT: Edward talks to his friends, and they all suggest to their teacher that she break the class up into small groups and give each group one portion of the overall assignment to complete.

THE PRACTICAL STUDENT: Edward peer-tutors his friend Larry to help Larry improve in math, and Edward finds that his own test performance increases as a result.

eighth-grade students used computers at least once a week to practice or review mathematics topics, and 25 percent and 30 percent, respectively, used computers to extend mathematics learning with enrichment activities.

Students' attitudes toward computers vary, as do the results or their computer use: One study showed that even students who assert that a teacher provides better help than an artificially intelligent computer tutor nonetheless prefer using the computer tutor to learning from the teacher—and often appear to learn more while doing so (Schofield, Eurich-Fulcer, & Britt, 1994). In this case, the computers provided additional help and resources for students, and the teachers were able to design programs tailored to each student's learning needs. The students benefited from tailored help and avoided the possible embarrassment of asking questions in public. Numerous quality computer programs are available that can target instruction to a student's level of understanding and, consequently, can relieve you of much repetitive drill-based instruction. Nevertheless, computers are tools that need to be used wisely—computers cannot replace books and teachers (Britt, Brasher, & Davenport, 2007)!

Some students spend hours each day surfing the Internet or using sophisticated computer games and simulations. Some recently introduced programs have significant educational implications—they encourage students to develop cognitively sophisticated reasoning skills. For example, one program allows the student to design an entire urban city down to the smallest detail. Other types of software include the old standbys of home-based research, such as encyclopedias, newly packaged on DVDs with graphics and audio additions. Students call up a term—such as *polar bear*—and get not only the full description that appeared in the original encyclopedia, but also bear vocalizations, a video of bears fighting, panoramic shots of bear habitats, and interviews with zoo officials running captive breeding programs. Parents often become as engrossed in these programs as do their children.

EFFECTIVE VERSUS INEFFECTIVE USES OF COMPUTERS. A key aspect of the successful use of computers as educational tools is the application of common sense. Sometimes, computers function as learning tools; other times, they function as expensive toys. A student who logs onto the Internet and reads the contents of chatrooms about a favorite television situation comedy, for example, is not engaging in an educationally relevant activity. A student who plays computer games involving shooting down as many monkeys as possible may be having fun, but she is not learning. Students who use e-mail to gossip about their classmates are not benefiting the same way as students who use e-mail to hear the perspective of students from different countries. Teachers (and parents) should use common sense in deciding which types of computer use constitute meaningful learning.

Computer-assisted instruction is a type of individualized instruction administered by a computer; it is an example of a meaningful learning activity enhanced through technology. Computer-assisted instruction can become part of a technology-enhanced student-centered learning environment that encourages the students' manipulation of information and that roots the learning process in concrete experience and extended investigation (Hannafin & Land, 1997).

A review of 42 studies examined the effectiveness of computer-assisted instruction programs in supporting beginning readers, and concluded that computer-assisted instruction programs generally tend to be effective (Blok, Oostdam, Otter, & Overmaat, 2002). Another large study compared the academic achievement of elementary students who received either traditional instruction or traditional instruction supplemented with computer-assisted instruction, and found that the students receiving both types of instruction showed higher levels of academic achievement (Christmann & Badgett, 2003).

Another important use of computers involves use of the word processor, complete with spell checker and thesaurus. Productivity can soar when students learn to write on screen instead of using pencil and paper and then transcribing words. However, there is another side to word processing: All students must eventually learn how to spell, choose vocabulary thoughtfully, and check their work for grammatical accuracy without the help of technology. The word processing program is a tool for good writing, just as a calculator is a tool for doing mathematical computation. It is one thing to use a calculator or word processor to improve your efficiency once you thoroughly understand the basic skills involved; it is another thing to depend on computers and calculators to fill gaps in actual knowledge.

EXPERT TEACHER INTERVIEW

FOCUS ON: INSTRUCTIONAL METHODS, INCLUDING TECHNOLOGY

BARBARA ROSEN: PUBLIC SCHOOL 145, DISTRICT 3, NEW YORK, NEW YORK—GRADES K–5, GEOGRAPHY

Barbara Rosen is a cluster teacher in geography at a Manhattan elementary school. She has been teaching social studies and geography for more than 20 years. In this interview, Barbara discusses the importance of geography as a subject, her strategies for teaching geography, their effectiveness for students with reading difficulties, and use of technology in the classroom.

Describe your role as a cluster teacher of geography.

As a cluster teacher, I have expertise in an area that the classroom teacher does not; these are very specialized positions. When I walk into a classroom to lead a geography lesson, the classroom teacher leaves for a preparation period. I teach geography in all grades, K–5, at our elementary school. In one day, I might teach a geography lesson to six different classrooms of students.

Geography is a much neglected subject area—one of the reasons I decided to focus on geography. For example, a study was conducted seven years ago that indicated that many American students couldn't recognize the United States on a world map.

You use a lot of hands-on methods and problem-based projects to teach geography. Can you describe a project?

Right now, the third graders are studying climates of the world. We've been studying climates in several ways. First, I defined global terms, such as *hemispheres* and *equator*, explaining that the cooler climates tended to be farther away from the equator. To help students with the new terms, we made an analogy to our bodies; the head as the North Pole, the feet as the South Pole, the waist as the equator, and so on. Then we played a game. I would say, "Point to where a cold climate in the Northern Hemisphere would be," and students would point toward their heads. We followed this up with several activities in which students colored pictures related to different climates. Now, they are dressing paper dolls. Each student will be randomly assigned a location on the globe. They need to draw and cut out clothes to dress their paper doll as though it were going to visit that place.

What are some of the benefits of project-based learning?

Hands-on projects take a long time, but there are great payoffs. Active engagement helps students really learn concepts in a way that is meaningful for them. High levels of engagement in projects also lead to fewer behavior problems in class. In addition, hands-on projects can often reduce the frustrations of students who have difficulties reading.

Can you recommend a basic geography project to classroom teachers?

When I do a workshop with teachers, I tell them that geography is a perspective on the world and understanding it. Get a globe and a map and use these when students are reading a story about another country. Point out the country to the kids; ask them how we'd get there. What do we have to cross? What separates us?

Human–environment interaction is one of the major concepts of geography. A great book to bring this point across is Dr. Seuss's *The Lorax* (Random House, 1971). In the beginning of the book, there are animals living in a forest of trees, and then a factory is built. Ask students, "What happens to the environment? What has changed? How do these things resemble what's happening in our environment?" Fifth graders, who loved this book from their earlier childhood years, now read it from a new perspective. They learn about the human role in creating pollution, such as acid rain.

How do you reach students with different learning styles and abilities?

Geography is an alternative mode for reaching children—students who are not word oriented can still be very bright. It is a different way to learn. One of the lecturers for *National Geographic* is a brilliant Ph.D. He discovered geography because he has dyslexia and geography is not word based. He excels at what he does. His story proves that there is another avenue, another way to shine.

Especially in elementary school, many children are concrete learners.

One study examined the effects of using a word processor in a one-year course on holistic writing skills (Dalton & Hannafin, 1987). This course emphasized the writing process rather than the mechanics of writing in a group of 80 seventh graders. Some students used word processors, and others used traditional paper and pencil. Word processing helped the low achievers write better compositions by encouraging them to revise their writing. By comparison, it did not help the able learners, who were hindered by the mechanics of word processing.

Expert teachers vary their instruction and assessment methods to require students to learn and perform both with and without the tools of technology. For example, in-class essays can be completed longhand, and homework compositions can be completed with a

Hands-on projects, with materials students can manipulate, help them learn. For example, the fourth graders were recently learning some words for different geographical formations: *island, river, peninsula,* and so on. We worked through three different methods before I really felt the students understood these words. First, students read the words and their definitions. Then, we tried an activity in which students matched the geographical term to a picture. I could tell that students just were not getting it. So, I got some blue construction paper and some brown paper bags. We cut shapes out of the bags to represent land and out of the blue paper to represent water. Students glued these together in ways that showed the various geographical features. It wasn't until we did this activity that I finally felt the students comfortably understood these words.

How do you use technology to teach geography?

Once a week for a year, the fifth-grade class geography lessons were based on *Where in the World Is Carmen Sandiego?* (Mindscape). Students worked in pairs in the computer lab. One student took notes to show how the kids were making decisions to get to the next city. It took them a while to acclimate to the game. They often just guessed at the answers and hit the keys on the keyboard more or less randomly.

I modeled how to play the game by projecting the game onto a big screen. I prepared worksheets for them to keep track of their answers. I gave them databases to help answer the clues and find the criminals. They had a wonderful year. If they caught a villain, they received a certificate. They learned to recognize a host of locations in the world, such as "Where do they have volcanoes and cold temperatures? Iceland." All this was learned through computer technology.

I have also used a computer atlas, *My First Amazing World Explorer* (DK Multimedia). This works in kindergarten and first grade, where students read a lot of stories. We use the atlas to locate places in the stories. When I click on the pictures in the atlas, the students learn the animals of that region and other information. The atlas zooms in or out so that you can start with a world map and zoom in on a city, and then zoom out again. This technique gives a global perspective on each specific location we study.

What advice would you give new teachers?

Try to engage the children. Get their attention with hands-on projects. New teachers might be concerned about finding the time for hands-on projects; they may be worried about all the different things they must teach in a year.

I suggest trying to find a theme behind the material that needs to be learned, and incorporating instruction in several disciplines as you explore that theme with the students. For example, our fourth graders need to learn a great deal of information about the history, economy, and geography of New York State. One theme that we've used to integrate much of this material is the importance of rivers. We talk about why Native Americans lived near rivers, why the first European settlers also wanted to live along rivers. Students read literature selections that relate to the river theme. The theme even extends to science, where fourth graders are learning about structures. They can study bridges, hydroelectric dams, and more. Teachers who find a theme like this can help students learn a lot of necessary information and integrate their understanding of a variety of disciplines.

I suggest trying to find a theme behind the material that needs to be learned, and incorporating instruction in several disciplines as you explore that theme with the students.

word processor if the student has access to a computer. It is essential not to become overly awed by technology, and not to allow technology to supplant imagination and real understanding.

Some particularly innovative work focused on using technology to create meaningful learning environments has been done by the Cognition and Technology Group at Vanderbilt University. Its ongoing series of projects, including the well-known Jasper Project, has involved a wide variety of students. For example, these researchers' work with young children (kindergarten and first grade) involves a program integrating literacy, mathematics, and science by anchoring instruction to a complex story presented on video (CD-ROM or DVD, as

Patrick White/Merrill

Kindergarten students use computers to practice both math and reading. Expert teachers are aware of both the benefits and liabilities of computer-assisted learning in the classroom. Computers should be regarded as one of many components of an effective learning system.

THINKING ANALYTICALLY

Name three good uses and three poor uses of computers for high school students, if the goal is enhancing meaningful learning.

SUGGESTION: Good uses: Searching out information related to lesson topics; conducting repetitive drills when necessary; designing simulated city or other environments that meet teacher-specified criteria. Poor uses: Distributing personal photographs; online shopping; chatrooms on nonacademic topics.

well as tape). The stories end with challenges that invite students to retell the story in their own words and then engage in other comprehension activities that deepen their understanding of important themes in the stories (Cognition and Technology Group at Vanderbilt University, 1997). Theme-related folktales are also available. Such software supports print-based literacy skills as well as building on the power of video to communicate and stimulate children's desires to communicate.

INTEGRATING COMPUTERS INTO DAILY CLASSROOM LIFE. In planning how to use computers in daily instruction, consider individual differences in the efficacy of computer-based instruction. In a study of 1,035 students in grades 5 to 10, Bannert and Arbinger (1996) found gender differences in computer use, with boys spending more time than girls on the computer. Another study (Owens & Waxman, 1998) involving more than 15,000 tenth-grade students again found boys using computers more often than girls did in science and mathematics classrooms. Obviously, you must remain aware of different patterns of computer use among students of different groups. Some students possess a learning style that is well adapted to learning from a computer terminal, but others do not; computers are not a panacea for all students.

Computers can also be used effectively as part of student-centered learning situations (Newell, 1996). Newell's study looked at the effects of a cross-age tutoring program on computer literacy learning of second graders. Seventeen fourth-grade students tutored 17 second graders on three computer programs: a keyboarding program, a problem-solving program, and a word processing program. Observations of the second-grade tutees were conducted before and after the tutoring program to determine the effects of the tutoring program on their computer literacy learning. The results indicated that prior to the tutoring, only five second graders could play a game, and three of them could use a simulation program. The observations following the program indicated that all 17 tutees could use and interact with the three programs, a game, and a simulation program. Thus peer tutoring was an effective approach for increasing computer literacy in these students.

LIMITATIONS OF COMPUTER-ASSISTED LEARNING. Researchers are also analyzing the limitations of learning from computers. Charles Brainerd and Valerie Reyna (Brainerd, Reyna, & Kneer, 1995; Reyna & Brainerd, 1993; Reyna, Brainerd, Bootzin, Effken, & Lloyd, 2002) have studied computer-based learning in children—especially how computer-based learning affects memory. Through experiments, they have shown that when material is presented in a form that produces especially vivid verbatim memories, children do better on rote memory tests, but they do worse on reasoning and inference tests of their ability to transfer material to new domains.

Computer-based learning relies heavily on strong visuals, which may improve children's verbatim memories at the expense of their reasoning ability. The data show that younger children are particularly sensitive to such interference. By middle elementary years, most children can compensate for this interference, but their reasoning ability is never helped by computer-based visual images.

More research on the role of computers in learning is clearly needed. As we learn more about the inappropriate versus appropriate uses of computers in the classroom, expert teachers should view computers as merely one part of an effective learning system, rather than as the central focus of that system.

■ **LIMITATIONS OF STUDENT-CENTERED APPROACHES** Critics of student-centered instruction point out that some teachers become so enamored with the activities and techniques of student-centered instruction that they lose sight of the main goal of education: meaningful learning. Group discussions, project work, and inquiry methods can be

far more fun than traditional forms of instruction—for students and teachers alike. Traditional teacher-centered methods can seem boring by comparison. Thus you may be tempted to abandon traditional approaches and allow students to spend too much time engaged in fun activities. The students may be happy and compliant, but they may not be learning essential material. The bottom line is that student-centered approaches should be used when they help meet the goals of meaningful learning, and not simply to make school more pleasant.

Another criticism of student-centered instruction is that it is easy to lose control of students and their learning experiences. Goals may take a backseat to simply doing activities. The focus can too easily shift from performing activities in service of learning to performing activities for their own sake, regardless of whether any meaningful learning is taking place. In addition, student-centered instruction takes more time than teacher-centered instruction. As a result, it becomes more difficult to ensure the required material and curriculum are covered.

Student-centered approaches are better for some types of educational objectives than for others. Even so, for some teachers, every educational goal or objective can become a vehicle for using a student-centered approach, regardless of the appropriateness of these objectives for student-centered methods. In general, the quality and insight of the teacher determine the effectiveness of student-centered teaching approaches. Expert teachers know how to incorporate student-centered approaches into their teaching—with exceptional results.

THINKING PRACTICALLY

Which type of teaching approach do you think you will most enjoy in your work as a teacher? Which type will you be best at? Why?

SUGGESTION: Ask yourself which approaches you would feel most comfortable with. If you had to teach a family member about a topic in current events, which approach would you most likely choose? How might your personality equip you to do a better job with certain approaches than others? For example, outgoing people with a good sense of humor can often do a better job with a lecture than can introverts who are shy before a group.

FORUM

WHO SHOULD BE AT THE CENTER?

Are teacher-centered approaches the best way to teach? Or are student-centered, constructivist approaches the most effective way to reach students?

FIRST VIEW: Students learn more from traditional, teacher-centered approaches. Proponents of traditional techniques of instruction cite the long-term success and proven track record of these techniques. Advocates cite the effectiveness of repeated drilling and repetition in helping children learn and remember basic facts and concepts. These basic facts are seen as the foundation for all other learning; thus they must be learned accurately and thoroughly for students to progress and not be derailed by a lack of basic knowledge. Teacher-centered approaches have the advantage of maximizing students' time on academic tasks, which maximizes learning per unit time. Students learn to discipline themselves, which is certainly an important life skill. The teacher—not other students—is seen as the natural and appropriate leader of student learning.

SECOND VIEW: Students learn the most from constructivist approaches. Advocates of constructivist approaches believe that meaningful learning occurs when students are deeply involved in their learning. Hands-on techniques and activities teach knowledge more deeply and result in a more mature and useful level of understanding. Constructivist techniques mirror real-world situations that students will encounter throughout their lives—cooperating rather than always competing, solving real-world problems, working with others from different backgrounds, generating and evaluating alternative hypotheses, asking fruitful questions, and completing extensive projects. The student is a leader rather than a follower in the teaching process, and consequently becomes a more engaged and active learner.

THIRD VIEW: A SYNTHESIS. Students benefit most from the combination of different teaching techniques. Both teacher-centered and student-centered techniques are useful. The key for the teacher is to recognize the strengths and weaknesses of each approach, as well as the types of students for whom each approach is best suited. The best teaching approach often consists of the use of traditional techniques to teach basic skills, facts, and concepts, and the use of constructivist techniques to encourage students to integrate their knowledge and use this knowledge to solve real-world

problems. Some students need more basic instruction than others. Other students may quickly become ready to move past basic instruction. For these students, project work under student control may encourage the greatest intellectual growth. By combining techniques, teachers can customize their approaches to meet the needs of every student. The key is to combine techniques effectively to provide a range of learning experiences to all students.

IMPLICATIONS FOR TEACHING

- **Take steps to ensure that your students are actively involved in learning.** The constructivist movement in education has helped expert teachers to understand students' central role in learning and to design instruction to create an active learning experience. Hands-on, active, compelling lessons working from the principle that students create their own knowledge become easier with the tools of constructivist approaches.
- **Familiarize yourself with the various student-centered teaching methods.** These techniques include individualized instruction, discovery, group discussion, groupwork, cooperative learning, and reciprocal teaching. From research in educational psychology, you can learn the details of what works for different types of students and why. Be willing to try different approaches to see which ones are most effective.
- **Consider the increasingly important role of computers and technology in the classroom, and use this technology as appropriate.** Computers can serve both meaningful and meaningless (and even harmful) ends, depending on how they are used. Effective teachers speak to other teachers, read magazines and journals, and consult other sources of information about computer programs before making their selections. They also preview programs to ensure their appropriateness for classroom use.

CONSTRUCTING YOUR OWN LEARNING

Choose a subject you hope to teach someday, and choose one age range of student on which to focus (elementary, middle school, or high school). Select one topic you believe might be difficult for the students to understand. Now, create five brief lesson plans portraying five distinct ways to teach the topic. For example, one way to teach fractions to fourth graders is to review several examples from the textbook on the chalkboard, asking students to chime in when they know the right answer. Another way to teach fractions would be to bring a pie or a pizza to class and cut it into many small pieces. Once you have sketched out five ways to teach the same topic, describe the strengths and weaknesses of each approach. Which types of students would be likely to do best with each approach, and why? Which approach do you like best, and why?

SUMMING IT UP

WHY UNDERSTANDING CLASSROOM TEACHING IS IMPORTANT TO TEACHERS

- Expert classroom teachers are more knowledgeable, more efficient, and more insightful than novice teachers. Experts' teaching plans tend to be more flexible and fluid than the plans of novices.

PRINCIPLES OF TEACHER-CENTERED TEACHING

- Teacher-centered teaching consists of techniques for direct, teacher-led instruction. Learning objectives are clear descriptions of educational goals. They can be action oriented and specific (referring to individual behaviors), or they can be general. If they are general, they should be tied to specific behaviors that indicate when the objectives are met.
- Taxonomies are systematic hierarchical classifications of learning objectives. Bloom sorted educational objectives into three categories: cognitive, affective, and psychomotor. Bloom's six levels of cognitive objectives have been very influential in education.

- Methods of direct instruction include lecturing, recitation and questioning, and seatwork and homework. Lectures should begin with a thorough introduction to the topic that gives relevant context. They should end with a review and an opportunity for teacher-supervised practice followed by independent practice. Recitation and questioning are effective when teachers choose good questions representing a variety of types of thinking, and when they wait for students to think before calling on anyone. The rules for seatwork and homework should be clearly specified. Teachers should provide help during seatwork. Homework, recommended as a normal part of instruction, should reinforce what was learned in class and should be graded promptly. Both homework and seatwork should stress meaningful learning.
- Aptitude-by-treatment interaction refers to the fact that students learn different things and in different amounts from the same instruction. Students have different personalities, abilities, and backgrounds; consequently, teachers must vary their instruction approaches to meet the needs of all students.

PRINCIPLES OF STUDENT-CENTERED (CONSTRUCTIVIST) TEACHING

- Student-centered (constructivist) teaching gives the student a central and active role in instruction. The constructivist view sees students as constructing their own understanding. The American Psychological Association's learner-centered principles define many of the objectives of student-centered teaching.
- Planning is very important for student-centered teaching: Activities need to include concrete goals and methods of assessment so that students' learning can be documented. Activities should not become merely excuses to have fun in the classroom.
- Among the several methods for teaching constructively, individualized instruction is a process in which teacher and students customize what the students learn, decide the time frame in which learning will take place, and specify the method and approach. In discovery approaches, and especially guided discovery, the teacher assists students in discovering concepts, ideas, and principles on their own, often using props and manipulatives.
- Another a constructivist approach, group discussion, requires teachers to keep students on track and focused; these discussions foster the students' development of interpersonal skills. Inquiry methods involve students testing alternative hypotheses to answer a question posed by the teacher. Groupwork consists of small groups of students working together on tasks in informal settings.
- Cooperative learning is a constructivist approach in which structured groups of students use strategies for enhancing learning and interpersonal development; groups consisting of four students are ideal. One type of cooperative learning approach uses Student Teams Achievement Divisions (STAD); another is called Jigsaw. Another constructivist approach, reciprocal teaching, is a method for reading instruction in which students learn four strategies to enhance understanding and then take turns leading the class or a small group in using the strategies.
- Computers can either assist in meeting educational goals through computer-assisted instruction or take students off track. The key is the precise activity the computer is being used for; teachers and parents should supervise students' use of this medium. Computers should not take the place of learning essential writing and mathematical skills.

KEY TERMS AND DEFINITIONS

- **Affective domain** Domain in which educational objectives are focused on feeling and emotion. Page 435
- **Aptitude-by-treatment interaction** Effect of instruction in which individual students learn different things from the same instruction depending on their personalities, abilities, and backgrounds. Page 446
- **Cognitive domain** Domain in which educational objectives are focused on thinking. Page 434
- **Computer-assisted instruction** Individualized instruction administered by a computer. Page 461
- **Constructivism** View of learning that sees students as constructing their own understanding. Page 449
- **Cooperative learning** Teaching approach in which structured groups of students use specific strategies for enhancing learning and interpersonal development. Page 457
- **Direct instruction** Teaching methods including lecturing, recitation, and questioning, and seatwork and homework. Page 438
- **Discovery learning** Learning process in which students use information supplied to them to construct their own understanding. Page 454
- **Expository teaching** Ausubel's instruction approach, which is designed to encourage meaningful verbal learning. Page 440
- **Group discussion** Conversation among students in which students pose and answer their own questions and in which the teacher does not play the dominant role. Page 455
- **Group instruction** Instruction in which students learn, process, and discuss material in groups. Page 449
- **Guided discovery** Learning process in which the teacher assists the students in making discoveries. Page 455

- **Individualized instruction** Form of instruction modified to meet the needs of individual students. Page 453
- **Inquiry method** Dewey's instruction method, in which teachers first ask students a question. Students then formulate various hypotheses that represent possible answers to the question, gather actual information to evaluate the rival hypotheses, and come to appropriate conclusions. Finally, students revisit the processes they followed and evaluate them. Page 456
- **Jigsaw** Cooperative learning approach in which groups of students are assigned topics on which to become expert, compare notes with other experts in their topic area, and then teach members of other groups about their topic. Page 458
- **Learning objectives** Clear descriptions of educational goals. Page 433
- **Open schools** Schools in which students are actively involved in deciding what and how they will learn and study. Page 449
- **Programmed instruction** Structured lessons that students work on by themselves and at their own pace. Page 443
- **Psychomotor domain** Domain in which educational objectives are focused on physical action. Page 435
- **Reciprocal teaching** Approach that attempts to increase students' understanding of what they read by teaching students four strategies: summarize, question, clarify, and predict. Page 459
- **Recitation** Teaching methods in which teachers ask questions and students provide answers. Page 441
- **Seatwork** Quiet, independent work students do at their desks. Page 443
- **Student-centered approach** Teaching that gives a central and active role to the student. Page 449
- **Student groupwork** Small groups of students working together on tasks in relatively informal settings. Page 457
- **Student Teams Achievement Divisions (STAD)** Formalized system for cooperative learning that creates learning situations most likely to result in desired outcomes. Page 458
- **Taxonomies** Systematic or hierarchical classifications of learning objectives. Page 434
- **Teacher-centered approach** Teaching centered on, or led by, the teacher. Page 432
- **Unstructured discovery** Learning process in which students make discoveries on their own. Page 455
- **Wait time** Period of silence before and after a student answers a question that gives all students an opportunity to think. Page 442

QUESTIONS AND PROBLEMS

IN ELEMENTARY SCHOOL

1. You teach a class of 15 first graders. How important do you believe general versus specific learning objectives are with such young students? Which type of objective would be more successful with this group, and why?
2. You are a new third-grade teacher preparing for your first year of teaching. Do you believe learning taxonomies could be useful in planning your teaching? How might you use a learning taxonomy to prepare a basic science lesson?
3. Your class of fourth graders seems to tune you out whenever you give a lecture, even if only for 10 minutes. Which steps might you take to hold the students' interest more effectively? Which other teaching techniques might work better?
4. Do you believe that students should be given homework in first through fourth grade? Why or why not? Describe which types of homework might be appropriate versus inappropriate for such young students.
5. Your class of second graders is socioeconomically, culturally, and ethnically diverse. You are concerned that instruction must reach every student in this widely varying group. What can you do to ensure that students from very different backgrounds relate to your teaching?

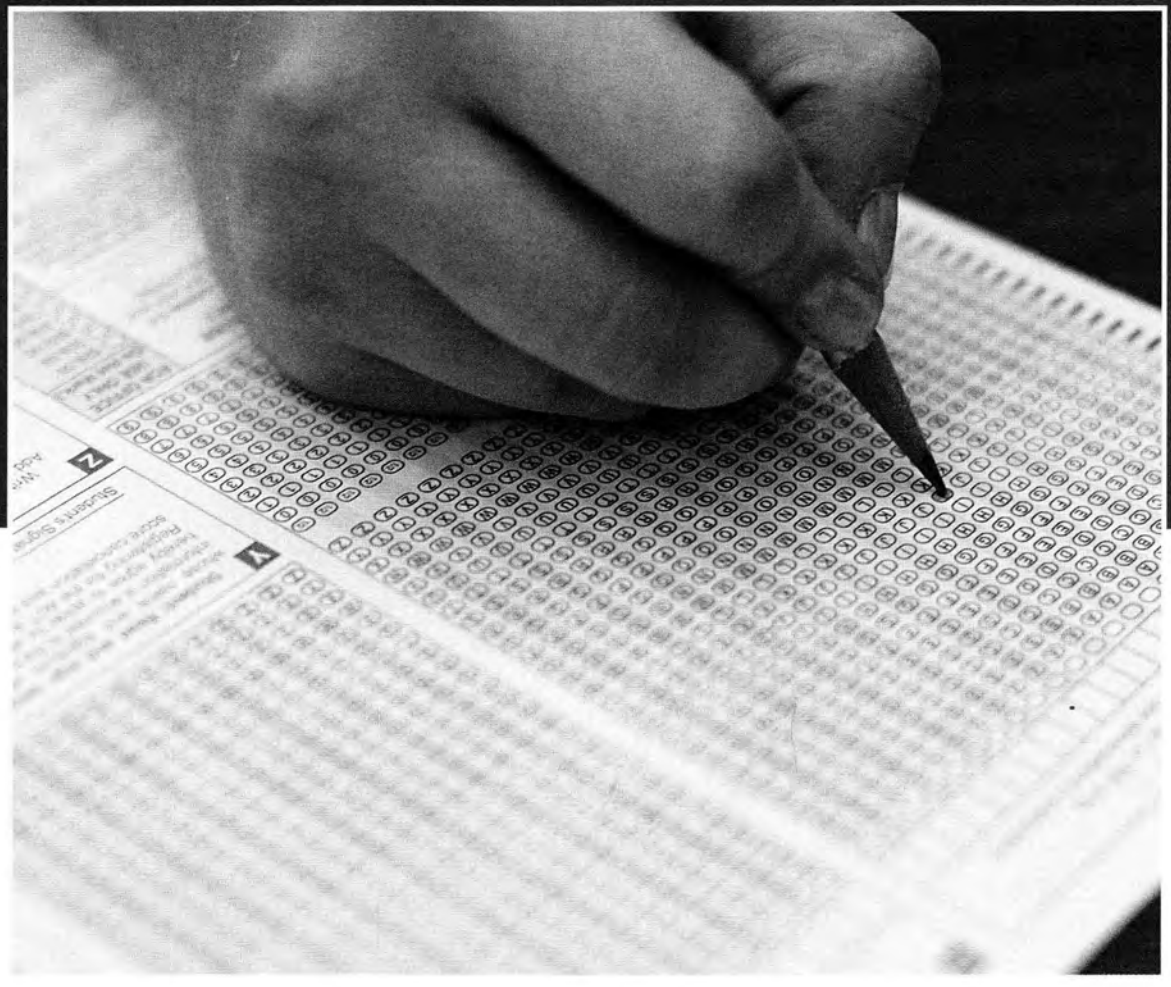
IN MIDDLE SCHOOL

1. Your eighth-grade math and science classroom is about to receive a gift of six new computers from a local business. How can you best take advantage of these computers to improve your science and math instruction?
2. Describe a situation in your teaching of seventh-grade social studies when a handout containing a learning taxonomy would be a useful teaching aid. What could the students learn from such a handout? How might this mode of presentation help the students understand the material?
3. You are leading an eighth-grade math class, and you often find it necessary to use lecture and recitation to cover all of the material. Which other teaching techniques could you use to help broaden your style? What about reciprocal teaching?
4. How much homework should teachers assign in grades six through eight? Which types of homework might be appropriate for students of this age? How would you know if you are assigning too much homework?
5. How might social and cultural issues interfere with students' learning as they enter adolescence? How can you use different instructional techniques to help students learn during this challenging period in their lives?

IN HIGH SCHOOL

1. You teach twelfth-grade biology and chemistry. How important are general versus specific learning objectives with students of this age? How can you use learning objectives to help students organize their studying and assimilation of the material?

2. How might you encourage eleventh-grade students to use learning taxonomies on their own to organize their coursework and, especially, their homework? How would you convince them that taxonomies could help?
3. When is direct lecturing most effective with high school language arts students? How about recitation? How can these techniques be made more effective for use with high school students? Which other techniques should teachers try with high school students?
4. You are concerned that many teachers do not assign enough homework to their tenth-grade students because they are afraid of overburdening these students. How can you determine how much homework is optimal for your own students?
5. You are a twelfth-grade foreign language teacher. Which steps might you take to tailor your instruction to each student's personal needs?



Standardized Testing 13

Why Understanding Standardized Testing Is Important to Teachers

What Are Standardized Tests?

Types of Standardized Tests

Tests of Intelligence

Intelligence Test Scores

Tests of Aptitudes and Interests

Tests of Achievement

Assessing Test Quality

Populations and Samples

Reliability

Validity

Interpreting Standardized Test Scores

Statistical Concepts Underlying Test Scores

Types of Scores

Issues and Concerns in Standardized Testing

Test Bias

The Cultural Context of Testing

Misuses of Standardized Tests

New Directions in Standardized Testing

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this chapter:

- What is a standardized test? How do standardized tests differ from tests that are not standardized? What are the main types of standardized tests?
- Which statistical concepts do you need to know to interpret test scores? Which types of scores can tests yield?
- When should students be compared to other students, to themselves, and to some objective standard of performance?
- What are the advantages and disadvantages of each test approach, and when should you use each one?
- How can you assess the fairness and quality of a standardized test?
- What are the main issues to consider in giving and interpreting tests?

Tonight was Jolene Johnson's first parent–teacher conference night. She was nervous about presenting the basic-skills test scores. At Southside Elementary School, third graders were required to take the California Achievement Test. It was the first major standardized test of their school careers. Teachers then presented the score reports at parent–teacher conferences. In this way, they encouraged attendance at the twice-a-year event.

Jolene confided her concerns to McKinley Phillips, the other third-grade teacher at Southside. McKinley had been teaching third grade for seven years. Jolene had relied on her expert advice frequently during the first few weeks of school.

"I read the booklet that came with the score reports. But I am afraid the parents are going to ask me to explain something that I don't fully understand myself," admitted Jolene.

"I worried quite a bit about the same thing," McKinley confirmed. "Let me tell you what works for me. The first thing I cover," said McKinley, "is the percentile score. Parents are always interested in finding out how their child compares to third graders around the country. It is a pretty natural instinct, I guess. Because our students usually do well in comparison to the national average, most of the time we begin on a positive note."

"Then, I point out the graph of scores on all the different subtests," McKinley continued. "The graph gives a picture of a child's strengths and weaknesses on the test. This profile helps some parents. One thing I try to make very clear is that what they are seeing is only the strengths and weaknesses on one particular test. I mention some things that might affect a test score. I also emphasize that at our school we are not going to base anybody's future on a single test. This observation usually helps alleviate any tension that may have arisen.

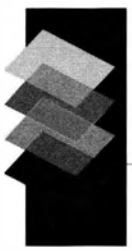
"I always make it a point to share my own perceptions. I say whether I agree or disagree with the picture the test scores are showing," McKinley advised. "Sometimes this sharing is a good introduction to my showing parents some of the student's work from the sample folders. We usually finish by discussing what the next steps will be for the student. I particularly emphasize how the parents can help," she finished.

"That sounds like a good plan," agreed Jolene, feeling reassured. "But what do you tell them about grade equivalents? One of my students has scored at the fifth-grade level in math. Won't her parents ask why she is not in fifth grade rather than third? After all, don't her tests show she is already working at a fifth-grade level?"

"Yes, I get that question every year," smiled McKinley. "I explain to the parents that grade equivalents can be misleading. A fifth-grade equivalent actually means the score their child got was the score that a fifth grader who was taking the third graders' test would get. It is not what their third grader would get if she tried to do fifth-grade work. See the difference?"

"I think I finally comprehend it myself," laughed Jolene. "Thanks, McKinley. I am feeling much better."

From your own experiences as a student, you are probably familiar with taking standardized tests, including a college entrance exam such as the SAT or ACT. As Jolene's experience makes clear, standardized tests will continue to be important to you in your role as a teacher. In this chapter, we define what standardized tests are. We also discuss how they are used and assess which types of tests are available. We review what results on these tests mean. We also discuss how you can assess the fairness and quality of a standardized test. Finally, we consider some of the issues associated with testing in general.



Why Understanding Standardized Testing Is Important to Teachers

Standardized tests are a part of the educational experience of nearly every U.S. student. Almost all states require standardized tests as part of their annual assessment of students. Standardized tests are also very important in American society. For example, they are used to help decide a student's academic placement, such as for college admissions. Standardized tests are also used to compare the performance of teachers, schools, districts, states, and even nations, with one another. Finally, they are used for placement in special education.

Why do schools use standardized testing—or any testing, for that matter? There are several general reasons. First, such testing is used as a *formative assessment*—an assessment to facilitate student learning. Formative assessments are typically diagnostic in nature. They are designed to pinpoint students' strengths and weaknesses. They provide feedback to students and teachers along the way to student mastery of material. Second, standardized testing serves as a *summative assessment*—an assessment conducted after instruction has taken place to assess students' overall learning. Third, testing motivates students to learn. Students often will study harder if they know they will be formally assessed. Fourth, testing motivates schools and teachers. The idea behind much testing is to ensure that schools convey to students the material they need to be educated citizens. Fifth, standardized testing provides accountability. Increasingly, schools are being held to standards that require all students to achieve certain levels of scores on standardized tests. These standards are increasingly becoming national in nature.

In recent years, some educators and researchers have argued that standardized tests are overemphasized (Gardner, 1999; Johnson, Johnson, Farenga, & Ness, 2007; Madaus & Kellaghan, 1993). Other commentators are pushing for even more standardized tests. In 1997, President Bill Clinton proposed a national standardized test for all students in fourth and eighth grades. More recently, President George W. Bush also proposed expansion of standardized testing.

The *No Child Left Behind Act*, discussed in Chapter 5, was designed to ensure that states would be held accountable for educating their children. It received broad bipartisan support in Congress. The Act requires extensive standardized testing throughout the nation for those states that accept federal funds. It specifies that states must develop and then meet adequate yearly progress objectives. Separate objectives must be specified for students in general and for students who fall into particular groups—that is, major ethnic and racial groups, students with various kind of disabilities, and students who have limited English proficiency. All schools must meet proficiency goals by the 2013–2014 school year. Those schools that fail to meet the objectives for two years in a row are identified as "in need of improvement," and their students will be allowed to transfer to other schools. If, after three years, the laggard schools still have not improved, sanctions may be imposed, such as change of curriculum or of staff in the schools (see also Neal & Schanzenbach, 2007; Porter & Polikoff, 2007).

Whatever your opinion about the future of standardized tests, their current prevalence and the importance placed on them demand that teachers know how to use them. Expert teachers understand the strengths and weaknesses of standardized tests. That understanding allows teachers to use their results both fairly and effectively (Linn & Gronlund, 2000). Expert teachers also know how and when to use a specific test. Further, they recognize which tests meet the needs of both schools and students.

After your students take a standardized test, you must then know what to do with the scores. Part of being an expert teacher is understanding the sometimes confusing array of standardized test scores and being able to interpret these scores for others. Expert teachers are able to interpret test scores. In doing so, they take into account students' cultural background, native language, and socioeconomic status. Finally, they understand some of the pitfalls of standardized testing—and they avoid these pitfalls wherever possible. The Forum feature, "Costs and Benefits of Standardized Testing," explores different opinions about the use of standardized testing.

FORUM

COSTS AND BENEFITS OF STANDARDIZED TESTING

Standardized test scores have assumed an enormously powerful role in American society. Their role has increased in many other societies as well. In the United States, standardized tests are used for evaluation and placement in both elementary and secondary schools. They also are used for admission to college, law school, medical school, dental school, education school, business school, and other kinds of programs. Many people, however, have begun to question the widespread use of standardized tests in this country.

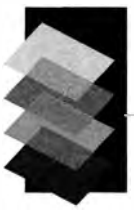
FIRST VIEW: Tests can help teachers and admissions officers make informed decisions. For example, a test such as the SAT or ACT can help compare students who come from different parts of the country, different high schools, and different family backgrounds. Comparing students on other factors, such as grades, is not as fair. Some teachers or schools may grade unusually easily or unusually strictly. As a consequence, a student who gets B's and C's at a "hard school" may be just as capable as one who gets all A's at an "easy school." Standardized test scores can be a reliable way of comparing students' achievement. In addition, such tests have been shown to predict performance. For example, they predict grades in the first year of college.

SECOND VIEW: Standardized tests can be, and at times have been, used irresponsibly. Such use occurs because there is a natural human tendency to value quantitative precision. People often fail to consider whether the quantitatively precise information is valid for the purposes for which it is being used. For example, one study investigated a standardized test used as a factor in many graduate-school admissions decisions. In the one program investigated, it did not well predict any other measure of success except first-year grades.

There is also the danger that test scores will become self-fulfilling prophecies (Rosenthal & Jacobson, 1968). In this situation, test scores can create an expectation on the part of a teacher for a student. The expectation then materializes simply because it was there. For example, a teacher might place students with low scores on a reading aptitude test in the slow reading group. The students in the slow group may get less challenging reading assignments and homework than the students in the faster groups. Eventually, the reading levels of students in the slow group may, indeed, fall behind those of the fast groups. But are the lower reading levels caused by the students' ability levels or by the teacher's low expectations, based on the test scores?

THIRD VIEW: A SYNTHESIS. Tests can be a blessing or a curse. It is up to all of us—teachers and researchers alike—to use them productively. Tests should be used only when they have been demonstrated to be reliable and valid for the purposes for which they are being proposed. Moreover, they should be used only in conjunction with other information. For example, a multiple-choice test may not provide a fully valid assessment of science knowledge. New forms of standardized tests include essay exams or tests that actually require students to demonstrate hands-on task performance. They may give better estimates of mastery and the ability to succeed in some areas of endeavor.

Tests should always be used together with other information. In elementary and secondary schools, placement should be based on class performance and teacher evaluations as well as test scores. The weighting of various factors in admissions decisions should be balanced so as to yield the best possible validity for decisions. These factors include test scores, grades, admissions essays, and interviews.



What Are Standardized Tests?

A **standardized test** is a test given to many individuals, often across the country, to develop appropriate content and scoring comparisons. It is administered and scored according to uniform procedures. Uniform—that is, standardized—procedures are the key to the definition of a standardized test. Constructors of these tests try to assure that every student taking the test has a similar experience. Standardized tests are usually purchased from test publishers, which sell the tests only to those qualified to use them.

Not all tests purchased from publishers are standardized. For example, textbook publishers often offer banks of test questions. The publisher, in this case, does not try to standardize the experience of every student who is tested. Likewise, teacher-made tests are not

standardized. Instead, they are created by or for individual teachers who use them on only a limited number of students. Each teacher scores the tests he or she creates in an individual way. Ideally, all tests of achievement should be closely tied to the learning that students have done (Dochy & McDowell, 1997). This is important, in part, because the way you test can affect the way students decide to learn (Airasian, 1997).

Standardized tests are of two types: norm referenced and criterion referenced (Gregory, 2000). **Norm-referenced tests** compare each test taker's scores with the performance of all the test takers (Haynes & O'Brien, 2000). Recall that standardized tests are given to large numbers of students to establish standards for scoring and content. Giving a test to many students allows test developers to develop **norms,** or **normative scores,** test scores that reflect the performance of individuals in the population of interest. For example, the population of interest to Jolene Johnson and McKinley Phillips is all the third graders in the United States. Typically, students, teachers, administrators, and parents are interested in finding out how test scores in their school compare with the national norms for the test. Norms are often based on national samples, but they do not have to be. Sometimes they are based on scores across a state (as in a statewide mastery test), across a school district, or even in a classroom. It is important to know who constituted the normative sample.

Criterion-referenced tests measure a student's performance relative to what the student should know, rather than to how other students scored on the test (Haynes & O'Brien, 2000). In an arithmetic test on fractions, for example, it is helpful for a teacher to know how well a student has done in comparison to others. At the same time, it is also important to know exactly which operations the child does and does not understand. Criterion-referenced tests are developed differently from norm-referenced tests. The goal with the former tests is not simply to compare students' scores on the test. Instead, emphasis is placed on comparing students' understanding of the knowledge required by a given curriculum. Publishers of some tests provide both normative and criterion-based information as part of their score reports.

Recall from Chapter 2 the difference between maximal performance and typical performance. *Maximal* performance is the very best you can perform under optimal circumstances. *Typical* performance is how well you perform under ordinary, everyday circumstances. Most of the standardized tests that students take in school are designed to elicit maximal performance. To do well, students typically have to work as quickly and as hard as they can. Only in this way can they finish some fairly difficult problems within a limited time period. In other words, they have to work their fastest and be at their best. For example, students might be asked to do a difficult arithmetic problem. They might also be asked to read a passage and then answer challenging questions on the material in the passage.

Many factors can prevent a student from giving a maximal performance. In fact, some factors might render students who want to give a maximal performance unable to do so. Examples are having a cold or being distracted in the testing room. Other students simply may not be interested in performing at their maximal level. Perhaps they do not regard the test as important or as worthy of their attention.

Expert teachers know that individuals' maximal performance is not necessarily a good predictor of their typical performance, and vice versa. Some students perform phenomenally well when they set their minds to doing well. On ordinary school tasks, such as homework, however, these same students might put in much effort and not do well. Other students might not do well on maximal performance tests, yet may give each task in school their all. As a result, their performance may actually be better on a day-to-day basis than that of the student who excelled in the maximal-performance test.

Researchers and expert teachers recommend several techniques to encourage and help students give their best performance on standardized tests:

1. *Make the importance and purpose of the test clear.* Today, many decisions about student and teacher placement and even school funding hinge on test scores. Teachers who try to reassure students by telling them "the scores really do not matter that much" are doing students a disservice, for two reasons. First, they are providing inaccurate information. Second, their cavalier attitude may inadvertently lower students' motivation to do well. Give students a realistic idea of the uses and

THINKING PRACTICALLY

Teacher-made tests are usually not standardized. What is one advantage to measuring achievement via teacher-made tests rather than standardized tests bought from a publisher?

SUGGESTION: The teacher-made test is specifically targeted to the material the teacher actually taught.

THINKING ANALYTICALLY

Normative and criterion-referenced scores are largely complementary. What is one obvious advantage of each type of score over the other?

SUGGESTION: Normative scores facilitate comparisons between students. Criterion-referenced scores identify which skills students have and have not mastered.

THINKING ANALYTICALLY

Which kind of task would you give students that involves typical performance? Which kind of task involves maximum performance?

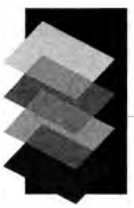
SUGGESTION: A typical performance task is stating an opinion. A maximal performance task is writing an essay justifying an opinion.

importance of test scores, but avoid placing so much emphasis on the test that students become nervous about the outcomes.

2. *Take the mystery out of standardized tests.* Spend some time preparing students for the test. In general, students who are well prepared for the testing experience are better able to focus their attention on the content of the test questions. They are not distracted by the directions or form of the questions. Use the practice tests provided by test publishers. In this way, you can acquaint students with the testing experience and with the types of questions they are likely to encounter. Help students become familiar with the way questions are phrased. Also, help them learn to spot words that can mislead them. Brainstorm and practice strategies for understanding what typical standardized-test directions are actually asking the student to do. Encourage students to develop effective strategies for handling various types of items, such as "fill-in-the-blanks" or "identify the incorrect sentence."
3. *Provide good testing conditions.* If students are to be tested in a room other than their usual classroom, assure them of the comfort of the testing site. Ensure that there are adequate climate control and lighting, few distracting features, sufficient supplies, and a seating pattern that gives all students a clear view of the clock and the ability to hear the test monitor. To prevent distraction or illness, some schools even provide snacks during breaks in long testing sessions.
4. *Prepare yourself.* Expert teachers know that monitoring standardized tests involves more than reading the directions and watching the clock. They also know the different types of tests available. In this way, they are able to adjust their facilitation to meet the needs of the test. Test monitors should know how to reduce distractions and help students stay focused during the tests. They should ensure that all students understand the directions. Test monitors also must be prepared to cope with problems. Typical problems are cheating, student illness or anxiety, or interruptions.

CONSTRUCTING YOUR OWN LEARNING

Consider how you will apply the guidelines listed above when you help your own students prepare to take standardized tests. Use a statewide criterion-referenced test as an example. Write out what you would tell students to describe the importance of the test. How would you fit into your regular lessons time for practice with typical test question types and directions? Plan what you would do if a student suddenly became ill during the testing session. This exercise may help you to think back to standardized tests you may have taken yourself. How did your teachers help you prepare for those tests? For example, was anything they said especially motivating or reassuring? Did any of your teachers respond especially well when unusual situations arose during testing? Try to adapt some of the best strategies as you make your own plans.



Types of Standardized Tests

As a teacher, you will probably have occasion to use many different types of standardized tests. Examples include reading tests, math tests, general ability tests, general achievement tests, and even occupational-preference tests. Expert teachers ensure that a particular standardized test is the most appropriate test for the purpose it is being used. For example, a test of reading comprehension may not be the most appropriate test for helping high school students determine their career direction. Consider the major types of tests so you will know which standardized tests you can use to assess students in a range of situations and for a range of purposes. One of several sources in which you can find formal reviews of standardized tests is the Buros Institute's *Mental Measurements Yearbook*, which is revised regularly.

TESTS OF INTELLIGENCE

Tests of intelligence were first developed by Frenchman Alfred Binet in the early 1900s to distinguish children who needed special education from those who were simply having behavior problems in school. Binet's test was very successful in making this distinction. In fact, a version of his test is still in use, along with many other intelligence tests.

Today, there are two basic types of intelligence tests, including both individual tests and group tests (Gregory, 2000). Like Binet's original test, intelligence tests are used as diagnostic tools to help determine whether children should receive special education. They can also be used as predictive tools, to suggest how students are likely to perform in school.

■ **INDIVIDUAL TESTS** The Stanford–Binet Intelligence Scales (DiStefano & Dombrowski, 2006; Roid, 2003) are the modern version of Alfred Binet's original intelligence test (Binet & Simon, 1905/1916). These scales can be used for children as young as 2 years up to adults of 90 years and older to measure intelligence according to Binet's conception. The test is given individually and must be administered by a trained psychologist. In its current version, it offers an overall score as well as subscores. Administration consists of 10 subtests. The test gives an overall IQ, verbal and nonverbal IQs, plus five factor scores: fluid reasoning, knowledge, quantitative reasoning, visual–spatial processing, and working memory. Each factor is measured by both verbal and nonverbal subtests.

A similar set of tests prepared by David Wechsler is also used (see Matazarro, 1972; Wechsler, 1939, 1974, 1991, 2002, 2003). Rather than developing a single, multiaged scale, Wechsler used different but related scales for different age ranges. These scales, with different names at different levels, are the Wechsler Adult Intelligence Scale—(WAIS-III), the Wechsler Intelligence Scale for Children (WISC-IV), and the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III). The Wechsler scales yield an overall score, as well as separate verbal and performance scores. Examples of items from the Stanford-Binet and Wechsler scales are shown in Figure 13.1.

THINKING ANALYTICALLY

Referring to Figure 13.1, name one similarity and one difference between the Stanford–Binet and Wechsler tests.

SUGGESTION: A major similarity is that both tests use many verbal items. A difference is that the Wechsler series places a greater emphasis on nonverbal performance-based tasks.

Other kinds of individual intelligence tests are used as well (Kaufman, 2000), such as the second edition of Kaufman and Kaufman's (2004; Kaufman, Lichtenberger, Fletcher-Janzen, & Kaufman, 2005) Kaufman Assessment Battery for Children (K-ABC II), which is loosely based on a biological theory of intelligence (Luria, 1966). The Kaufman Brief Intelligence Test (K-BIT) is a short intelligence test that aims to measure intelligence with an abbreviated scale (Prewett & McCaffery, 2006). Another test, the Differential Abilities Scales, provides a large number of subtests as options, from which the examiner decides which tests to administer. An innovative kind of individual intelligence test is Reuven Feuerstein's (1979) Learning Potential Assessment Device (LPAD). This test measures not children's developed potential, but rather their zone of proximal development (Vygotsky, 1978; also see Chapter 3 of this book)—that is, the difference between their underlying capacity and their developed ability, as measured by their ability to profit from guided instruction.

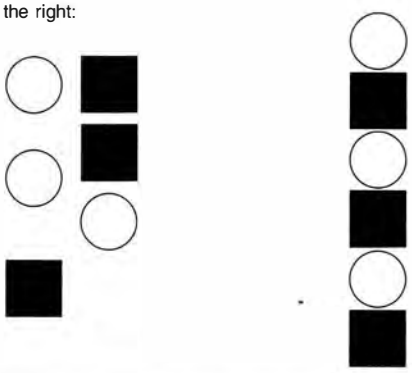
A student takes an individual intelligence test, administered by a trained psychologist.

Jim Whitmer/PH College

■ **GROUP TESTS** It is sometimes not practical to test each student individually. In these cases, schools may decide to use group tests of intelligence. Group tests typically are paper-and-pencil measures of intelligence that can be administered in an hour or two. These tests, unlike individual tests, do not require extensive professional training to administer. The main functions of the examiner are to read directions and to enforce time limits. Because they do not require each student to meet with a trained psychologist, group tests of intelligence tend to be faster and less costly to administer. However, the results of individual tests are often more accurate. In some states, use of group tests is restricted. For example, the state of California does not allow use of group tests of intelligence

FIGURE 13.1 Examples of Items Appearing on the Stanford–Binet and Wechsler Scales

The sample questions here are not actual questions from the scales. The questions simply illustrate the kind of questions that would appear in the main content areas of the tests.

Types of Questions Seen on the Stanford–Binet Intelligence Scales		
Content Area	**Explanation of Question**	**Example of Possible Question**
Verbal reasoning	Describe how one word is different from three other words.	Select the word from the following word list that is not like the others. mug fork straw cup (Note that you cannot drink from a fork, but you can drink from a mug, straw, and cup.)
Quantitative reasoning	Complete a number series.	Which number seems most likely to come next in the following series of numbers: 3, 10, 17, 24, __?
Figure/abstract reasoning	Combine geometric pieces to form a particular geometric shape.	Use the pieces below to form a pyramid.
Short-term memory	The examiner will say a sentence. Repeat the sentence back exactly.	Repeat this sentence back to me: "Allison jumped over a bush and ran down to the lake."
Types of Questions Seen on the Wechsler Adult Intelligence Scale		
Content Area	**Explanation of Question**	**Example of Possible Question**
Verbal scale	Define a word's meaning.	What does *orthodontics* mean? What does *conspicuous* mean?
Content Area	**Explanation of Question**	**Example of Question**
Performance scale	Use patterned blocks to create a design that looks like the design provided by the examiner.	Put the blocks on the left together to copy the pattern on the right: 

Source: Table 11.2, p. 358 from *In Search of the Human Mind*, 2nd ed., by Robert J. Sternberg. Copyright © 1998 by Cengage Learning. Reprinted by permission of the author.

THINKING ANALYTICALLY

As you examine the test items in Figure 13.1, which do you think are most dependent on cultural background for their solution? Why?

SUGGESTION: Vocabulary is an example of a type of item that is highly dependent on cultural background.

in schools. In general, group tests of intelligence are used much less frequently in schools than they once were.

Group tests of intelligence generally are of two main kinds. In the first kind, an *omnibus test*, such as the Otis–Lennon School Ability Test and the Henmon–Nelson Test of Mental Abilities, multiple kinds of test items are intermixed. For example, a series-completion item may follow immediately after a vocabulary item. In the second kind, tests are divided into parts, or subtests, in which each part is typically timed separately. Each item in a part is the same kind (e.g., vocabulary). A well-known example of such a test is the Cognitive Abilities Test. Figure 13.2 shows examples of items that frequently appear on group tests of intelligence.

FIGURE 13.2 Examples of Items Appearing on Group Intelligence Tests

The sample questions here are not actual questions from the scales. The questions simply illustrate the kind of questions that would appear in the main content areas of the tests.

1. **What month comes just after March?**
   (1) February (2) May (3) April (4) July (5) November

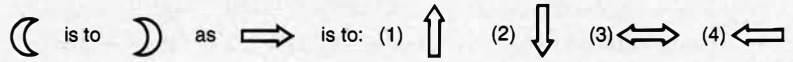
2. **Young** is to **old** as **quick** is to:
   (1) tired (2) hungry (3) happy (4) slow

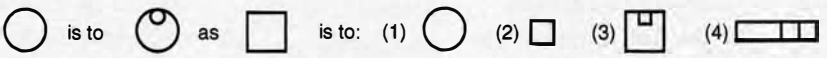
3. **Up to how many dimes can you have in 50¢?**
   (1) 2 (2) 5 (3) 10 (4) 50

4. To **chide** is about the same as to:
   (1) help (2) feed (3) scold (4) cheer

5. **How many ounces are in 2 quarts?**
   (1) 64 (2) 100 (3) 56 (4) 16

6. **What number, if multiplied by 6, is equal to 3 times 10?**
   (1) 8 (2) 5 (3) 2 (4) 12

7. 

8. 

INTELLIGENCE TEST SCORES

What kinds of scores are used to interpret the results of intelligence tests? Here, we discuss two possibilities.

Binet suggested that we can assess children's intelligence on the basis of their **mental age (MA)**—their level of intelligence compared to an average person of the same physical age (also called chronological age [CA]). Suppose, for example, a person performs on a test at a level comparable to that of an average 10-year-old. We say the person's mental age is 10. People with very different chronological ages can all have the same mental age. Consider the case in which an 8-year-old, a 10-year-old, and a 12-year-old all have the same score on a test of intelligence. Their mental ages are the same, despite the differences in their chronological, or physical, ages.

There are several problems with the concept of mental age. First, chronological age increases indefinitely throughout a person's lifetime; mental age does not. Usually, people's mental age stops increasing, or starts to increase only slowly, at a chronological age of roughly 16. In old age, mental age may actually decline. This decline typically is due to decreases in scores on tests of rapid and flexible abstract thinking. These facts suggest that the ratio of mental age to chronological age takes on a meaning different for adults from that for children. It can even mean different things for adults of varying ages. For example, an average adult of 40 would have a mental age not of 40, but of 16 to 17 or so. Although compensations in scoring systems have been made to account for this fact, the problem has never been resolved in a fully satisfactory way.

A second problem is that although mental age implies a continuous distribution of intellectual development, we know that intellectual development is not wholly continuous. Whether we see it as occurring in stages or in relation to the acquisition of domain-specific knowledge at certain ages, the fits and starts of mental development are not reflected in the mental-age construct.

The German psychologist William Stern suggested that mental age is a problematical measure, because it is difficult to compare scores of people of different ages. How do you compare

TEACHER INTERVIEW

FOCUS ON: PREPARATION FOR TESTING

JULIE YOUNG: ASHAWAY ELEMENTARY SCHOOL, ASHAWAY, RHODE ISLAND—GRADE 4

Julie Young's approach to teaching math and writing is in sync with the requirements of a statewide standardized test. It allows her students to feel prepared for a demanding week of testing.

What is the statewide standardized test?

The test, which is three days each for math and for language arts, is required of all fourth-grade students in our state. The expectations on the standardized tests are high. The tests concentrate on higher-level thinking skills—in my opinion, a good thing. The test is a true assessment of what we should be teaching and what the students should be learning.

The language arts test involves one day of writing in response to a writing prompt. The next day, students read an excerpt and write about it. On the third day, students interpret many passages for meaning and grammar.

On the first day of math testing, the students work on concepts and skills in math. On the second and third days, the students show their process in solving problems.

How did you prepare your students for the math portion of the test?

Problem solving is a significant part of the test. My background is in math, and I believe that problem solving is an important skill for the students. Problem solving used to mean a word problem with a definite answer. Today, students are given a problem that may have more than one right answer. They must show their thinking and write why their answer makes sense. I believe that it is important to know the reasons why you're doing things in math, not just to memorize the steps to get the right answer.

> I believe that it is important to know the reasons why you're doing things in math, not just to memorize the steps to get the right answer.

Our school has just adopted a new math series this year. As part of using that series, we are focusing on students' being able to explain what they do, and being able to solve problems in different ways. This move—away from the past emphasis on computation and memorization—matches my own beliefs.

It also fits in well with the emphasis on problem solving that is part of the statewide standardized tests, so, in a sense, I use the entire year to prepare the students. We start every morning with problem solving. Some problems we work on cooperatively, and other problems, students solve on their own. To prepare specifically for the statewide test, my

THINKING PRACTICALLY

Suppose that someone were to receive an extremely low IQ score on a hypothetical test. Would the very low score mean the person has a very low level of intelligence? If not, what else might it mean?

SUGGESTION: The person might have decided he or she does not want to engage with the test and thus deliberately does not do well.

the mental age of 10 achieved by an 8-year-old with that achieved by a 12-year-old? To deal with this difficulty, Stern suggested the **intelligence quotient (IQ)**, a measure of intelligence comparing mental age (MA) to chronological age (CA) times 100. Because of the use of a ratio of MA to CA in calculating the IQ, an IQ calculated in this way is sometimes referred to as a ratio IQ:

$$\text{Ratio IQ} = (\text{MA}/\text{CA}) \times 100$$

Ratio IQs are rarely used today, because a weak link was discovered in their calculation—namely, the construct of mental age. Instead, we generally use **deviation IQ scores.** Deviation IQs are calculated on the basis of how high a person's score is relative to that of other people of his or her age. The average score for either a ratio or deviation IQ is 100. Scores below 100 are "below average." Scores above 100 are "above average." Using common statistical calculations, roughly two-thirds of all IQ scores fall between 85 and 115. Roughly 19 out of 20 scores fall between 70 and 130.

TESTS OF APTITUDES AND INTERESTS

Aptitudes are abilities developed over a period of years that predict success in particular areas of endeavor. Examples are music, writing, or reading. Among the most widely used aptitude

students took practice tests one month prior to the real test.

How do you prepare students for the language arts portion of the test?

For the most part, the language arts test is in line with the approach I use to teach writing. We have writers' workshops and readers' workshops. These really help the students with the test. I didn't cater to the test—it just happened to be the way I taught writing.

I often start with a mini-lesson based on what I see as their needs—for example, how to write an interesting beginning. Students practice by cutting and pasting new beginnings onto their stories. Then they write, and they confer with each other. They revise and confer some more. Finally, they share their writing with the class. They all have experience in writing a draft, revising it, and getting feedback. The test allows them to write a first draft, edit, and revise.

Is there anything about the standardized tests that you would like to see changed?

The writing assessment was problematic. Doing the writing test in one undertaking is unrealistic. In real life, you ask others to read your writing, and you get their comments. In a test, you can't talk and you have to write the piece in one day. As a result, the students can't reflect on what they've written. It's not true to the real-life process of writing. It's not how we teach writing.

Another drawback of these tests is that they are timed, a practice that is hard for students who work more slowly.

We often hear about the problems with standardized testing. Do you see any positive aspects of standardized testing?

Standardized test scores provide a way to see if you and your students are moving in a positive direction. You can use the test scores to spot weaknesses, or areas for improvement, in your instruction.

Also, the focus that our standardized test places on higher-level thinking skills may help some teachers who want to include more thinking and problem-solving activities in their curricula.

What advice about standardized testing would you give to new teachers?

Make sure you're aware of the expectations for students, that you know what will be asked of them on the tests. Use the school resources available to you. When I was a new teacher, I relied heavily on an experienced fourth-grade teacher at our school to tell me what the students needed to be able to do at the end of the year and what they needed to do on the tests. You'll find that testing goes a lot more smoothly if you know what's expected.

tests are the **Differential Aptitude Tests.** They are designed to measure such aptitudes as verbal reasoning, numerical ability, abstract reasoning, clerical speed and accuracy, mechanical reasoning, space relations, spelling, and language usage. Such tests are used to help students with curriculum or vocational planning.

Tests of specific aptitudes are used for narrower purposes, such as selection or vocational placement. They include, among others, the Bennett Mechanical Comprehension Test and the Seashore Tests of Musical Aptitudes. For example, a student who wishes to be in the vocal music program at a performing arts high school might be given the Seashore Tests as part of the admissions process.

Counselors and teachers often recommend that students engaged in career planning take not only an aptitude test, but also a **vocational interest test,** such as the Strong Vocational Interest Blank. The goal of such tests is to help students decide where their vocational interests lie. The tests do not indicate *ability* for these vocations, however. For this reason, teachers often recommend taking both an interest test and an aptitude test. Unlike most of the other tests mentioned here, interest tests are designed to measure typical—rather than maximal—performance. Students are asked to describe or behave in ways that exemplify how they usually think or behave. For example, students are asked to rate statements such as "I enjoy working with others" and "I like to travel." A person rating each of these statements high might be encouraged to become a travel agent, tour guide, or scientific field researcher. The recommendation would depend on the person's other interests, skills, and abilities.

THINKING ANALYTICALLY

Why do people today generally prefer deviation IQs to ratio IQs, even though the former are not, strictly speaking, intelligence quotients?

SUGGESTION: Deviation IQs are not susceptible to statistical problems such as interpretations of ratios of MA to CA for older individuals.

TESTS OF ACHIEVEMENT

An **achievement test** measures accomplishments in either single or multiple areas of endeavor. Areas include reading comprehension, mathematics, social studies, and science (Cohen & Swerdlik, 1999; Gregory, 2000). Five of the most commonly administered achievement tests are the Iowa Tests of Basic Skills, the SRA Achievement Series, the California Achievement Test, the Metropolitan Achievement Test, and the Stanford Achievement Test. All of these tests contain measures of achievement in multiple academic subjects. Consider, for example, the California Achievement Test: It measures achievement in vocabulary, reading comprehension, language mechanics, language expression, mathematical computation, mathematical concepts and applications, spelling, study skills, science, and social studies. In all cases, these tests can be used at multiple levels throughout the elementary and secondary grade levels. Examples of typical items from one test are shown in Figure 13.3.

Some tests, such as the SAT, were originally conceived of as aptitude tests (the acronym originally stood for "Scholastic Aptitude Test"). Today, however, they are conceived of as closer to achievement tests. There are two SATs:

- SAT Reasoning Test measures basic skills that are important for college. It is divided into verbal and mathematical sections.
- SAT Subject Tests measure achievement in specific areas, such as mathematics, biology, various foreign languages, and so forth.

Over the years, there have been various changes in the SAT. For example, until 1995, the tests were based on a normative scale established in 1941. The mean was set to 500 and the standard deviation to 100 for each test (verbal and mathematical) in that year. Subsequently, scores were based on that normative sample. As the years went by, however, the nature of the population of students taking the SAT changed. Far more students of much more diverse

FIGURE 13.3 Examples of Types of Items Found in Some Achievement Tests

The SAT is in part an achievement test frequently taken by high school juniors and seniors who are planning to attend college. It includes the types of questions shown here. The SAT emphasizes reasoning with the material one has learned and, therefore, has a strong critical-thinking component. Other achievement tests use similar formats, adjusted for the grade level of students who will take the test.

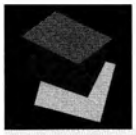
Content Area	Explanation of Task/Question	Example Task/Question
Sentence Completion	Show knowledge of meanings of words and their uses and relations.	Choose the word or set of words that best fits into a whole sentence, such as "The most common use for a _____, of course, is to lock and unlock doors." (Correct answer choice would be "key.")
Verbal Analogies		Choose the pair of words with the same relationship as a given pair (analogies). For example: plumber : sink : : mechanic : engine
Reading Comprehension	Demonstrate understanding of a text passage.	Correctly answer multiple-choice questions about a text passage, such as "What did the main character of this story hope to achieve?"
Quantitative Skills	Make calculations involving geometry, algebra, fractions, arithmetic, exponential numbers, and other mathematical concepts.	Choose the correct answer from several possible answers in a multiple-choice format. For example, after viewing a picture of a polygon with some angles and sides labeled and others left blank, students might be asked to identify the correct number for one of the missing side measurements.

backgrounds started taking the test. As a consequence, the number of high scores decreased and the number of low scores increased—that is, scores became lopsided, such that there was a preponderance of scores at the lower end of the distribution. For this reason, the scales were recentered in April 1995, so that the sample of students who took the test in that month became the basis for a new set of norms with a mean of 500 and a standard deviation of 100 (http://www.ets.org/research/dload/RR-02-04.pdf, retrieved January 11, 2004). Of course, old scores can be converted into new scores, and vice versa.

Beginning in 2005, the SAT Reasoning took a new form. Indeed, this new form has been referred to as the "New SAT" (http://www.collegeboard.com/newsat/index.html, retrieved January 11, 2004). In revising the test, the goal of the College Board, the organization that creates the test, was to more closely align the SAT with the curricula currently taught in high school and college. This change reflected not the scale by which the test is scored, but rather the content. A new writing section is now scored separately on the same 200 to 800 scale as the other two sections. It includes both an essay section and multiple-choice grammar and usage items. A "perfect" score (obtained by adding up part scores), therefore, has increased from 1600 to 2400. The verbal test, which is now called the critical-reading test, contains both short and long reading passages. The mathematical section now includes more difficult items whose complexity extends as far as Algebra 2. Analogies and quantitative comparison have been dropped.

*i*MPLICATIONS FOR TEACHING

- **Take into account the purpose of each type of score.** Expert teachers use both norm-referenced and criterion-referenced information. Suppose a new student joins Jolene Johnson's third-grade class. Jolene knows that the student scored better than 78 percent of the students in the country on a standardized reading comprehension test. She can use that information in various ways. One way is to compare the student to others in her class. Another way is to use the information as an initial indicator of the work Jolene should assign the student.
- **Pinpoint strengths and weaknesses.** Achievement tests that provide diagnostic information can be used as tools to determine what students still need to learn to attain mastery of a body of knowledge. For example, you can use the information in score reports to diagnose the strengths and weaknesses of a student's performance. To do so, you compare the scores on individual subtests or parts of the test to the student's overall average score. Areas in which the student scored below his or her own average may be targets for improvement.
- **Combine test scores with other evaluations to better assess performance.** Compare test performance to work samples and everyday observations. For example, Jolene Johnson noticed the incoherent book reports turned in by one of her third-grade students. The student's test scores on reading comprehension and language expression, however, were well above average. Jolene realized that the student was waiting until the night before the paper was due to read the book. He then slapped together a book report. Jolene can now work with him on the true problem: time management.
- **Evaluate the performance of the class as a whole.** Suppose an elementary school teacher notices that his or her class does much better on the science subtests than on the English ones. As it happens, the class has many students whose first language is not English. This teacher may wish to request help from the school's ESL program. Suppose, however, the students are mostly native English speakers. In this case, the teacher then may wish to look closely at his lessons and the time spent on science relative to English. He could look for ways to add enjoyment, as well as rigor, to English lessons.



THE FLEXIBLE EXPERT

USING STANDARDIZED TESTS EFFECTIVELY

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Lily puts together a spreadsheet on her computer to help her compare her own classroom objectives with the objectives covered by the standardized tests required in her school so that later she can decide which scores are most meaningful to her and her students.

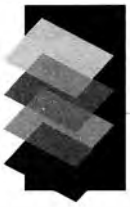
THE CREATIVE TEACHER: Lily tells a few jokes to help her students relax during breaks in the standardized testing session.

THE PRACTICAL TEACHER: One of Lily's students feels bad because his percentile scores on the standardized achievement test are below the national average. Lily helps the student see that he is making progress by pointing out the scores that show how much of the material covered by the test the student has actually mastered. She also pulls his scores from the previous year from his file to show him how much he has improved in just one year.

THE ANALYTICAL STUDENT: Ethan uses the practice test session to develop a list of possible hazards for misreading the instructions on the upcoming standardized test.

THE CREATIVE STUDENT: Ethan substitutes several key words that clarify standardized test directions for the words of a popular song. During the test, he silently sings the song to himself as a reminder to look for key words in the test instructions.

THE PRACTICAL STUDENT: When Ethan looks at his score report, he realizes it shows areas in which he is strong and areas in which he can improve his performance.



Assessing Test Quality

Most of the standardized tests that teachers give their students are mandated by the school, school district, or state in which the school is located. Teachers may even encounter nationally mandated standardized tests. In such cases, teachers have little or no say over which tests are given or whether the tests are to be given at all. Sometimes, however, teachers and administrators have the opportunity to choose the standardized tests their students will take. After deciding which type of test they need, a group assigned to choose a standardized test must determine the quality of the various tests available. So how do teachers and administrators pick a high-quality test?

Assessing the quality of a standardized test is a fairly involved procedure. It usually is done by school psychologists or others with advanced training in assessment. These professionals assess the test in a number of ways. For example, they look at whether the test predicts what it is supposed to predict. They also consider the appropriateness of the test for the students who will be taking it. To assess the fit of the test, professionals must understand the population to which test results are intended to apply. They also examine the samples, or members of that population on which the test was normed.

POPULATIONS AND SAMPLES

The **population** is the complete set of individuals to which a set of results will be generalized (Rosnow & Rosenthal, 1999). For example, suppose test constructors are interested in creating a test for third graders, the (imaginary) Whiz-Bang Intelligence Scale. Would the population be all third graders to whom they wish to generalize their results? It is important that the test developers think carefully about this group. Are they talking about all

third graders in a school, a school district, a state, a country, or even the world? There is a difference in how one interprets the results. Countries vary drastically in the educational expectations they hold for schoolchildren.

When state departments of education construct tests for pupils in their state, they are usually interested in generalizing the results only to pupils in their state. The goal is to understand what pupils in that state have learned. Typically, they also wish to compare pupils and school districts within that state to each other. When a test publisher creates a standardized test, the publisher is usually concerned with national comparisons. But if the test is used in another country, the population will change. The standardization that held for the one country will almost certainly not apply to the other country.

THINKING CREATIVELY

Why is it important to specify the population to which you wish to generalize results from a test?

SUGGESTION: If the population is not specified, you cannot determine whether a test is applicable to a given individual.

A *sample* is a subset of a population (Kish, 2000). Test constructors are almost never able to try out their test on all the members of the population of interest. For example, it is not feasible to try out a test for third graders on every third grader in the United States. Instead, test constructors have to content themselves with administering the test on a trial basis to a sample, or portion of the population.

Suppose test constructors want to standardize the Whiz-Bang test for third graders in the United States. They can sample in two basic ways. In the first, called a *random sample*, every member of the population has an equal chance of being drawn for the sample. Thus, for the Whiz-Bang test, a truly random sample is one in which any third grader in the country has an equal chance of being included in the tryout. Such sampling is not practical, of course: Test constructors do not have complete access to every third grader in the country that they would need to generate a truly random sample.

In the second way of sampling, called a *stratified random sample*, the test constructors make sure they proportionately take into account, in the group on which they try out the test, all of the characteristics that might be relevant to the scores that people receive. The sample is then random within each of the stratified groups (Rosnow & Rosenthal, 1999). What are some of the likely characteristics along which a test constructor might want to stratify the Whiz-Bang test? One is likely to be gender. Assuming the population consists of roughly one-half boys and one-half girls, the test developers will want their sample to reflect this distribution of boys and girls. A second characteristic may be ethnic group. The test constructors will want to sample members of diverse ethnic groups. The presence of members of these groups in the sample should be roughly in proportion to their appearance in the third-grade population of the country. A third characteristic may be type of community, such as urban, suburban, and rural. A fourth characteristic may be socioeconomic level. The goal is to ensure that the sample on which the test constructors build their test adequately reflects the population to which they wish to generalize.

THINKING CREATIVELY

If you were developing a standardized test, which attributes of the school population would you take into account to ensure a representative sample of students?

SUGGESTION: Examples are sex and grade.

A good stratified sample—in which the balance of relevant attributes in the sample is the same as that in the population—is called a *representative sample.* A representative sample takes into account the distribution of relevant characteristics of the population as a whole. Test publishers generally stratify their samples, although they do not always achieve fully representative samples.

If the population and sampling of a test seem appropriate, teachers and administrators must then assess two other important measures of test quality: reliability and validity.

RELIABILITY

Reliability is the consistency of test results (Anastasi & Urbina, 1997; Cook & Beckman, 2006; Fekken, 2000; Johnson & Christensen, 2000; Megargee, 2000). Suppose, for example, that one of Jolene Johnson's students takes the Whiz-Bang test repeatedly. He (assuming the student's ability remains the same) keeps getting exactly the same score. Jolene can conclude that the test measurements are highly reliable. However, if the student's scores are very different each time he or she takes the test, Jolene will conclude that the test measurements are not very reliable. Reliability is usually expressed as a proportion, on a scale that ranges from 0 to 1. Decimal numbers near 0 indicate low reliability. Numbers nearer 1 indicate high reliability.

Reliability can be measured in several different ways. Each approach addresses a somewhat different aspect of consistency (Gliner & Morgan, 2000). For example, test constructors may

give the same test to the same group of students more than one time, to determine *test-retest reliability*. Test constructors may also wish to determine *alternate-forms reliability*—whether measurements from two or more slightly different versions of the same test are consistent with one another. To determine this, they administer the different versions to a group of students and compare the results on each version.

Another way to calculate reliability is to compare students' performance on one part of the test with their performance on another part. This kind of *internal-consistency reliability* is often determined by *split-halves reliability*—dividing the test questions in half and comparing the two halves of the test. Finally, the scoring of some tests (such as essay tests) requires subjective judgment by graders. For these tests, test constructors try to determine *interrater reliability*, or the extent to which two or more evaluators of a given response (such as an essay) rate the response in the same way.

The reliability of standardized tests varies according to the method used, but it is generally high. One team of researchers has suggested that well-constructed standardized tests used to make decisions about individuals should have a test-retest reliability of .90 or higher and an alternate-forms reliability of .85 or higher. Split-half reliability should be .95 or higher. Across standardized tests, there is somewhat more variation in internal-consistency reliabilities, such as split-half reliability, than there is in test–retest and alternate-forms reliabilities. Standardized tests divided into subtests generally have high split-half reliabilty for the test as a whole, but not necessarily for each of the subtests.

On average, longer tests tend to be more reliable in the measurements they provide than do shorter tests. The reason is that the more items there are, the better the estimate of the level a person shows on the construct or attribute being assessed. To pick an extreme example, suppose you attempted to measure a person's achievement in the sciences with a five-item test. You would not expect much consistency across different forms of five-item tests: They are just too short to provide any kind of adequate measurement. If even one item were a bad item susceptible to error of measurement, it would have a substantial effect on reliability. Conversely, if the test contained 500 items, you would expect the errors of measurement to cancel each other out. In this case, you would get a fairly consistent measure of science knowledge. One bad item would have little effect.

THINKING CREATIVELY

Name at least three common sources of non-ability-related effects in standardized testing that may distort the accuracy of the scores obtained.

SUGGESTION: Examples include distracting noises, poor lighting, and poor temperature regulation in the testing room.

Relevant variation among individuals being tested also affects reliability. Here, too, test results from a large range of people in terms of the construct being measured tend to be more reliable than those from a small one. To take an extreme example, suppose everyone you plan to test has almost the same level of achievement. It will be extremely difficult to develop a test that consistently distinguishes among them, because they are hardly different at all. For example, try consistently measuring differences in height between people, all of whom are between 5 feet 6 inches and 5 feet 6½ inches! It is difficult to distinguish among people within such a narrow range. By comparison, it is not hard to construct a test that consistently distinguishes among people with broad ranges of abilities or achievements—in our example, analogous to heights ranging from 5 feet to 6 feet.

VALIDITY

Validity refers to the degree to which a test provides measurements that are appropriate for its intended purpose (Anastasi & Urbina, 1997; Cook & Beckman, 2006; Krueger & Kling, 2000; Megargee, 2000). Several kinds of validity are distinguished. In this section, we discuss three that are especially important to teaching and learning.

■ PREDICTIVE VALIDITY

Predictive validity refers to the extent to which a test predicts a performance that will be demonstrated after the test has been taken (Gliner & Morgan, 2000). When such a prediction is made, the test is referred to as the *predictor*. A predictor is the thing doing the forecasting of future results. The outcome to be predicted is referred to as the *criterion*. For example, tests of intelligence are often used as predictors of later school achievement in general. Tests of readiness for reading are used as predictors of how well a child will be able to learn how to read. School achievement and reading ability are the criteria being predicted in these two examples.

Predictive validities are expressed using a correlation coefficient. Correlations range from −1 (perfect inverse relation) to 0 (no relation) to 1 (perfect positive relation). A perfectly predictive test has a predictive validity of 1 (or −1) with respect to the criterion. For example, suppose you have a perfectly valid test for predicting a measure of school achievement, such as grades, as the criterion. You then will be able to forecast with absolute accuracy the grades each student will achieve. The correlation coefficient in this example is 1. Such tests, of course, do not really exist. A test with no predictive value at all in its measurements has a predictive validity of 0 with respect to the criterion. In this case, knowing the test score will tell you absolutely nothing about what grades students will achieve. A test for which higher scores are perfectly predictive of lower scores on the criterion has a predictive validity of −1. For example, a high score on a particular test might accurately predict a poor grade in the class.

Realistically, most predictive validities are greater than 0 but less than 1. What constitutes a good validity coefficient is largely a measure of subjective judgment. Anything significantly greater than 0 indicates some level of prediction. Typical ability tests predict school grades with validity coefficients ranging from about .3 to .6. Many tests fall outside this range, however.

The closer in time one measurement is taken to another, the higher the correlation between the two measurements is likely to be. For example, achievement in fourth grade is likely to be a better predictor of achievement in fifth grade than it is a predictor of achievement in eleventh grade.

Predictive validities are lower when there is *restriction of range*, the difference between the highest and lowest scores. Consider the case of students applying to a competitive college. If only students with SAT scores of 1800 or higher are admitted, by definition most students admitted will have SAT scores that are roughly comparable. The reason is that the SAT only goes up to 2400. Of course, some of the students at the competitive college are bound to get poor grades. It is difficult to use the SAT to predict who these students will be, because the SAT scores are all roughly comparable. Even though the SAT might predict freshman-year college grades for a wide range of students, the SAT will not be able to predict college grades as well for students at this school.

THINKING CREATIVELY

What factors might increase the predictive validity of measurements from a test for predicting some kind of criterion? Which factors might undermine predictive validity?

SUGGESTION: Predictive validity tends to increase as a test is more similar in its content to what it is supposed to predict. It tends to decrease as the test becomes less similar to what it is supposed to predict. Suppose a test is intended to measure reading comprehension. The test's predictive validity will be higher if the students are required to read passages from a work of literature. The test's predictive validity will be lower if the students are required to read mathematical word problems written in a language the students do not understand.

■ **CONTENT VALIDITY** **Content validity** is the extent to which the content of a test actually measures the knowledge or skills the test is supposed to measure (Gliner & Morgan, 2000). Suppose, for example, a general test of mathematical achievement for high school juniors includes only plane geometry items. It would be seen as having relatively low content validity. A more valid test would include algebra as well, and probably arithmetical operations, too. Content validity is typically judged by a panel of experts. It is not expressed in terms of a single number, but rather represents a consensus judgment of how appropriate a test's content is.

Content validity must also be considered in terms of the particular curriculum used in a classroom, school, or district. Teachers should play an important role in evaluating the content validity of an achievement test. After all, they are the ones who best know what they teach (or should be teaching). Teachers should also assess the content validity of the tests they develop themselves. Thus we return to the issue of how the test fits the students who will be taking it.

Consider, for example, teachers and administrators in a school that embraces a curriculum emphasizing expressiveness and creativity in writing. At the same time, these educators deemphasize the mechanical skills of writing, such as spelling and punctuation. These teachers and administrators might decide that an English achievement test composed primarily of multiple-choice questions about writing mechanics lacks content validity for evaluating their students.

THINKING CREATIVELY

What makes a person an expert? List two criteria you would use to select experts in a content-validation procedure.

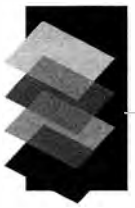
SUGGESTION: Two criteria are an extensive knowledge base in the appropriate content area and an understanding of the principles to be tested.

■ **CONSTRUCT-RELATED VALIDITY** All the kinds of validity just discussed are subsets of construct-related validity. **Construct-related validity,** sometimes called simply **construct validity,** is the extent to which a test completely and accurately captures the theoretical construct or attribute it is designed to measure (Cohen & Swerdlik, 1999; Gliner & Morgan, 2000; Westen & Rosenthal, 2003).

Suppose, for example, you want to develop a test of memory abilities. Your test will be construct valid to the extent that it fully and fairly measures the various aspects of memory. These

aspects will depend on the theory of memory you accept. Recall from Chapter 8 that various alternative theories of memory have been proposed. Exactly how you test memory depends on which of these theories you accept. Whatever the theory, you will almost certainly want to use a variety of kinds of memory items in your test. For example, you might include items requiring students to recall lists of words. Students might also have to recognize which items of a set of words were presented earlier. The goal is to ensure that you have captured your particular idea of memory as completely as possible.

Once an appropriate test has been chosen and administered to students, teachers and other professionals such as guidance counselors and school psychologists are faced with the task of deciding what the test scores mean to them and their students.



Interpreting Standardized Test Scores

Teachers are expected to know how to interpret the results of standardized tests for students, parents, and even other teachers and administrators. Often, students' scores are mailed to schools by the testing companies or scoring agencies to which the completed tests were sent for scoring. For some standardized tests, teachers themselves must know how to score the tests, using scoring keys and answer guidelines distributed with the tests. Many times, several types of scores are calculated for the same test. Expert teachers understand how different types of scores are calculated. They also know what each type of score means and understand the implications of each type of score for teaching and learning.

STATISTICAL CONCEPTS UNDERLYING TEST SCORES

To understand standardized tests and to use and interpret these tests effectively, expert teachers must understand several basic statistical concepts that underlie these tests. These concepts include frequency distributions, measures of central tendency and dispersion, the relationship of scores to the normal distribution, and the statistical significance of scores.

■ **FREQUENCY DISTRIBUTIONS AND GRAPHS** Values obtained on a test are sometimes shown via a **frequency distribution,** a numerical display of the number or proportion of student scores at each score level or interval. An example of a frequency distribution appears in Table 13.1. The table shows, for example, that 10 students received a score of 45 on a hypothetical test.

The frequency distribution enables us to distinguish between two kinds of numbers at each score level. The *relative frequency* represents the number of students who receive a given score. In Table 13.1, the relative frequency of a score of 45 is 10 percent. In other words, 10 percent of

TABLE 13.1 A Sample Frequency Distribution

Score	Frequency	Relative Frequency	Cumulative Frequency
40	5	5%	5%
41	10	10%	15%
42	15	15%	30%
43	25	25%	55%
44	25	25%	80%
45	10	10%	90%
46	3	3%	93%
47	2	2%	95%
48	2	2%	97%
49	2	2%	99%
50	1	1%	100%

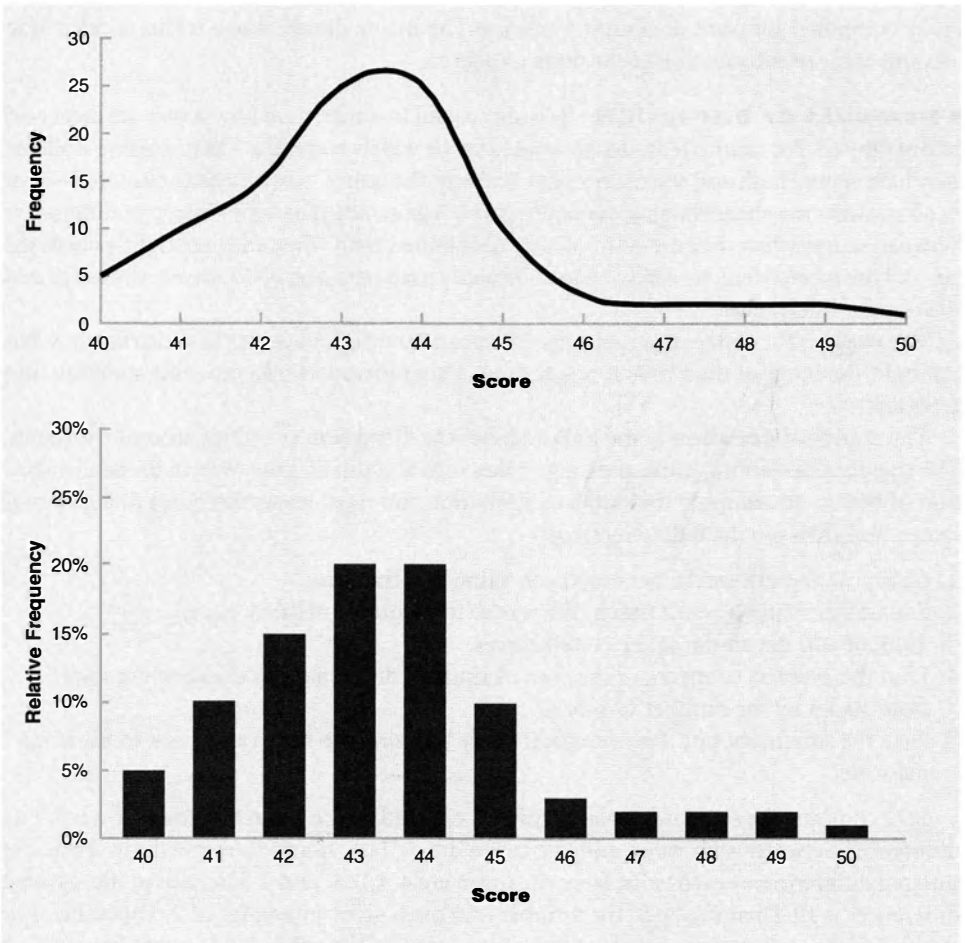
the test takers scored 45. The *cumulative frequency* represents the number of students who received scores up to that level—in other words, at that level or lower. In Table 13.1, the cumulative frequency for a score of 45 is 90 percent—that is, a student who scored 45 did the same as or better than 90 percent of all the students who took the test.

Scores on standardized tests can also be represented graphically. Figure 13.4 illustrates the two main kinds of graphic distributions: bar graphs and line graphs. The bar graph shows frequencies as a set of usually vertical (but occasionally horizontal) bars, and the line graph shows frequencies as a series of connected line segments. In addition to frequencies, both kinds of graphs can display levels of performance achieved on different tests or subtests. For example, a bar graph can show the number of correct answers on each of seven tests of knowledge.

■ **MEASURES OF CENTRAL TENDENCY** Teachers who want to evaluate their students need to know what constitutes a typical score. *Measures of central tendency* show the most typical value or score for the population. There are three major measures of central tendency: the mean, the median, and the mode.

The **mean** is the arithmetic average of a set of numbers. To compute the mean, add up all the values of interest and divide by the number of values added. For example, consider the mean of the numbers 2, 3, and 4. Here, we compute the mean by finding that $2 + 3 + 4 = 9$; $9 / 3 = 3$. Thus the mean of the values 2, 3, and 4 is 3. The mean is a measure of central tendency that takes into account all the information about the values in a sample. It is also significantly affected by extreme values. For example, the mean of 1, 1, and 10 is 4, a value higher than two of the three values in the sample.

FIGURE 13.4 Graphing Frequency Distribution



Another measure of central tendency, the median, is less affected by extreme values. The **median** is the middle of an ordered set of values. With an odd number of values, the median is the number in the middle in value. For example, if you have five values ranked from lowest to highest (2, 5, 9, 12, 18), the median will be the third (middle) value (9). With an even number of values, there is no one middle value. For example, if you have six values ranked from lowest to highest, the median will be the number halfway between (the average of) the third and fourth values—again, the middle. Thus, for the numbers 2, 6, 8, 14, 18, and 20, the median is 11. Although the median is less affected by extreme values than the mean, it also takes into account less information than the mean. For example, the values 1, 1, and 2 have the same median as the values 1, 1, and 10—namely, 1.

The **mode** is the most frequent value of an ordered set of values. This measure of central tendency can be used only when there are at least some repeated values. On occasion, a distribution may be **bimodal**—that is, it has two modes. More generally, it may be **multimodal**—that is, it may have two or more modes, or most frequent values.

The mode takes into account less information than does either the mean or the median. It typically is least affected by extreme values. Consider, for example, the scores of eight individuals on a hypothetical test: 2, 3, 3, 3, 4, 4, 5, 6. In this set of numbers, the mean is 3.75, or $(2 + 3 + 3 + 3 + 4 + 4 + 5 + 6) / 8$. The median is 3.5, or the middle value between the fourth and fifth values (3 and 4). The mode is 3, the value that occurs most frequently.

The mean has a substantial advantage over the other two measures of central tendency: It fully takes into account the information at each data point—each individual test score. Thus the mean is generally the preferred measure of central tendency. Of course, as mentioned earlier, the mean is also sensitive to extremes. For example, in our sample set of scores, if an additional value is 33, the mean will be 7 (or 63 / 9). This value is higher than any number except the highest one (33). The median is less sensitive than the mean to extremes, but it does not take into account all the information in the values. The major advantage of the mode is that it is an easily computed measure of central tendency. The major disadvantage is that it takes into account the least information of the three measures.

■ **MEASURES OF DISPERSION** It is also useful to understand how scores are dispersed or distributed. For example, students' scores may be widely scattered—that is, some students may have scored high and others low. Alternatively, the scores may be tightly clustered—that is, all students may have roughly the same scores. It generally is easier to interpret differences between scores when they are more widely distributed than when they are tightly clustered around the mean. Here, we discuss two commonly used *measures of dispersion:* the range and the standard deviation.

The **range** is the distance between the lowest and the highest values in a distribution. For example, the range of the scores 2, 3, 4, 5, 6 is 4. Other measures take more information into account.

The **standard deviation** is the adjusted average dispersion of values around the mean. The standard deviation, unlike the range, takes into account all information in the distribution of scores. To compute the standard deviation, you must know the mean of a group of scores. You then use the following steps:

1. Compute the difference between each value and the mean.
2. Square (multiply by itself) each difference (to eliminate negative signs).
3. Sum, or add up, all the squared differences.
4. Find the average, or mean, of the sum of squared differences by dividing the total from step 3 by the number of scores.
5. Take the square root of this average, thereby bringing the final value back to the original scale.

Let's compute the standard deviation of 2, 3, 4, 5, and 6. The mean of these scores is 4. The differences between each value and the mean are 2, 1, 0, 1, and 2, respectively. Thus the squared differences of each value from the mean are 4, 1, 0, 1, and 4. The sum of the squared differences is 10. Dividing by 5 (the number of scores) gives an average of 2. This value is in squared units, so we must compute the square root of the value. The square root of 2 is approximately 1.41, which is the standard deviation.

The standard deviation is a measure of variability. It tells us how much scores differ from the mean, on average. At one extreme, if all values are equal to the mean, the standard deviation is 0. At the opposite extreme, the maximum value of the standard deviation is half the value of the range (for numerical values that are maximally spread apart).

Sometimes dispersion among scores is measured by an index called the **variance,** the value of the standard deviation squared. This measure is particularly useful when various statistical analyses need to be carried out.

■ **NORMAL DISTRIBUTION** Many standardized tests have patterns of scores that fall roughly into what is called a **normal distribution.** In a normal distribution, most data values cluster around the average value of the distribution. (In a truly normal distribution, the mean, median, and mode are all the same. Thus any of them can be used as the average.)

Figure 13.5 shows an example of a normal distribution. As the figure illustrates, the normal distribution of scores is symmetrical. Half of the scores fall below the average, and the other half appear above it. In general, measured values rapidly decline on each side of the center of the distribution. They then tail off more slowly as scores become more extreme. Most people have scores relatively close to the center of the distribution; relatively few people have scores at the extremes. If the scores on a standardized test fall into a normal distribution, roughly 68 percent of the scores in the distribution will be within one standard deviation of the mean (i.e., plus or minus one standard deviation). Roughly 95 percent will fall within two standard deviations of the mean.

TYPES OF SCORES

Many different types of scores are used to describe students' performance. Expert teachers are aware of how these scores compare to one another in terms of the information they provide.

Figure 13.6 shows a score report from an achievement test, the Terra Nova California Achievement, second edition, for Ken Jones, a hypothetical fourth-grade student. The figure makes it clear that you are likely to encounter several different types of scores, even for the same standardized test. Refer to Figure 13.6 as we discuss the most common scores.

■ **RAW SCORES** The first score to understand is the **raw score,** typically the number of items correctly answered. The raw scores for each performance objective are shown in the column labeled "Student" on the first page of the score sheet in Figure 13.6. These scores have been adjusted to estimate the number of items it is estimated the student would have

FIGURE 13.5 A Normal Distribution

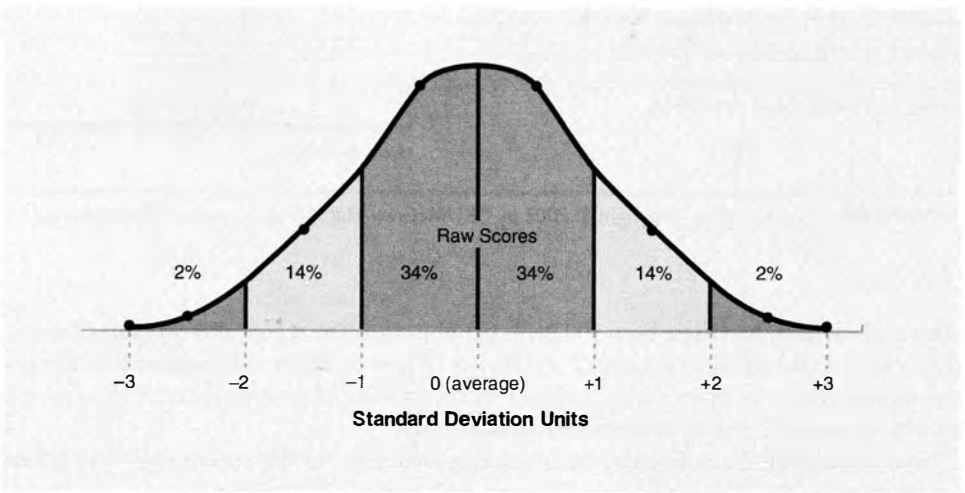
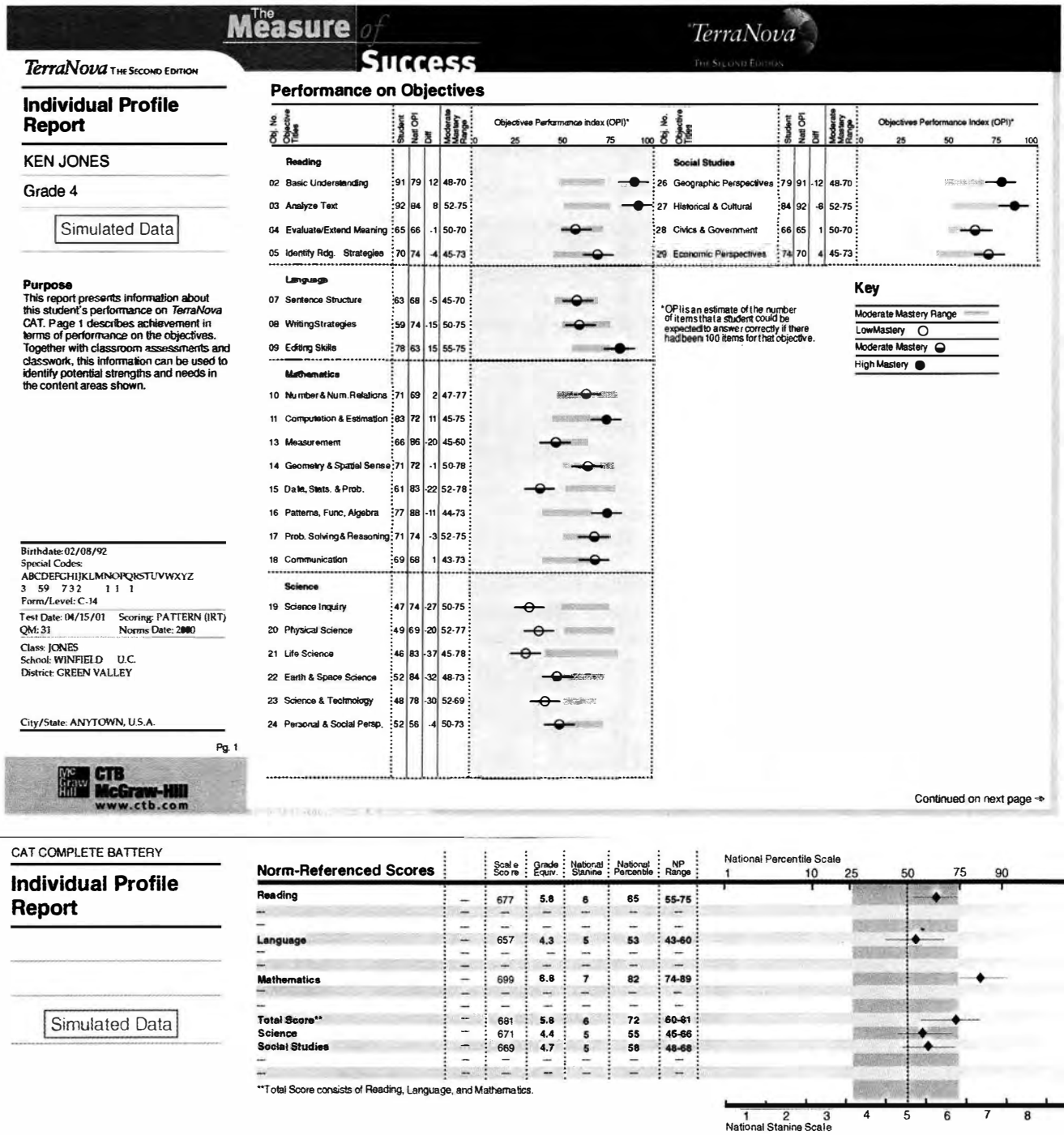


FIGURE 13.6 A Typical Score Report



The Measure of Success

TerraNova The Second Edition

Individual Profile Report

KEN JONES

Grade 4

Simulated Data

Purpose
This report presents information about this student's performance on *TerraNova* CAT. Page 1 describes achievement in terms of performance on the objectives. Together with classroom assessments and classwork, this information can be used to identify potential strengths and needs in the content areas shown.

Birthdate: 02/08/92
Special Codes:
ABCDEFGHIJKLMNOPQRSTUVWXYZ
3 59 732 1 1 1
Form/Level: C-14
Test Date: 04/15/01 Scoring: PATTERN (IRT)
QM: 31 Norms Date: 2000
Class: JONES
School: WINFIELD U.C.
District: GREEN VALLEY

City/State: ANYTOWN, U.S.A.

Pg. 1

CTB McGraw-Hill www.ctb.com

Performance on Objectives

Obj. No.	Objective Title	Student	Natl OPI	Diff	Moderate Mastery Range
	Reading				
02	Basic Understanding	91	79	12	48-70
03	Analyze Text	92	84	8	52-75
04	Evaluate/Extend Meaning	65	66	-1	50-70
05	Identify Rdg. Strategies	70	74	-4	45-73
	Language				
07	Sentence Structure	63	68	-5	45-70
08	Writing Strategies	59	74	-15	50-75
09	Editing Skills	78	63	15	55-75
	Mathematics				
10	Number & Num. Relations	71	69	2	47-77
11	Computation & Estimation	83	72	11	45-75
13	Measurement	66	86	-20	45-60
14	Geometry & Spatial Sense	71	72	-1	50-78
15	Data, Stats. & Prob.	61	83	-22	52-78
16	Patterns, Func, Algebra	77	88	-11	44-73
17	Prob. Solving & Reasoning	71	74	-3	52-75
18	Communication	69	68	1	43-73
	Science				
19	Science Inquiry	47	74	-27	50-75
20	Physical Science	49	69	-20	52-77
21	Life Science	46	83	-37	45-78
22	Earth & Space Science	52	84	-32	48-73
23	Science & Technology	48	78	-30	52-69
24	Personal & Social Persp.	52	56	-4	50-73
	Social Studies				
26	Geographic Perspectives	79	91	-12	48-70
27	Historical & Cultural	84	92	-8	52-75
28	Civics & Government	66	65	1	50-70
29	Economic Perspectives	74	70	4	45-73

Objectives Performance Index (OPI)* 0 25 50 75 100

*OPI is an estimate of the number of items that a student could be expected to answer correctly if there had been 100 items for that objective.

Key
Moderate Mastery Range
Low Mastery
Moderate Mastery
High Mastery

Continued on next page →

CAT COMPLETE BATTERY

Individual Profile Report

Simulated Data

Norm-Referenced Scores

		Scale Score	Grade Equiv.	National Stanine	National Percentile	NP Range
Reading	—	677	5.8	6	65	55-75
Language	—	657	4.3	5	53	43-60
Mathematics	—	699	6.8	7	82	74-89
Total Score**	—	681	5.8	6	72	60-81
Science	—	671	4.4	5	55	45-66
Social Studies	—	669	4.7	5	58	48-68

**Total Score consists of Reading, Language, and Mathematics.

National Percentile Scale 1 10 25 50 75 90 99

National Stanine Scale 1 2 3 4 5 6 7 8 9

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answered correctly had there been 100 items per objective. The report also compares the student's score to the national average (Natl OPI). It further computes a difference between the two scores (Diff). For example, on the Basic Understanding objective of reading, Ken's score was 91. This was 12 points above the national average.

Raw scores are difficult to interpret on standardized tests. For this reason, these scores thus are often converted into other types of scores, such as percentile scores.

■ **PERCENTILE SCORES** Sometimes we wish to have a direct comparison of a person's performance with that of other people—to make a normative comparison. A useful kind of score for this purpose is the percentile score. The **percentile score** is the proportion of other students' scores that equal or fall below a given student's score, multiplied by 100. The percentile scores for Ken Jones are shown in the column labeled National Percentile. Ken's percentile score for the language section is in the 53rd percentile. In other words, 53 percent of the fourth graders across the United States who took this test scored at or below Ken's raw score. Ken is very slightly above average in language compared with his peers.

Note the difference between raw scores, especially when they are expressed in percentages, and percentile scores. The percentage score pertains to the proportion of items on a test that are answered correctly. The percentile score pertains to an individual's standing on a given test relative to other individuals. Thus percentile scores are a measure of comparison against other students, rather than of direct performance. Expressed in terms used earlier in the chapter, percentile scores are based on norms rather than criteria.

THINKING ANALYTICALLY

What is the difference between a score of 75 percent and a score in the 75th percentile? Can a score of 75 percent be in the 75th percentile?

SUGGESTION: The 75 percent is calculated on the total number of test items. The 75th percentile is calculated with respect to other individuals. A score of 75 percent can be, but need not be, in the 75th percentile.

■ **TRUE SCORES** A useful distinction to make is that between two different kinds of scores: observed scores and true scores (Cohen & Swerdlik, 1999; Gregory, 2000). An **observed score** is the score someone actually receives on a test. For example, Ken's percentile score on the mathematics section is 82.

Suppose that Ken takes the test again. Chances are he will not receive a percentile score of exactly 82. Maybe he will get a score of 78, or 85. Maybe his score will change more dramatically. Test constructors differentiate between the observed score and the true score. The **true score** is the hypothetical score someone would get if he or she took a test an infinite number of times with no practice effects in taking the test.

Earlier in the chapter we described some of the factors that can keep an observed score from being a measure of a student's true abilities. For example, a student might get a cold or simply be unmotivated to try hard on the test. A student might also receive a higher observed score than his or her true score. For example, the student may have just finished studying a book that includes the passage that tests reading comprehension.

You might want to determine the true score by giving a test many times. In reality, when people take a test multiple times, they begin to show practice effects. *Practice effects* are changes in scores that occur as a result of increasing familiarity with the particular items, the test as a whole, and the experience of taking the test. For the purposes of thinking about true scores, we ignore practice effects.

A true score is obviously a hypothetical construct: We can never know what a person's true score would be, because no one is able to take a test an infinite number of times. We can, however, estimate how likely it is that a student's observed score is similar to his or her true score. Whenever a person gets a score, it actually represents a range of scores that the person might plausibly receive. Sometimes teachers and test developers use the concept of a confidence interval to determine the likely range of scores within which a person's true score lies. A **confidence interval** is an interval estimate of a person's true score. The measure used to compute a confidence interval is called the **standard error of measurement.** Ken's score report contains a column labeled NP Range that shows the range of observed scores within which Ken's true score is likely to fall. The chances are about two out of three that his true score falls within this range.

Let's be a bit more precise. If we assume a normal distribution of test scores, the chance that a person's true score will lie within plus or minus one standard error of measurement of the observed score is approximately 68 percent. The chance that the score will lie within plus or minus two standard errors is approximately 95 percent. There is a 95 percent chance that Ken's true score lies between these two scores. For Ken, the chances are about 68 percent that

A teacher confers with parents to explain a student's results on a standardized test. The expert teacher plans nontechnical explanations for parents, practices the explanations to make sure that they are clear, and always makes clear how the test scores will be used by the school.

Anthony Magnacca/Merrill

THINKING ANALYTICALLY

Sometimes college admissions officers take scores from several administrations of a given test, such as the SAT or ACT, and use only the highest of the scores in evaluating a candidate for admission. Which do you think will give a better estimate of a person's true score—the highest score obtained or the average score obtained? Why?

SUGGESTION: The average score is a better estimate because it is based on more information.

his true reading percentile score falls between 55 and 75 and 95 percent that his true math percentile score falls between 45 and 85.

■ **STANDARD SCORES** **Standard scores,** also called ***z*-scores,** are obtained by converting a raw score into units of standard deviation. Standard scores are arbitrarily defined to have a mean of 0 and a standard deviation of 1. If the scores fall into a normal distribution, roughly 68 percent of the scores will be between −1 and 1. Roughly 95 percent of the scores will be between −2 and 2.

Standard scores are useful because they make it possible to compare results that initially are on different scales. For example, a teacher using standard scores can compare a student's scores for two tests, one on a 100-point scale and one on a 30-point scale. Suppose the mean on the first test is 75 points and the mean on the second test is 20 points. Both of these scores will correspond to a *z*-score of 0, the mean value for *z*-scores. To compute a standard score for a student, you need to know the mean and the standard deviation of the distribution of raw scores. Then, you take these steps:

1. Subtract the mean raw score from the student's raw score.
2. Divide the difference (the number found in step 1) by the standard deviation of the distribution of raw scores.

Thus, the formula for a *z*-score is

(observed score – mean raw score) / standard deviation

The *z*-score tells teachers how many standard deviations above or below the mean a raw score is. For example, a raw score that is one standard deviation above the mean yields a *z*-score of 1. A raw score that is two standard deviations below the mean translates into a *z*-score of −2. Even if one test is harder than another test, translating two raw scores from two tests into standard scores is comparable because the scores are phrased in common terms: standard deviations from the mean.

Many standardized tests use variants on standard scores. For example, the College Board scores many of its tests, such as the SAT, on a scale that has a range of 200 to 800, with a mean of 500 and a standard deviation of 100. Thus a *z*-score of 0 corresponds to an SAT score of 500, a *z*-score of 1 corresponds to an SAT score of 600, and so on. A variant of the College Board–type score is the ***T*-score.** The *T*-score has a mean of 50 and a standard deviation of 10. Unfortunately, these two kinds of scores can lead users to misinterpret small and insubstantial differences as meaningful.

Another type of standard score is the **stanine.** The stanine has a range of 1 to 9, a mean of 5, and a standard deviation of 2. The advantage of stanines is that they are relatively simple and make no pretense of being highly precise. The disadvantage of stanines is that their imprecision may blur meaningful differences in scores. The Terra Nova California Achievement Test uses stanine scores. The stanine score for Ken Jones is shown in Figure 13.6 in the column titled "National Stanine." The stanine score of 6 on reading shows that Ken's raw score was about one-half of one standard deviation below the average for all students who took the test.

Note that all the kinds of scores derived from *z*-scores are interchangeable through mathematical formulas.

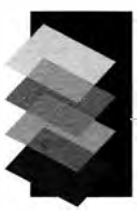
■ **GRADE EQUIVALENT SCORES** Achievement tests also can be scored using the **grade equivalent score,** a measure of grade-level achievement compared with the normative sample for a given test. Suppose a student in the second month of the third grade scores at the same level on a test of mathematical computation as an average student in the sixth month of the fifth grade is expected to score on that test. Her grade equivalent will be 5 years, 6 months, sometimes abbreviated 5–6 or 5;6.

Teachers often like grade equivalents because they are used to thinking in terms of grade levels. Grade equivalents are often misleading, however (Goodman & Hambleton, 2004). Use them cautiously—even avoid them when possible. For example, Ken Jones's grade equivalent score, shown in Figure 13.6, is 6.8 in mathematics. Keep in mind that the fact that a fourth

grader receives a grade equivalent of sixth to seventh grade on a fourth-grade test does not mean the fourth grader can do sixth- to seventh-grade math. In fact, many of the tests for elementary school have grade equivalents going up to high school for tests that cover none of the algebra, geometry, or trigonometry covered in high school math classes. The same problem applies across the curriculum. Grade equivalent scores refer to how well students at these grades would be expected to do on the elementary school test, were they given this test. Because students in the higher grades typically take grade-appropriate tests but do not usually take elementary school tests, the grade equivalents are often misleading.

*i*MPLICATIONS FOR TEACHING

- **Be prepared to explain the scores.** Make sure you fully understand each type of score included on test reports provided for students and parents. Plan nontechnical explanations for parents and students. Consider practicing the explanations to make sure they are clear. Explain norm-referenced versus criterion-referenced scores. Describe how scores will be used by you or your school.
- **Explain errors of the measurement.** If a student's percentile score changes from a 97 to a 94, some students and parents may become alarmed. Point out the standard error of measurement, explaining that any score has a confidence interval. The score may actually reflect a true achievement above or below the actual number on the score sheet.
- **Focus on the entire student.** Avoid overemphasizing a single set of test scores. Scores reflect only one day's performance. If possible, communicate true patterns of achievement and ability by combining news about test scores with information about students' work in class. Think about using test scores as feedback to students to challenge them to set higher goals for themselves.
- **Use tests to set teaching and learning goals.** Comparisons of a student's overall average with scores on various subtests suggest areas in which the student needs improvement. Combining test scores with other performance evaluations, work with students and parents to target ways to improve in upcoming months. Teachers may choose to work with students to improve their test-taking skills.
- **Use achievement tests to build self-esteem.** Norm referencing can help build self-esteem when the student scores high in relation to other students who took the test. If left unaddressed, lower norm-referenced scores may undermine students' motivation. However, even students with low norm-referenced scores are likely to show increases in their learning from year to year. Examine criterion-referenced scores or compare current test scores with previous scores to demonstrate these improvements.



Issues and Concerns in Standardized Testing

As the discussion of the challenges involved in presenting test scores points out, several potential pitfalls in using standardized tests exist. Some new developments in standardized testing show promise for overcoming some of these pitfalls. This section considers a key question: What are some of the larger issues involved in standardized testing?

Standardized tests, like most technology, can be helpful to teachers and students alike if they are used properly. Unfortunately, standardized tests can also be harmful if they are misused. For example, they will be harmful if they are biased in favor of one group of students at the expense of another group or if they do not work for students of certain cultural backgrounds. Even high-quality tests can be harmful if they are used for invalid purposes.

THINKING PRACTICALLY

What might be the costs to society of using biased standardized tests in the schools?

SUGGESTION: The society may deprive worthy individuals of opportunities they deserve.

TEST BIAS

Test bias refers to a test's being unfair for members of some groups but not for others. Whether a test is considered biased, however, depends in large part on exactly how bias is defined (Anastasi & Urbina, 1997).

The most naive way of defining test bias is to state that a test is biased if it produces a difference between groups in terms of scores. For example, some groups have challenged the use of standardized college entrance examinations on the basis of the fact that African American and Hispanic American students often score lower on these tests than do white and Asian American students. Courts have occasionally ruled in favor of such challenges. In reality, such legal views can be based on a false assumption that groups will not differ in the construct being measured. For instance, given that ethnic groups differ in average height, weight, hair color, eye color, and many other features, there is no reason to assume in principle that they could not differ in whatever is being tested.

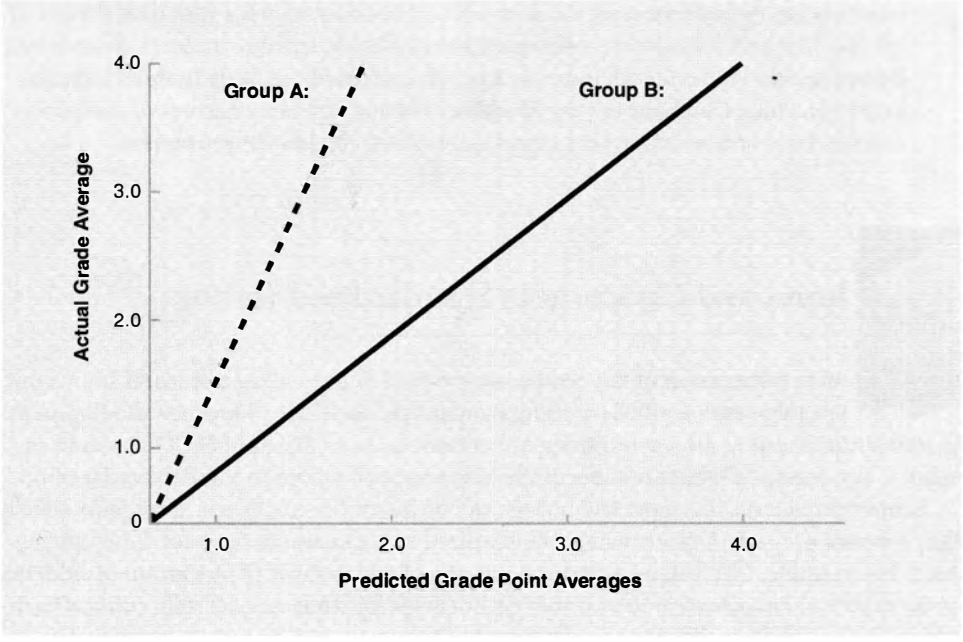
A second way to define test bias is to view a test as biased if the content is judged by a panel of experts to favor certain groups over others. Most test publishers have panels of experts read test items carefully to search for bias against women, minorities, and members of other groups. The problem here is that the experts may be wrong. For instance, saying an item will discriminate against women does not necessarily make it so. And, of course, the experts may miss items that actually are discriminatory.

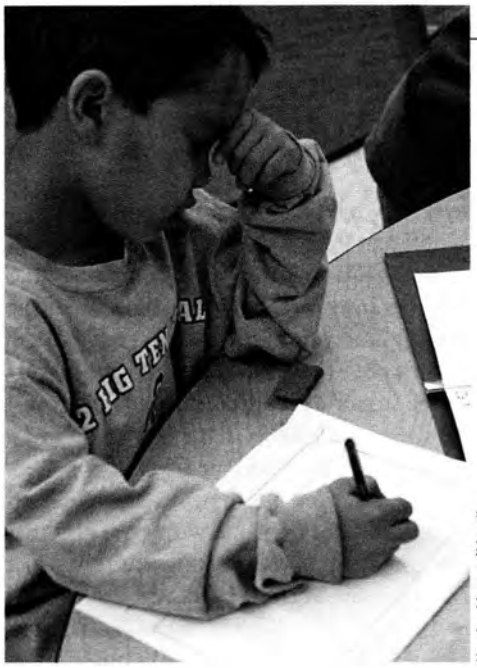
A third, more sophisticated view of test bias is that a test is biased if it either overpredicts or underpredicts some criterion or set of criteria for members of one group versus members of another group. In *overprediction*, the test predicts a *higher* level of performance than a student actually achieves. In *underprediction*, the test predicts a *lower* level of performance than the student actually achieves. In other words, the predictive validity of the test varies between groups.

Such a conception of test bias is illustrated in Figure 13.7. Suppose scores on the fictional Whiz-Bang intelligence test described earlier predict school grades quite well for girls. In contrast, the scores consistently underestimate the grades of boys. In this case, the test is biased in favor of girls (or, equivalently, against boys). As a result of the biased results, boys with low

FIGURE 13.7 A Biased Test

These two line graphs show how the relationship between scores and performance measures would differ for a hypothetical test that more accurately predicts performance for Group B than it does for Group A.





Katelyn Metzger/Merrill

A kindergartner shows his anxiety as he works on a test. Many researchers and educators are strongly opposed to the use of readiness tests for grade placement, such as entering first grade.

scores might not be admitted to advanced classes or other special programs in school. Their failure to gain admission would occur despite the fact that they can probably do as well as girls who had higher test scores.

If we accept this definition of test bias, then the tests most frequently used to measure abilities typically are not statistically biased (Reynolds, 1994). In other words, when members of a given group score lower on the tests—for example, tests of various abilities—their performance on the criteria to be predicted, such as school grades, is generally lower. Not everyone accepts this definition, however. Some people believe we need to view bias as part of a larger system, in which it is possible for both the criteria (e.g., school grades) and the predictor test to be biased (see also Freedle, 2006; Reed et al., 2007).

THE CULTURAL CONTEXT OF TESTING

Although we discussed cultural issues in general in Chapter 6, certain aspects of culture apply directly to issues in standardized testing. These aspects are called culture-relevant, culture-fair, and culture-free testing.

■ CULTURE-RELEVANT TESTING

People go into testing situations with very different cultural as well as socioeconomic backgrounds. A person whose native language is not English will obviously be at a disadvantage when given a test in English (Sattler, 1992). A person who is not used to doing things under time pressure will be at a disadvantage when asked to take a severely time-constrained test. *Cultural relevance* is the extent to which a task or test is an appropriate measure, given a person's cultural background. In interpreting measures of individual differences, teachers need always to think about the extent to which a person's background has prepared him or her to take that test (Greenfield, 1997). Making a test culture relevant means not just translating it into a language a person can understand. It also means ensuring that the content is meaningful to the person, given his or her cultural contexts. For valid cross-cultural comparisons, one must further ensure that the meaning of the test items in one culture is the same as the meaning in the culture to which the comparison is being drawn.

Consider an example. Obviously, a question such as "Who was the first president of the United States?" does not become culturally fair when translated into the native language of a non-American. Why would a non-American even know who the first president of the

United States was? This person would be far more likely to know the first leader of his or her own country. However, changing the test item to read, "Who was the first president of your country?" does not achieve equivalence either. Why not? First, because the country may never have had a president. Second, even if it has, the importance of the presidency in another country (e.g., one that also has a prime minister) may be different from that in this country. (For more on these issues, see Ogbu, 1994.)

The hazards of single-culture research have been shown by many research programs. For example, Greenfield (1997) found that it means a different thing to take a test among Mayan children than it does among most children in the United States. The Mayan expectation is that collaboration is not only permissible, but that it is rather unnatural ***not*** to collaborate. Such a finding is consistent with work suggesting different cultural constructions of the self in individualistic cultures (i.e., cultures that stress the importance of the role of the individual) versus collectivistic cultures (i.e., cultures that stress the importance of the role of the group) (Markus & Kitayama, 1991). Indeed, some cultures, especially Asian ones, tend to be more dialectical in their thinking, stressing that many problems have no "right" and "wrong" answers that stay the same over time. Other cultures, such as European and North American ones, tend to be more linear, believing that most problems do, indeed, have right and wrong answers that remain the same over time (Nisbett, 2003). Individuals in different cultures may even construct concepts in quite different ways (Atran, 1999; Coley, Medin, Proffitt, Lynch, & Atran, 1999; Medin & Atran, 1999). For example, they may view "disease" in totally different ways, as caused by bacteria, spirits, or other entities. Thus groups may think about what appears superficially to be the same phenomenon—whether a concept or the taking of a test—differently.

Many investigators have realized the importance of cultural context (Laboratory of Comparative Human Cognition, 1982; Serpell, 2002). Some studies have looked at Brazilian street children (Carraher, Carraher, & Schliemann, 1985; Ceci & Roazzi, 1994; Nuñes, 1994). Brazilian street children are under great pressure to form a successful street business. If they do not, they risk death at the hands of "death squads," which may murder children who, because they are unable to earn money, resort to robbing stores (or who are suspected of resorting to robbing stores). Researchers have found that the same children who are able to do the mathematics needed to run their street businesses are often poorly able or completely unable to receive passing grades on tests of school mathematics. In fact, the more abstract and removed from real-world contexts the problems are in their form of presentation, the worse the children do on the problems. These results suggest that differences in environmental context can have a powerful effect on performance.

Such differences are not limited to Brazilian street children. Homemakers in Berkeley, California, who could do the mathematics needed for comparison shopping in the supermarket successfully, were unable to do the same mathematics when they were tested in a classroom and given the same kinds of problems presented in an abstract form (Lave, 1988). In other words, their problem did not occur at the level of mental processes, but rather at the level of applying the processes in specific environmental contexts.

■ **CULTURE-FAIR TESTING** A **culture-fair test** has the same meaning for members of all cultures. This idea is different from that of culture relevance, where a test is designed to work for a particular culture, or occasionally, more than one culture.

True culture fairness is virtually impossible to achieve. People in different cultures have different language and educational backgrounds, different social backgrounds, different experience with and attitudes toward tests, and even different notions of how to perform in a testing situation.

THINKING ANALYTICALLY

Can you ever free a test completely of cultural influence? Why or why not?

SUGGESTION: Probably not. The very act of taking a test is culturally influenced.

■ **CULTURE-FREE TESTING** A **culture-free test** is unaffected by culture or cultural context. It is difficult to imagine constructing a test that is wholly unaffected by culture. Indeed, the very act of taking a test is a cultural act. People bring to the testing situation their cultural background. Moreover, scores on tests are always interpreted in a cultural context by people who have grown up with certain cultural expectations.

Even tests that lack bias or achieve cultural relevance can be harmful if used for purposes for which they are not valid, as we discuss next.

MISUSES OF STANDARDIZED TESTS

Two ways in which standardized test scores sometimes are misused in U.S. schools are (1) their use as the sole basis for selection or placement decisions and (2) their use as the sole way of judging the performance of a school, district, state, or even country. Why are these inappropriate uses of standardized tests?

■ **HIGH-STAKES TESTING** The use of test scores as the sole or primary basis for making important decisions about a student's placement or admission to educational programs is sometimes called **high-stakes testing.** This use of tests was the concern parents often raised in conferences with McKinley Phillips, the teacher described in the chapter-opening vignette. The pressure on students resulting from high-stakes testing has led many students to spend a great deal of time, effort, and money on test preparation courses in an effort to gain a competitive advantage on the tests. Some students have even resorted to cheating.

As we have emphasized in this chapter, test scores alone cannot be expected to provide a complete picture of a student's achievements or abilities. Thus high-stakes testing practices may lead to mistakes in placement. Ideally, standardized test scores will be combined with other methods of evaluation, such as grades, interviews, or observations, to make important decisions. All too often, however, this is not the case.

As most college students know, standardized tests such as the SAT and ACT often play a large part in the college admissions process. Test scores become even more important in the admissions process for graduate school, law school, and medical school. Standardized test scores also have been used to indicate placement along various tracks at the middle school or high school level. Many school districts and states even use **readiness tests** to measure the extent to which a student is prepared to learn something, such as reading. Such tests are also used to determine the extent to which a child is ready for a grade placement, such as entering first grade. Many researchers and educators are strongly opposed to the use of readiness tests for the following reasons (see also Engel, 1991; May & Welch, 2006; Meisels, 1989; Shepard & Smith, 1989):

- Very young children are generally not prepared for the kind of paper-and-pencil tests typically used to measure readiness.
- Delaying entrance into first grade on the basis of a readiness test is a gross overinterpretation of a single source of information.
- It is not clear that the tests accurately measure readiness.

Another kind of high-stakes standardized test is the **minimum-competency test,** which measures whether a student has attained the minimum level of overall achievement necessary for a particular purpose. Such tests are used, for example, to determine whether a student is eligible to graduate from high school (see also Christenson, Decker, Triezenberg, Ysseldyke, & Reschly, 2007; Gewertz, 2007; Warren & Edwards, 2005). Forty U.S. states use minimum-competency tests, although not all of those states base graduation decisions on test scores. Opponents of minimum-competency tests believe that no one test should be of such great importance that a monumental decision, such as whether to graduate a student from high school, is based on that test score alone.

TEACHER TESTING. As an aspiring teacher, you may be exposed to a series of evaluations that may feel like high-stakes testing to you, known as the Praxis Series (Dwyer & Villegas, 1993; http://www.google.com/search?hl=en&lr=&ie=UTF-8&oe=UTF-8&q=praxis+test, retrieved January 11, 2004). The Praxis battery includes three tests. States may require any or all of them as part of their teacher certification processes. These tests are an important requirement for teacher certification in many states: Nearly 80 percent of states that require testing of teachers for licensure require the Praxis series.

The first of these tests, called Praxis I, is taken early in your college career and assesses basic skills in reading, writing, and mathematics. It is essentially a test of academic skills to indicate your suitability for teacher training. Praxis II is taken at the end of your undergraduate studies and assesses mastery of your major subject and basic principles of teaching. Both Praxis I and Praxis II are the typical paper-and-pencil standardized tests described throughout most of

this chapter, with which you are probably quite familiar. The Praxis I test is also offered in certain testing centers in a computerized version (http://www.ets.org/portal/site/ets/menuitem.fab2360b1645a1de9b3a0779f1751509/?vgnextoid=48c05ee3d74f4010VgnVCM10000022f95190RCRD, retrieved December 28, 2007). These computerized tests are relevant for licensure.

The third test in the Praxis battery, Praxis III, varies from state to state, but generally consists of classroom observations of your teaching skills, made by trained local evaluators. The four major areas of focus of the Praxis III are evidence of planning for teaching, classroom environment, classroom instruction, and fulfillment of professional responsibilities (http://www.ets.org/portal/site/ets/menuitem.c988ba0e5dd572bada20bc47c3921509/?vgnextoid=e39e4c757f346110VgnVCM10000022f95190RCRD&vgnextchannel=83c45ee3d74f4010VgnVCM10000022f95190RCRD, retrieved December 28, 2007). This assessment is conducted during actual teaching, often during the first year.

It certainly would be wise for you to use all the methods you would recommend to your students to achieve your best performance on these tests. The Praxis series makes fairly heavy use of performance-based assessment. The idea is that teachers can be evaluated only if their actual classroom performance skills are taken into account.

Teachers are increasingly being tested when they seek to achieve certification by the National Board for Professional Teaching Standards (NBPTS; http://www.nbpts.org/about/hist.cfm, retrieved January 11, 2004). The procedure for National Board certification was developed by teachers for teachers. Certification is a way of demonstrating professionalism and excellence in teaching. Certification at present is voluntary and is not intended to be a replacement for state licensing. Indeed, certification indicates that an individual has met advanced standards, rather than the entry standards set of licensing.

The NBPTS certifies teachers according to five propositions that it believes are essential for effective teaching:

1. Teachers are committed to students and their learning.
2. Teachers know the subjects they teach and how to teach those subjects to their students.
3. Teachers are responsible for managing and monitoring student learning.
4. Teachers think systematically about their practice and learn from experience.
5. Teachers are members of learning communities.

The tests used to assess these goals are in a process of continuing development.

■ **OVERUSE OF TESTS IN MEASURING ACCOUNTABILITY** The Praxis tests may be popular among many states because they support the goal of a growing movement to hold teachers and schools accountable for meeting measurable educational outcomes. One of the factors many observers relate to the growth in the use of standardized tests in recent decades is the increasing demand among politicians, parents, and taxpayers for **accountability** from schools (Darling-Hammond & Snyder, 1992; see also Linn, 2006; McDermott, 2007). Proponents of this view believe that schools should set measurable goals for the education of children. Teachers and schools are then held responsible for the extent to which they meet their stated goals. The quantitative measurements provided by standardized tests—and particularly those that provide criterion-referenced scores—have made the tests valuable tools for those who wish to measure and state the achievements of teachers and schools in numerical terms.

As we have emphasized, several problems arise when standardized tests are used as the basis for judging teachers and schools. First, suppose the objectives measured by the standardized test in use do not fully match those of the school or school district. Students then may score low on objectives because they are not emphasized by the students' teachers. Teachers, in turn, may experience pressure from parents or administrators to raise test scores in an effort to prove they are providing quality education (Berliner & Biddle, 1997; Bracey, 1994; Herman, Abedi, & Golan, 1994). Some teachers can succumb to the temptation to change their learning objectives and lesson content so they coincide with the objectives and question content of the test their students must take. This phenomenon is known as *teaching to the test.* Evidence suggests that when teaching certain populations, such as English language learners, an increase in teaching to the test is

An example of an authentic assessment is to ask a student to plan and possibly carry out a simple science experiment. Another example is to ask a student to read a historical document and comment on why it is or is not a credible source. In the first instance, the goal is to assess the extent to which the student can think as a scientist does. In the second instance, the assessment is the extent to which the student can think like a historian. Such assessments are quite different from multiple-choice tests of factual recall or inferences from facts.

Performance assessments are often scored by means of rubrics, or formal specifications of criteria for evaluation (Mabry, 1999; Stiggins, 1997). For example, the evaluation of a historical document might use a rubric such as the following:

> **High = 5.** The response is accurate, focused, coherent, and clearly articulated. The student shows firm understanding of bases for evaluating the credibility of a historical document, and of relating the document content to the historical context in which it was written. The response is insightful and draws connections among facts and ideas.
>
> **Medium = 3.** The response is generally accurate and fairly coherent. The argument is focused but not necessarily compelling. Connections among ideas and between facts and ideas are not always well articulated. The response is at least somewhat insightful but generally does not contain any breakthrough ideas.
>
> **Low = 1.** The response is often inaccurate and largely unfocused. Arguments are not clearly supported. Connections are either absent or weak. The response shows little grasp of the historical context in which the document was written.

We cover the use of authentic assessment in individual classrooms in some detail in Chapter 14, but note here that special concerns arise when attempts are made to standardize authentic assessment (Worthen, 1993). The uniformity of experience for each student that is the hallmark of a standardized test is difficult to achieve in performance tests or portfolio evaluations. You must take special care to achieve interrater reliability, as discussed earlier in the chapter. This is especially important if such assessments are to be useful in comparing ratings of students' performance from widely varying schools. In addition, you must take as much care as you have with traditional tests to assure that authentic assessments are valid. A performance test that requires a student to graph sets of numbers, for example, may lack content validity. (Recall the lack of content validity in the math test we described earlier in the chapter that tested only plane geometry.) As you will learn in detail in Chapter 14, authentic assessments, when they are carefully chosen, developed, and used, can be a useful addition to the present selection of ways to assess and compare students.

SUMMING IT UP

WHY UNDERSTANDING STANDARDIZED TESTING IS IMPORTANT TO TEACHERS

- Teachers need to understand standardized test scores because they are widely used in schools and teachers are expected to be able to interpret them for students and parents alike.

WHAT ARE STANDARDIZED TESTS?

- Standardized tests are measurement devices that have been given to many individuals, often across the nation, to develop appropriate content and scoring comparisons. They are administered and scored according to uniform procedures.
- Norm-referenced tests report scores in relation to a set of normative scores. Criterion-referenced tests report students' levels of mastery of a specific body of knowledge. In this chapter, we primarily focused on maximal performance tests, although typical performance tests are also used in assessment.

TYPES OF STANDARDIZED TESTS

- Various types of standardized tests are available. Some of the most commonly used are intelligence tests, aptitude tests, vocational interest tests, and achievement tests.

- Intelligence tests yield a score known as the intelligence quotient (IQ). Ratio IQs are calculated by comparing a person's mental age with the person's chronological age. In contrast, deviation IQs compare the individual's performance with that of an average person of the same chronological age.
- Achievement tests are the most commonly used standardized tests in schools. Omnibus tests combine items of several types in one large test. Other tests divide items into groups of similar item types, or subtests.

ASSESSING TEST QUALITY

- Test quality can be assessed in many ways. One option is to consider the samples of people used to develop the test, as well as the population for whom test scores are relevant. Random samples are very difficult for test developers to achieve. Test norms are instead based on stratified samples, including representative samples.
- Tests vary in their consistency of measurement (reliability) and in the extent to which they measure what they are supposed to measure (validity). Types of validity include content validity, predictive validity, and construct-related validity.

INTERPRETING STANDARDIZED TEST SCORES

- A number of statistics are used in interpreting group data from tests. These statistics include frequency distributions and measures of relative frequency and cumulative frequency, measures of central tendency (mean, median, and mode), and measures of dispersion (range, standard deviation, and variance).
- A variety of kinds of scores can be used on standardized tests, such as raw scores, standard scores (including *T*-scores and stanine scores), percentile scores, or grade equivalents. We can distinguish between true and observed scores, but can only estimate the former, using confidence intervals and the standard error of measurement.

ISSUES AND CONCERNS IN STANDARDIZED TESTING

- Test bias means a test is unfair to members of certain groups. The cultural backgrounds of groups of students often are related to issues of test bias. It is possible, albeit difficult, to make tests culturally relevant. Culture fairness is often regarded as an ideal to be strived for rather than something that can be achieved. Many believe a truly culture-free test is simply impossible to construct.
- Tests are often used in the pursuit of accountability on the part of teachers and students. High-stakes testing and readiness scores can be misused, to the detriment of the students. Authentic assessments have been developed, in part, to address some of the potential misuses of traditional multiple-choice standardized tests.

KEY TERMS AND DEFINITIONS

- **Accountability** Practice of evaluating teachers and schools for the extent to which they meet measurable educational goals. Page 500
- **Achievement test** Test that measures accomplishments in either single or multiple areas of endeavor. Page 482
- **Authentic assessments** Tests designed to allow students to show their achievements or abilities in a real-life context. Page 501
- **Bimodal (or multimodal) distribution** Distribution that has two (or more) modes, or most frequent values. Page 490
- **Confidence interval** An interval estimate of a true score falls within a certain range of the observed score. Page 493
- **Construct-related validity (construct validity)** Extent to which a test completely and accurately captures the theoretical construct or attribute it is designed to measure. Page 487
- **Content validity** Extent to which the content of a test actually measures the knowledge or skills the test is supposed to measure. Page 487
- **Criterion-referenced tests** Tests that measure a student's performance relative to what the student should know. Page 475
- **Culture-fair test** Test that, in theory, would have the same meaning for members of all cultures. Page 498
- **Culture-free test** Test that, in theory, would be completely unaffected by culture or cultural context. Page 498
- **Deviation IQ scores** Intelligence test scores calculated on the basis of how high a person's score is relative to that of other people of his or her age. Page 480
- **Differential Aptitude Tests** Tests designed to measure abilities developed over a period of years that predict success in particular areas of endeavor. Page 481
- **Frequency distribution** Numerical display of the number or proportion of student scores at each score level or interval. Page 488
- **Grade equivalent score** Measure of grade-level achievement in comparison with the normative sample for a given test. Page 494
- **High-stakes testing** Use of test scores as the sole or primary basis for making decisions important to the lives of students (and teachers). Page 499
- **Intelligence quotient (IQ)** Measure of intelligence comparing mental age to chronological age, multiplied by 100. Page 480
- **Mean** Arithmetical average of a set of numbers. Page 489
- **Median** Middle of an ordered set of values. Page 490
- **Mental age (MA)** An individual's level of intelligence compared to an average person of the same physical age. Page 479
- **Minimum-competency test** Test that measures whether a student has attained the minimum level of overall achievement necessary for a particular purpose. Page 499
- **Mode** The most frequent value within an ordered set of values. Page 490
- **Normal distribution** Commonly occurring distribution of test scores in which most data values cluster around the average value. Page 491

- **Norm-referenced tests** Tests that compare test takers' scores with the average performance of the test takers. Page 475
- **Norms (normative scores)** Test scores that reflect the performance of individuals in the population of interest. Page 475
- **Observed score** Score someone actually receives on a test. Page 493
- **Percentile score** Proportion of other students' scores that equal or fall below a given student's own score. Page 493
- **Population** Complete set of individuals to which a set of results will be generalized. Page 484
- **Predictive validity** Extent to which a test predicts a performance that will be demonstrated after the test has been taken. Page 486
- **Range** Difference between the lowest and the highest values in a distribution, or group of test scores. Page 490
- **Raw score** Number of test items answered correctly. Page 491
- **Readiness tests** Tests intended to measure the extent to which a student is prepared to learn something. Page 499
- **Reliability** Consistency of test results. Page 485
- **Standard deviation** Measure indicating the adjusted average dispersion of values, such as test scores, around the mean, or average, value. Page 490
- **Standard error of measurement** Measure used to express a confidence interval. Page 493
- **Standard score (z-score)** Test score that is calculated by converting a raw score into units of standard deviation. Standard scores are arbitrarily defined to have a mean of 0 and a standard deviation of 1. Page 494
- **Standardized test** Test that has been given to many individuals, often across the country, to develop appropriate content and scoring comparisons, and that is administered and scored according to uniform procedures. Page 474
- **Stanine score** Standard test score that has a range of 1 to 9, a mean of 5, and a standard deviation of 2. Page 494
- **Test bias** Tendency for a test to be unfair for members of some groups but not others. Page 496
- **True score** Hypothetical test score a person would get if he or she took a test an infinite number of times with no practice effects. Page 493
- ***T*-score** Type of standard score that has a mean of 50 and a standard deviation of 10. Page 494
- **Validity** Degree to which a test provides measurements that are appropriate for its intended purpose. Page 486
- **Variance** Value of the standard deviation squared, an index that measures dispersion among scores. Page 491
- **Vocational interest test** Test designed to help students decide where their vocational interests lie. Page 481

QUESTIONS AND PROBLEMS

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

1. How would you explain the importance of sitting through an entire standardized testing session to a fourth grader who is hyperactive? What are some strategies you might use to help the student complete the test?
2. What are some ways you could ensure that your second graders understand the instructions for a standardized test?
3. How would you adjust your fifth-grade reading lessons if you noticed that nearly all your students had low scores on the vocabulary portion of a standardized test, although they scored well on the other reading objectives?
4. How would you respond to questions from the parents of a kindergartner who did not score well on the first-grade readiness test? What could you do if you were convinced the low test score did not truly reflect the student's readiness for first grade?
5. Nearly all of your third-grade class scored below average on the statewide achievement test last year. You are now under pressure from the principal to bring up this year's scores. What are some ways you could improve scores, without teaching to the test?

IN MIDDLE SCHOOL

1. Your seventh graders have taken so many standardized tests that they are thoroughly bored with practice test sessions. How can you motivate them to pay attention to yours?
2. Without specifically teaching to the test, or targeting test content, what are some general principles or activities you can include in a sixth-grade science class in hopes of improving the students' scores on the annual achievement test?
3. The parents of one of your eighth-grade English students have expressed concern because the student's grade equivalent score in reading is at the sixth-grade level. They ask, "Are you really giving students hard-enough books to read?" How will you explain the meaning of the student's score?
4. One of your students disagrees with your comments about her math test scores. "I scored better than 91 percent of kids in the country," she says. "What do you mean I have not fully mastered geometry?" How can you explain the difference between norm-referenced and criterion-referenced scores to her?
5. One of your eighth-grade math students has come to you in tears. She has just learned that a low math score on the standardized placement test will put her in the slow track next year at high school. You believe the placement would be an error. Which steps do you think she (or you) can take to change her placement?

- **Norm-referenced tests** Tests that compare test takers' scores with the average performance of the test takers. Page 475
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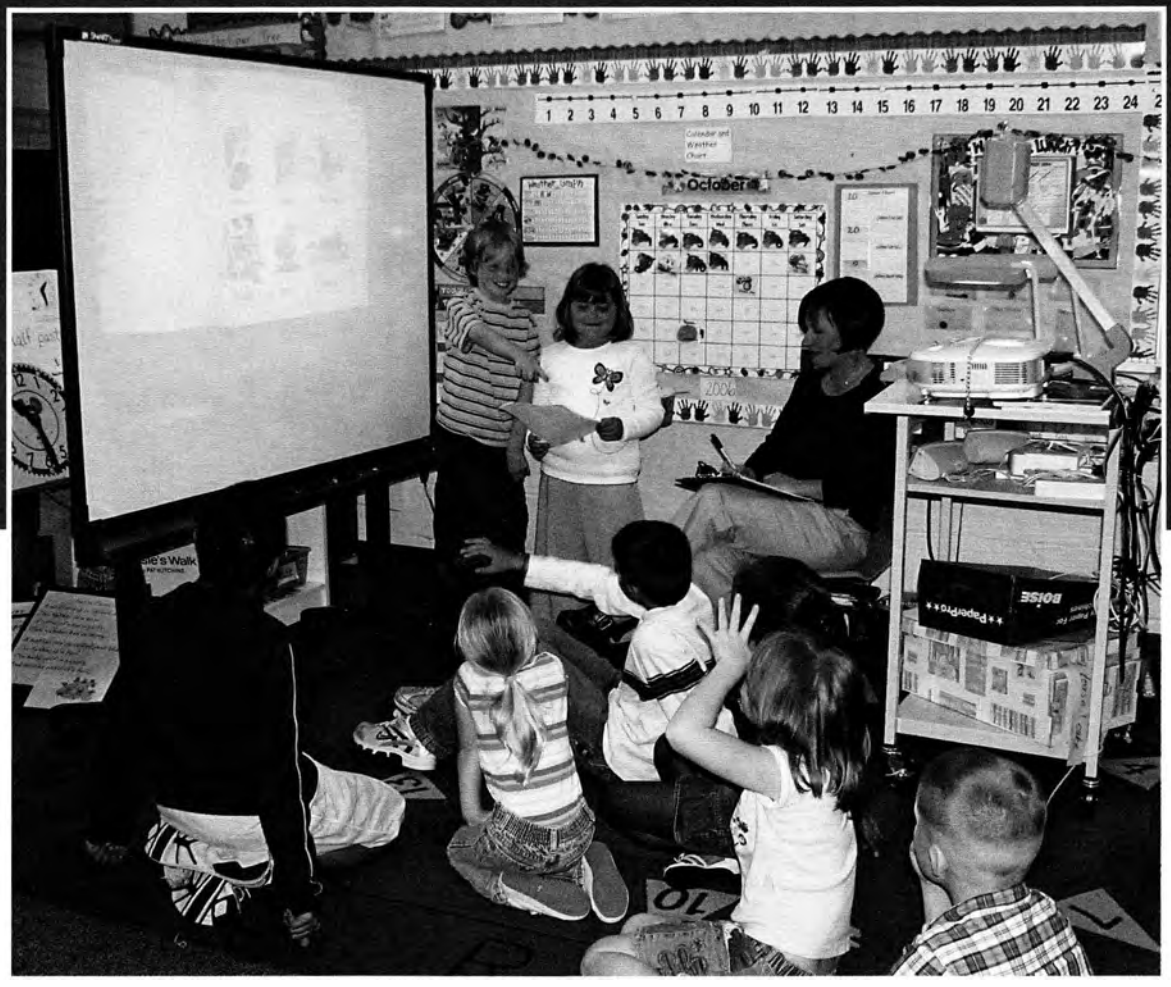
IN HIGH SCHOOL

1. One of your junior year students wonders about his chances of getting into college. "African Americans always score lower on those tests," he says. "They are never going to let me in." What can you say to reassure this student?
2. Some of your seniors are worried they will not be able to graduate. They always have scored below average on standardized tests and they are not sure they can pass the state-required minimum-competency test. How can you help them?
3. You know one of your students works late most nights as a nurse's aide. The student is trying to gain experience for a career in physical therapy, but you are concerned that a lack of sleep and preparation time will hurt her performance on the college entrance exam. What will you tell her?
4. You teach a world history class that emphasizes problem solving, critical thinking, and creativity, and includes lots of group projects. During the past few years, you have heard complaints from students and parents that, although fun and instructive, your class does nothing to help students excel in the multiple-choice college entrance and minimum-competency tests. How can you better prepare students for these high-stakes tests without compromising your approach to teaching?
5. Which kinds of standardized tests would you include in a junior-level life skills unit on career planning? Which other information would you ask the students to collect about themselves as part of their career planning process?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Classroom Assessments 14

Why Understanding Classroom Assessments Is Important to Teachers

Formal and Informal Assessments

Evaluating Student Achievement

Formative and Summative Assessment

Norm-Referenced and Criterion-Referenced Assessments

The Goals of Assessment

Traditional Assessments

Which Material Should the Test Cover?

The When and How of Testing

Developing Objective Test Questions

Developing Essay Tests

Authentic Assessments

Types of Authentic Assessments

Characteristics of Good Authentic Assessments

Portfolios

Exhibitions

Evaluating Performance on Authentic Assessments

Grading and Reporting

The Importance of Grades to Students

General Grading Guidelines

Relative Improvement Versus Absolute Performance

Criterion-Referenced and Norm-Referenced Grading Systems

Total-Point Grading Systems

Percentage Grading Systems

THE BIG PICTURE

To help you see the big picture, keep the following questions in mind as you read this chapter:

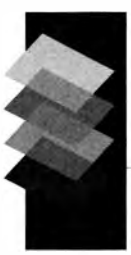
- What is the role of classroom assessments in today's schools, and why are they important? How do assessments affect student learning, and how do they affect instruction?
- What is the difference between using tests to select students for programs or to place them in classes, on the one hand, and using tests to measure what students have learned in a specific course, on the other hand?
- How can a teacher write fair and appropriate assessments? When is it best to use multiple-choice, fill-in, sentence completion, matching, and essay questions?
- What is the difference between traditional and authentic assessment? What are the advantages and disadvantages of each approach to assessment?
- How can a teacher be sure to use the information from assessment to grade students fairly? How can assessment and grading be used most effectively to enhance student motivation and increase learning?
- How can teachers using their own tests ensure they are clear and fair? When should teachers use prepackaged tests?
- How does a teacher accommodate to school-wide grading policies that do not seem to apply to his or her class?
- How can a teacher allow students to do extra work to make up for poor performance while still being fair to other students who scored well the first time around?

Jing Xu was trying to put together her American history final exam for her twelfth-grade class. The class had spent the semester doing so many different types of activities—listening to lectures, watching videotapes, breaking into groups for discussions, producing their own play as a final project, and writing three book reports. How could she possibly give a fair test on everything the class had learned? Jing's students had performed well and had exceeded her expectations—by all accounts, her class was a huge success. Because Jing knew that one-third of her students had begun the term with limited proficiency in English, she had based the curriculum on varied formats and presentation styles so as to engage those students and give them a chance to do well. Now, she faced the dilemma of testing and grading the students in a way that met the school's uniform assessment goals. She also faced the need to assess the students' factual knowledge of history, even though the emphasis of her instruction was not on factual knowledge.

Jing finally settled on a varied format for the test: a selection of multiple-choice, fill-in-the-blank, and matching questions, followed by two essays (the topics for which students could select from a list of five questions). She wrote some of the questions herself, but—because she had trouble recalling exactly which material she had covered in lectures and class activities—she also chose some questions from the sample tests in her teacher's guide. She proofread the test carefully to make sure it was free of typographical errors. Feeling reasonably satisfied, she called it a night.

The next day, Jing noticed the perplexed looks on her students' faces as they worked through the exam. When the bell rang, three-fourths of the class had not finished the test. Several students stayed afterward to tell Jing that the test was unfair and had nothing to do with what they had learned in class. Knowing they had performed poorly on the test, these students asked if they could do an extra project to help raise their averages. Jing did not know how to react. She believed the test was fair: If she let some students do an extra project to make up for their poor performance, her final grades for these students would be higher than the grades students should be getting, based on their knowledge of history. She couldn't give all her students good grades without angering the other history teachers and the principal, as well as the students with high test scores. What should Jing do?

Jing is a dedicated teacher whose goal is to reach her students and excite them about history. Although she succeeded in teaching an interesting and popular course, she failed in her attempt to assess the students fairly. Jing made several mistakes. First, the test she designed did not cover the same material that she taught: Because she had not followed an explicit teaching plan, when it came time to draw up the final exam, she could not remember what she had covered. Second, she wrote test questions that were sometimes unclear because she did not have time to review the questions, try them out on another teacher, and revise them. Third, Jing borrowed questions from sample tests that had little to do with her course. Jing must grade her students in accordance with school policy—one that makes it difficult for every student to get an A or a B in her course. During the semester, however, most students had done well on their projects and reports, and many believed they deserved high grades. In this chapter, we discuss what Jing might do next semester to avoid her mistakes and assess her students more fairly.



Why Understanding Classroom Assessments Is Important to Teachers

What would it be like to be a student in a school with no assessment? Would you learn as much? Would you study as often at home? Freed from the worry of being evaluated, would you blossom in the school environment? Although many students might think the purpose of assessment is to make their lives miserable, research in educational psychology has shown just the opposite: Assessments increase motivation and learning and, as a result, students benefit more from the time they spend in school (Brookhart, 1997; Brookhart

& DeVoge, 1999; Brookhart, Walsh, & Zientarski, 2006; Crooks, 1988; F. N. Dempster, 1991, 1992). The specific assessments used create some of the most salient aspects of the students' learning environment. Even within the same classroom, the type of assessment given affects students' perceptions of assigned tasks, self-efficacy for those tasks, reported mental effort invested, goal orientation, and learning strategy use. These factors also differ from one student to the next (Brookhart & Durkin, 2003).

Fair assessments help students and teachers alike measure the students' progress toward their goals; fair assessments also help teachers improve their teaching to better assist students in meeting their goals. Students learn most when they are given brief, frequent assessments instead of longer and less frequent assessments (Bangert-Drowns, Kulik, & Kulik, 1991; F. N. Dempster, 1991; F. N. Dempster & Perkins, 1993).

What is classroom assessment? Is it just the tests a teacher gives every two weeks over the course of the semester or school year? Actually, it encompasses much more: **Classroom assessment** consists of every type of information you take in about the students in the classroom. It consists of test results, grades on homework and class presentations, and the informal conversations you have with your students over the course of the year. As Jing Xu, the teacher in the chapter-opening vignette, realized, classroom assessment is a complex issue that requires a teacher to consider numerous aspects of the students and the instructional environment. Taken as a whole, classroom assessments define student learning: what and how much students have learned, in what time frame. The entire picture of the ways you gather information on your students constitutes your assessment system. Often, teachers map out an effective **assessment system** at the same time they plan instruction. Even in schools that do not give grades, teachers gather information about students' progress so they can guide students and help them develop in their learning.

THINKING PRACTICALLY

What is your personal attitude about taking tests? Do you think that tests make you study harder and learn more? Why or why not?

SUGGESTION: Think about your past experiences with tests, and how an upcoming test tends to influence your behavior. Do you budget your time to prepare for the test, or do you put off studying until the last moment? Does anxiety overwhelm you? Do your results on tests vary from time to time, and from subject to subject? Why might this be?

FORMAL AND INFORMAL ASSESSMENTS

Even though both tests and discussions give you information about what a student has learned, the types of information you gather from these two sources are very different. These two sources of information correspond to formal and informal methods of assessment. **Formal assessments** are objective and rigorous methods for obtaining information about student learning, such as tests, quizzes, book reports, and assigned in-class presentations. **Informal assessments** consist of observations you make of students in the classroom, doing work, and talking to you or to other students; such dialogue may include student answers to teacher-initiated questions. Informal assessments also consist of information in written form that you obtain from some students, such as a special letter to you or an extra composition or journal entry that the student asks you to read.

Formal assessment usually results in information collected in a uniform manner on all students, whereas informal assessment consists of information collected opportunistically on some students, but not always on others. You gather the information to help plan future instruction and to gauge the success of current instruction. You also use it to evaluate individual students, to form the basis for feedback, and, in general, to help students achieve their maximum potential.

THINKING ANALYTICALLY

Describe three situations in which informal assessments might be fairer than formal ones. *Hint:* Consider the plight of students with test anxiety.

SUGGESTION: Very anxious students might do better if asked informal questions by a friendly teacher than if confronted with the same questions on an exam. Students with limited English proficiency might do better if questioned informally by a teacher who recognizes their language limitations. Students with low self-esteem might do better if the teacher gives them a few encouraging words before administering an informal test.

Scott Cunningham/Merrill

A student interacts informally with her teacher. Anxious students often do better if asked informal questions by a friendly teacher. The teacher can then use the interchange as part of her total assessment of the student.

EVALUATING STUDENT ACHIEVEMENT

THINKING CREATIVELY

Suppose you took over a fellow teacher's class at mid-term, and the only information you were given about your students consisted of their grades on three classroom tests. How could you determine the informational value and fairness of these grades? Which steps would you take to ensure that the students were judged fairly?

SUGGESTION: You might ask the students if you can see their notebooks and homework assignment sheets to learn what kinds of notes they took and what, exactly, was being covered in class. You could consider the readings they were assigned and compare the test content to what was taught. You could also ask students if the tests were fair, and if not, what might have made the tests more fair. You could repeat a test about which you were concerned by making up your own test on the same basic content.

What do you do with the results of formal and informal assessments? The assessments themselves represent measurements of student learning. **Measurements** are data on student performance and learning that you collect. You use these measurements to perform an **evaluation,** the process of making judgments about individual student's learning and performance (and effort) based on the measurements, or information, at hand.

Consider an example of the difference between measurement and evaluation. Larry Jacobs, an English teacher, has available the following information on two students: Stan received on his tests the grades of B+, A–, B+, and A; he also received a B– on his classroom presentation of his book report project. Susan received the grades of C+, B, B+, and A on the same tests; she also received an A on her classroom book report presentation. These grades, as well as grades on homework and other items, represent the measurements available to Larry on which he will base his decisions regarding final grades.

Doing an evaluation is more complex than simply averaging each student's grades to obtain a final grade, however. Consider how the following pieces of information might affect the final grades doled out to Larry's students: What if Susan started out the year with an undiagnosed reading disability and then got appropriate help in the middle of the term? What if Stan became terribly nervous when speaking in front of the class? What if Susan's book report project showed evidence of significant parental involvement? What if Stan were caught cheating on the last test of the semester? As you can see, the process of evaluating students' learning often must take into account many factors beyond simply the scores students receive on tests and assignments.

Remember, too, that evaluation is not the only subjective aspect of the measurement and evaluation process. Measurement itself can have subjective aspects, such as the grade given on an essay—which might be higher if the teacher liked the topic or identified with it—and the grade given on a classroom presentation, which may sometimes reflect the particular preferences and prejudices of a given teacher.

Like Jing Xu, any teacher can become overwhelmed by the responsibility of conducting fair assessments. What is a beginning teacher to do if her or his goal is to assess all students fairly? We begin by discussing how to design and score different types of assessments and how to use the information provided by these scores in final grading decisions. Throughout the chapter, we return frequently to two terms introduced in Chapter 13—reliability and validity, both of which are important goals of assessment:

- *Reliability* describes the consistency of a measurement—in other words, the extent to which the method of measurement can be relied on to provide consistent information every time the method is used.
- *Validity* describes the extent to which an assessment measures what it is supposed to measure.

A spelling test is not a valid measure of reading comprehension, for example, nor is a math test on fractions a valid test of everything learned in the sixth-grade curriculum. Assessments can be invalid for many reasons: They might ask the wrong types of questions, given the stated goal of the assessment, or they might ask the right types of questions but cover only a portion of the material they are supposed to cover.

FORMATIVE AND SUMMATIVE ASSESSMENT

Have you ever taken a test to get into a special class, program, or school? Perhaps you have taken a math test to see which math class you belonged in. This type of assessment is called **formative assessment;** its purpose is to discover the strengths and weaknesses in prior learning. Formative assessment reveals a student's developmental stage in the area being tested. It is intended to be diagnostic—that is, it is often used to assist teachers and others in making decisions about where to place students (Herman, Osmundson, Ayala, Schneider, & Timms, 2006).

You have undoubtedly been exposed many times in your academic career to the other type of assessment, called summative assessment. **Summative assessment** is the typical final exam type of assessment you are used to—a final test of student learning in a particular area.

You can remember the difference between the two different forms of assessment by focusing on the words *form* (as in "to form a decision") and *sum* (as in "to summarize prior learning").

The distinction made between these two types of assessments refers more to the purposes for which the assessments are used than to any defining characteristics of the tests themselves. For example, consider the swimming test given at some colleges. If you take the test during your first week as a freshman and you pass it, you are exempt from a swimming requirement that you would otherwise have to fulfill during your four years in college. In this case, the swimming test is a formative assessment, used for making placement decisions. The same test can also be used at the end of the one-semester athletic course in which swimming is taught. Used at this point, the test becomes a summative assessment, or a measure of what you learned in the course. Put simply, the purpose for which the test is administered is the differentiating aspect.

As a teacher, you will use both formative and summative assessments. You may be asked by your school to administer standardized formative assessments early in the school year to help place students into various programs, special classes, or groups within classes. And, of course, you will give many summative assessments to fulfill your school's testing requirements to document student learning.

THINKING ANALYTICALLY

Name three examples of formative assessment and three examples of summative assessment.

SUGGESTION: Formative: baking a cake to qualify for an advanced cooking class; swimming laps to qualify for a lifeguard position; taking a Spanish test for placement in an advanced Spanish class.

Summative: baking a cake to be given credit for an advanced cooking course; swimming laps as a final exam in a swimming class; taking the final exam in an advanced Spanish class.

NORM-REFERENCED AND CRITERION-REFERENCED ASSESSMENTS

Another general concept to understand about assessment is the difference between norm-referenced and criterion-referenced grading (see also Chapter 13). You may not realize it from the terms, but you already know what each expression means. When your teacher in seventh-grade science class announced, "You need to answer 80 percent of the test questions correctly to earn a B," he was using a **criterion-referenced grading system.** In this system, a grade represents a specific set of accomplishments, which can be identified for one student independently of the performances of other students (for example, getting 80 percent of the questions right).

If your teacher in college-level science said, "I grade on a curve, and 20 percent of you will get A's, 40 percent will get B's, and 40 percent will get C's and below," she was using a **norm-referenced grading system.** Such a system indicates how well a student has done compared with other students. It involves assigning a student a grade relative to the other students who took the same assessment.

THINKING ANALYTICALLY

Name two additional drawbacks of both norm-referenced and criterion-referenced grading systems. Consider this question from your own perspective as a student: What seems unfair about each method of grading?

SUGGESTION: Norm: has no clear standard of performance that can be communicated to the students ahead of time; causes extreme competitiveness among students. Criterion: teachers can set inappropriate or irrelevant criteria; the best students may feel cheated by overly easy criteria.

■ **FAIRNESS ISSUES** Imagine that half of your educational psychology class consists of people who already know the material, but who are taking the course to pad their transcripts with A's. What will this fact mean to you and to your chances for earning an A, if you are not already an expert in educational psychology? Conversely, think of the opposite situation, in which you are better prepared from past experiences and coursework for a given course than are the other students. You might sail through with little effort and receive an A. Thus a norm-referenced system can be unfair and highly influenced by the specific situation and the experiences of the students in a given class.

Criterion-referenced systems, too, can present problems. One teacher complained that he set what he believed were reasonable criteria for an A, a B, a C, and so on. At the end of the term, he found that most of his students had gotten C's. This situation is not likely to satisfy parents or the school principal regarding the teaching and learning that have been taking place. Nor would the opposite situation satisfy the principal or other teachers (although the parents probably would not mind!)—that is, if nearly every student earns an A in one class because the teacher set lenient criteria for receiving an A, whereas other teachers in the same school established more rigorous criteria.

■ **APPLYING UNIFORM CRITERIA** Obviously, both norm-referenced and criterion-referenced grading systems have both advantages and drawbacks. In practice, many school districts set uniform criteria for teachers to use in assessment and grading, thereby attempting to make the system and the standards more consistent. You will probably be given instructions from your principal regarding which type of grading system you should use. Some

principals will not supply this information, in which case it is up to the individual teacher to identify the customary procedures. For example, if you are told to use a criterion-based system, ask your principal and fellow teachers which criteria have been established for use in your school, so your practices do not deviate significantly from the practices of other teachers.

THE GOALS OF ASSESSMENT

What are the goals of assessment? To measure student learning and achievement fairly, appropriately, and consistently. Your goals should actively shape the nature of the assessments you use, their frequency, and the types of grading and reporting of grades based on these assessments. At first you may think the only goal of assessment is to determine what students know. However, research has shown that the use of assessments creates an incentive for students to study; thus assessment influences student motivation. The type of assessment given has a direct effect both on how students study and on what they learn (Crooks, 1988; F. N. Dempster & Perkins, 1991, 1993; Gronlund, 1993). Researchers have looked at the effects of different assessment formats on student motivation and learning (Stefanou & Parkes, 2003). It turns out that traditional paper-and-pencil tests and performance assessments lead to more task-focused goal orientation among students than do laboratory tests.

THINKING PRACTICALLY

How has the nature of the assessments in your educational psychology course influenced your learning and studying behavior?

SUGGESTION: Ask yourself, first, what types of assessments have been used this term and, second, how you have responded to them. Have any assessments been particularly good at motivating you to study more?

■ **ASSESSMENT, MOTIVATION, AND LEARNING** Imagine you are taking an American history course, and you are told you will have a 100-item multiple-choice test on the American Revolution. A friend of yours is told that, in her class, there will be an all-essay exam on the American Revolution. You and she would probably study the same material in different ways, because each of you would be guided by the different uses to which your knowledge will be put. You might be well advised to spend your time on hard-core memorizing of facts and figures. Your friend might be well advised to think in more conceptual terms about the general issues surrounding the American Revolution and how she can write about these issues in essays. Although you and your friend might share equal amounts of motivation, the actions you take and the learning you accomplish will probably be shaped by the different types of assessments the two of you were preparing for.

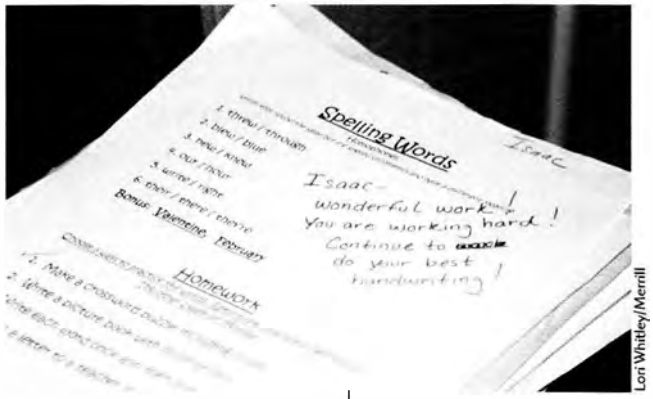
In addition to shaping learning strategies, assessment provides information that serves as a guide to the effectiveness of teaching strategies and as a mechanism for improving teaching. The goal is meaningful learning. Consequently, if your students do not exhibit such learning on an assessment, you must ask yourself why and attempt to improve the situation.

Assessment influences motivation and learning in other ways. Imagine that your goal is to help your students gain confidence in their ability to master tough material in history. Like Jing Xu, the teacher in the chapter-opening vignette, you might design assessments that allow the students some choice in which essay questions to complete (to help them do as well as possible). Alternatively, you might allow students to grade their own papers, telling them the test will not count toward their grade this time, but rather will be used to help pinpoint areas of personal weakness. Another common incentive is to tell students that their lowest test grade will be deleted. This approach encourages students to study harder for future assessments, even if they did poorly on one test. Otherwise, the students might surmise that their test grade average had already been destroyed, and not study hard for the next test.

■ **ASSESSMENT AS STUDENT FEEDBACK** Another important use of assessments is to serve as feedback to students about their progress in learning. To maintain their motivation, students need feedback—preferably on a frequent basis—about their progress, including about what they are doing right and wrong and how to change (Bardine, 1999). With feedback, students can chart their progress and gain additional motivation as they move nearer their goals. The more explicit and detailed this feedback—as long as it is constructive—the better. Students who receive written feedback in addition to the more typical letter grades are more likely to believe that effort and hard work, rather than luck and external factors, are responsible for their success (Cross & Cross, 1980–1981). As readers may know, currently there is a trend toward giving tests in a real-time computer setting. Research has shown that students learn more when they receive immediate feedback about whether they

answered each question correctly (Brosvic, Epstein, Dihoff, & Cook, 2006; Epstein, Epstein, & Brosvic, 2001).

As we discussed in Chapter 10, *positive feedback* consists of praise and encouragement designed to give students confidence about their ability. By comparison, *constructive feedback* is designed to show students specifically which aspects of their performance need improvement, and to provide specific suggestions for how to improve those areas. Both types of feedback are valuable. Expert teachers often start out with positive feedback to place a student in a receptive and nondefensive mood, only then giving constructive feedback that shows what the student must do to improve (see Table 14.1).



Lori Whitley/Merrill

Students who receive written feedback in addition to letter grades are more likely to attribute their success to effort and hard work rather than to luck and external factors.

One study looked at the relationships between teachers' praise and feedback and students' perceptions of the classroom environment. Negative teacher feedback and effort feedback were both related to students' relationships with their teachers, whereas ability feedback was associated with perceptions of the classroom environment. Praise did not affect students' perceptions of the classroom environment or teacher–student relationships. Satisfied students received more general praise, more general ability feedback, more effort feedback, and less negative teacher feedback compared to dissatisfied students (Burnett, 2003).

Another study looked at the relationships between teachers' feedback and students' self-talk and self-concepts. Self-talk (positive and negative) helped students deal with teacher feedback and moderated the effect of negative feedback on their academic self-concept. The importance of providing both ability feedback and effort feedback was highlighted by this research (Burnett, 2002).

Yet another study showed that the amount and type of feedback students receive predict a significant, although small, part of the quality of the content, organization, and mechanics of students' writing assignments (Matsumura, Patthey-Chavez, Valdes, & Garnier, 2002; see also Matsumura & Gallimore, 2005). Clearly, teachers' feedback influences students' performance.

THINKING CREATIVELY

How can you help students who are unfamiliar with school requirements and tests become more comfortable with the system in use? How can you ensure that students understand the system?

SUGGESTION: Give practice tests with lots of explanation about the testing and grading process. Discuss the system openly in class—do not keep it a secret. Encourage questions about the system and answer them openly.

■ **ASSESSMENT AS TEACHER FEEDBACK** Assessment of student performance also provides important feedback to teachers about the quality and success of their instruction. A teacher might be very popular with her students; however, if assessments show that her students are not learning, the teacher must face the fact that her instruction is lacking. A teacher who is not popular might point to high student performance in defense of his effectiveness. Principals, other administrators, and school boards use feedback on teacher performance, as reflected in student assessments, to hold teachers accountable for their work.

Evaluations of students also have a direct effect on parents. Most parents wish to be involved in their children's school experiences, and knowing how well their children are

TABLE 14.1 Contrasting Positive and Constructive Feedback with Unhelpful Feedback

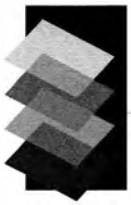
Constructive Feedback	Unhelpful Feedback	Positive Feedback
"Try to open your composition with a sentence that explains the main idea."	"Do better work next time."	"You worked very hard on this assignment."
"Please do extra math problems each night until you feel more comfortable with fractions."	"Did you even study for this test?"	"Excellent job."
"Your answers show good thinking but not good organization—try writing from an outline."	"You missed the point of the assignment."	"This shows real effort."
"You subtracted each column perfectly, but you forgot to borrow from the ten's place."	"Poor job."	"You are such a good student."
	"Study harder next time."	"I enjoyed reading this."
	"Think before you write!"	

doing is essential to keeping their at-home interactions with the children on target. For example, if a parent institutes a "no television on school nights" rule, the parent needs tangible evidence that her child's test scores have improved. This information will bolster the decision to limit television.

iMPLICATIONS FOR TEACHING

Given the many and varied uses for assessments, how can teachers ensure that assessments are as fair and useful as possible? Here are several basic factors to remember about how to use assessments effectively:

- **Make assessments meaningful to students.** Make explicit their role in students' learning and their role in computing final grades. Apply these standards consistently.
- **Ensure that assessments are objective and as fair as possible to all students from all backgrounds.** Assessments should be both reliable and valid—they should consistently measure what they are supposed to measure.
- **Ensure that assessments are neither so easy that all students do well with little effort, nor so difficult that no student does well despite having worked hard.** Assessments must be challenging to students but always within reasonable limits, so that a competent student who works hard will do well.
- **Use methods of assessment frequently**—frequently enough so that students get practice in being assessed and the assessment process is demystified for them.
- **Bear in mind the many and varied influences on students' ability to score well on assessments.** Students' age, developmental level, sex, and cultural background and experiences may all affect how they perform on assessments.



Traditional Assessments

Traditional assessments consist of the typical interim and end-of-semester tests that teachers give to measure how much students have learned—much like the final exam prepared by Jing Xu to assess her students' understanding of history. Traditional assessment tests usually contain different types of questions, including multiple-choice, fill-in, sentence completion, matching, and essay forms. Traditional types of assessments are not the only way, or necessarily the best way, for teachers to evaluate student learning. Nevertheless, they are the most common means of determining how well students have learned. Indeed, well-designed traditional tests provide valuable information about student learning (Linn & Gronlund, 1995). In this section, we review the process of designing and writing each type of test item so that the tests you design will be reliable, valid, and fair. In the next section, we explore alternative methods of assessing students that go beyond traditional forms of assessment.

WHICH MATERIAL SHOULD THE TEST COVER?

Before considering how to write good items for a particular test, first decide which material the test will cover. What are you testing the students on? What did you cover in your instruction? Which activities did the students perform, and what kind of homework and seatwork did you assign? Looking back to the beginning of the term, what were the goals and objectives of your instruction?

■ **CONSULTING PUBLISHED SOURCES** Before designing a test on your own, examine the tests provided with your instructor's manuals and other teaching materials. You may be able to adapt or use, as is, some of the test questions—or even whole tests—that publish-

ers have developed. The advantage of using these published test questions is that they have often been checked for errors or potential problems in phrasing; it is also much quicker to use these items than to write your own. The disadvantage of using published test questions is that they may not accurately reflect what you taught, because you may have adapted the material in the textbook or used material from more than one textbook or source. Published tests may also have been developed for a population different from yours. You will have to use your judgment both to evaluate the quality and fairness of the published tests and to see if they contain useful material, given your goals (Airasian, 1996).

THINKING ANALYTICALLY

What might you do if the material on which you wish to test students was not thoroughly covered in class, but was covered by students as a home reading assignment? How can you ensure that the test is fair?

SUGGESTION: Make clear to the students that the home reading will be tested. Give students classroom time to do extra reading if you suspect some may get no time to read at home. Also, ask students to tell you beforehand if being tested on home reading presents any problem. Finally, vary the content of tests so as not to give an overt advantage to students with parents who are heavily involved in their home reading.

■ **USING INSTRUCTIONAL OBJECTIVES** Assuming you have decided to write your own test questions, consider the following pointers. The most important part of designing a good test is to make sure the test reflects what the students were taught. In other words, the test must be valid. The best way to ensure that the material on the test corresponds to the material taught is to return to your set of instructional objectives, which were discussed at length in Chapter 12 on classroom teaching. If you followed the plan you set forth, your test should cover the same basic content as the instructional objectives. The number of questions on each concept or topic should correspond to how much time you spent on the topic in class and how much time students were expected to spend on the topic in homework and out-of-class activities. Some teachers—particularly those at the elementary levels—may have taught several different subjects over the course of the year; these teachers will have to refer back to the units taught within each content area when developing their tests.

A precise way to accomplish the goal of matching assessment to instruction is to use a behavior–content matrix, like the one shown in Figure 14.1 (Berliner, 1987). A behavior–content matrix lists the topics you covered in the left column, and the types of thinking or behaviors that students should be able to engage in across the top row. To design a test, start by summing up how many days (or units of time) you spent on each topic. Next, allocate these totals according to the types of thinking that were encouraged, showing which types of thinking you stressed more or less in your instruction on the various topics.

FIGURE 14.1 *A Behavior–Content Matrix for a High School Biology Course*

	BEHAVIORS										
CONTENT	Recall and Recognition	Terminology	Specific Facts	Methodology	Theories and Structures	Knowledge Application	Interpretation of Qualitative Data	Screening of Hypotheses	Identification of Problems	Extrapolation	**TOTALS**
Cells: Structure											
Functions											
Reproduction											
Genes: Dual Roles											
Macro/Micro Structures											
Inheritance											
Technology											

As an example, consider a biology course in which you have spent 12 days on cells and 8 days on genes. You estimate you used about half your time teaching students how to understand the basic concepts about cells and genes, and the other half teaching students how to apply this information to their own projects. In this case, your test should include roughly 12 of 20 questions (60 percent) on cells, and the other 40 percent on genes. Of the cell questions, roughly half—or 30 percent of the entire number of questions on the test—should stress understanding of basic concepts, and the other half should stress applying the information. Similarly, of the 40 percent of the test devoted to genes, approximately half should focus on understanding concepts—20 percent of the entire test's length—and 20 percent should involve applying information. (See Table 14.2 for an example.) When you follow these guidelines closely, the system ensures that what is tested matches what was stressed in instruction. Although it may seem a bit complex, this type of planning will result in a fairer and more valid test.

THE WHEN AND HOW OF TESTING

In many schools, the administration dictates the curriculum and the general schedule guidelines for testing students. Sometimes, however, teachers have considerable leeway in deciding if and when to test. When you plan your instruction and assessments for the semester or the year, keep in mind the following guidelines about the best ways to help students benefit from the experience of taking tests.

■ **GIVE FREQUENT, SHORT TESTS** First, schedule frequent and shorter tests rather than infrequent, longer ones. Students tend to leave their studying until just before the test; the more often they are tested, the more they will study. Moreover, the use of many shorter tests helps test-anxious students overcome the paralyzing fear of being given only one opportunity to show what they know. Also, by scheduling frequent tests, you encourage students to actively process and use the material.

When you design a test, try to tailor it to the material that has been covered in the recent past. If you give many shorter tests, you will be testing frequently, as the students learn individual topics. Later, you can give a longer retest in which you integrate material across topics and help students think broadly about what they have learned. As you develop assessments during the term, incorporate questions that require students to reason actively with concepts they learned earlier.

■ **CONSIDER TESTING CONDITIONS** When you administer a test, be attentive to the conditions students will face. Poor environmental conditions can depress test performance. For example, noises, music, laughing students in a neighboring room, and other distractions may all affect students' ability to concentrate. Give students explicit instructions regarding how long they will have to complete the test, whether you will give them any warnings about elapsed time, and what they should do once their test is handed in so they do not annoy other students still working on the test. Also keep a close watch on students during a test, so you are available to answer questions if students need help with interpreting instructions, and so your presence will discourage cheating. By remaining attentive to students as they take a test, you can also help anxious students by offering a word of encouragement.

TABLE 14.2 Percentages of Test Questions in Each Area of Instruction

Content	Understanding Basic Concepts	Applying the Information	Total Percentage of Test Questions
Cells	30%	30%	60%
Genes	20%	20%	40%
Total	50%	50%	100%

■ **GIVE CLEAR DIRECTIONS** To ensure that tests accurately reflect student learning, be certain your students understand the test directions. For example, go over a sample test question to demonstrate the task required.

■ **GIVE RAPID FEEDBACK** Once the students complete the tests and the tests are collected, grade them and return them as soon as possible while the students are still interested in how they did and why. Waiting too long ensures that students will not link learning to performance, or to their level of reward and recognition for that performance. Many teachers find it helpful to discuss right and wrong answers immediately after the test, or even to distribute a list of correct answers or information on where to find these answers. Having students share their correct answers with the class is also a good practice, because it will help you incorporate testing into the curriculum as an instructional activity in itself.

DEVELOPING OBJECTIVE TEST QUESTIONS

In **objective tests** there is a single, known, correct answer to each question. Contrast objective tests with **subjective tests,** the most common of which are essay tests. In subjective tests, there is no one correct answer; the quality of an answer is open to interpretation, and different teachers may even award different grades for the same response. Objective test items consist of multiple-choice, fill-in-the-blank, short-answer, true/false, and matching items. You are probably familiar with all these items. When should you use each type? What testing goals are best served by multiple-choice versus matching items, for example?

■ **MULTIPLE-CHOICE ITEMS** Research has supported the advantages of the multiple-choice item as the item type of choice in objective tests (Gronlund, 1993). Multiple-choice items let you test a great deal of information in one sitting. That explains why the format of the SAT, ACT, or other standardized tests you may have taken is usually multiple choice. Multiple-choice items are useful for measuring factual knowledge; however, a well-crafted item can also measure higher levels of reasoning and application of knowledge—as is the case with many of the difficult items on the SAT and other challenging standardized tests.

You are probably familiar with multiple-choice questions. Each question of this type contains a **stem** (consisting of the question or incomplete statement) and a group of options, one of which is the keyed or correct answer. (The word "keyed" comes from "answer key.") The incorrect options are called **distractors** because they serve to distract students who are not sure which option is the keyed or correct answer. In some multiple-choice questions, there is only one right answer. In other questions, the options represent varying degrees of correctness, and the test-taker must choose the best option.

A well-written test item includes the following components:

- A stem that presents one question or problem. The stem must be clear and unambiguous.
- Distractors that are clear, grammatically consistent with the question in the stem, and equally technical in their language so the right answer does not leap out because of its technical phrasing compared to the distractors.
- Randomly varied positions of the right answer amid the group of distractors.
- Options, whether correct or incorrect, that are comparable in length.
- Underlined negative wording, to ensure that students see it.
- No absolutes such as "never" or "always" in distractors because these terms often give away the correct answer to students who are guessing.

When developing multiple-choice questions, avoid "none of the above" and "all of the above" because they encourage test-taking strategies that are irrelevant to subject matter knowledge—for example, choosing "all of the above" if at least two options are identified as plausible. In addition, two distractors should never have the same meaning, because it is obvious to students that the two distractors must be incorrect answers. (For additional information on writing multiple-choice test items, see the following sources: Gronlund, 1988; Haladyna, 1999; Haladyna, Downing, & Rodriguez, 2002; Sadler, 2000).

As mentioned previously, carefully constructed multiple-choice items can be used to measure higher-order learning and reasoning. Students can be given material to analyze on their own during a test; this material may be new to the students, although the analysis should be related to what the students have learned in class (Gronlund, 1993). Many science tests are designed in this way. For example, the test-taker might be shown a picture of a group containing different types of animals standing at varying distances from one another while drinking from a watering hole in Africa. The question is asked, "Based on this picture, what can you infer about the dietary patterns of the different animals?" The students' task is to analyze which animals are the solitary hunters that eat meat and which are the herd-dwelling grazers that eat grass and vegetation. The clues consist of the animals' relative positions at the watering hole and their social groups—that is, whether they travel in groups or alone. Animals that travel alone and look like predators are more brazen at the watering hole and thus would have a prime spot in the picture; by contrast, herd-dwelling grazers are tentative and take safety in numbers at the periphery of the watering hole. As you can see, answering such a question correctly requires higher level reasoning and application of ideas about animal ecology.

Table 14.3 provides examples of good and poor multiple-choice items.

■ **TRUE/FALSE ITEMS** In a true/false item, the test-taker is presented with a statement and must judge whether it is true or false. Obviously, with only two possible answers, students have a 50 percent chance of guessing correctly. In addition, the nature of each statement to be judged as true or false is usually simple and factual. For these reasons, use true/false items only when they are clearly warranted—such as when there are a great number of basic facts students have been taught. Even then, however, there should be only a few such items on a single test (Linn & Gronlund, 1995). True/false items are also good for young students who are not yet adept at writing out their answers.

If you decide to include true/false items on a test, follow these guidelines:

- Write each statement so it is clear and unambiguous.
- Be sure each statement contains only one idea to be judged as true or false. When two ideas are represented, a student may become confused, thinking one idea is true and the other is false.
- If possible, avoid words such as *most, some, sometimes, possibly, may, usually, always, never, all,* and *none*; if you must use these words, scrutinize them carefully because they can often provide clues to the student who guesses (Gronlund, 1993).

Some teachers ask students to write a rationale explaining why false items are false, thereby increasing the amount of meaningful information being assessed by true/false items. Table 14.4 on page 521 shows good and poor examples of true/false questions.

THINKING PRACTICALLY

Write four good true/false items on the material you have learned in this chapter.

SUGGESTION: Use the examples in Table 14.3 to write questions about classroom assessment. For example, "Guessing correctly is easier with true/false questions than with multiple-choice questions containing four potential responses: True or false?"

■ **MATCHING ITEMS** Matching items are similar to multiple-choice items, except there is both a group of stems and a group of options from which to choose the answers. The best matching items are those in which the same answer can be used several times, and in which the phrasing of the stems, on the one hand, and of the options, on the other hand, is consistent. When we say that you should use the same answer several times, we mean that when students match question stems to answers, there should be some answers that are correct for more than one question stem. This way, students cannot simply get the correct answer by a process of elimination. If some potential matches are used multiple times and others are not used at all, students will have to keep on their toes.

Matching items are useful for measuring students' ability to discern the exact definitions of a group of terms. Well-written items allow students to show what they know more quickly than they would by reading through numerous multiple-choice items. However, to avoid confusion:

- Do not make matching lists longer than roughly ten items.
- Keep lists of items on the same page because flipping back and forth between two sheets can also be confusing (Linn & Gronlund, 1995).

TABLE 14.3 Examples of Poor Versus Good Multiple-Choice Questions

POOR: 1. Which of the following is not a character in *The Odyssey*?

A. Telemachus
B. Penelope
C. Laertes
D. Persephone

Why Is It Poor?
By failing to underscore the word "not," a student may read quickly and misunderstand the question.

GOOD: 1. Which of the following is **NOT** a character in *The Odyssey*?

A. Telemachus
B. Penelope
C. Laertes
D. Persephone

POOR: 2. Which animal is a mammal that can fly?

A. Arachnid
B. Bat
C. Moth
D. Vulture

Why Is It Poor?
"Arachnid" may be an unfamiliar term for students and it is more technical than the other terms presented.

GOOD: 2. Which animal is a mammal that can fly?

A. Spider
B. Bat
C. Moth
D. Vulture

POOR: 3. Hemingway has been considered by some critics to be a master of dialogue-writing. Which of the following works did he write?

A. "Hills Like White Elephants"
B. *Tender Is the Night*
C. "Maggie, a Girl of the Streets"
D. *The Grapes of Wrath*

Why Is It Poor?
The information being tested bears no relationship to the opening sentence, which may confuse students.

GOOD: 3. Ernest Hemingway wrote which of the following works?

A. "Hills Like White Elephants"
B. *Tender Is the Night*
C. "Maggie, a Girl of the Streets"
D. *The Grapes of Wrath*

POOR: 4. Which of the following terms refers to the tempo of a piece of music?

A. Forte
B. Decrescendo poco y poco
C. Piano
D. Largo

Why Is It Poor?
There is an imbalance in the length of choices, with one option much longer than the rest.

GOOD: 4. Which of the following terms refers to the tempo of a piece of music?

A. Forte
B. Poco
C. Piano
D. Largo

POOR: 5. What is the definition of *bellicose?*

A. War-like
B. Attractive
C. Beautiful
D. Pretty

Why Is It Poor?
Three of the choices are so similar that the answer must be the remaining item.

GOOD: 5. What is the definition of *bellicose?*

A. War-like
B. Attractive
C. Sensitive
D. Dishonest

POOR: 6. Which of the following neurotransmitters is most commonly linked with schizophrenia?

A. Dopamine
B. Chlorophyll
C. Platelets
D. GABA

Why Is It Poor?
Two of the choices (b and c) are not neurotransmitters, thus allowing them to be quickly discarded.

GOOD: 6. Which of the following neurotransmitters is most commonly linked with schizophrenia?

A. Acetylcholine
B. Serotonin
C. GABA
D. Dopamine

POOR: 7. Which of the following plays did Shakespeare not write?

A. *Hamlet*
B. *A Doll's House*
C. *Timon of Athens*
D. *The Winter's Tale*

Why Is It Poor?
The word "not" should be emphasized so students do not misread the question.

GOOD: 7. Which of the following plays did Shakespeare **NOT** write?

A. *Hamlet*
B. *A Doll's House*
C. *Timon of Athens*
D. *The Winter's Tale*

TABLE 14.3 (continued)

POOR: 8. Schizophrenic disorders affect approximately what percentage of the U.S. population?

A. 1%
B 1.5%
C. 2%
D. 3%

Why Is It Poor?
The percentages are too similar across the options.

GOOD: 8. Schizophrenic disorders affect approximately what percentage of the U.S. population?

A. 1%
B. 8%
C. 14%
D. 20%

POOR: 9. Which time period is commonly referred to as the Renaissance?

A. 13th–15th centuries
B. 14th–16th centuries
C. 15th–17th centuries
D. 16th–18th centuries

Why Is It Poor?
The choices are temporally overlapping, thus allowing several partially correct answers.

GOOD: 9. Which time period is commonly referred to as the Renaissance?

A. 8th–10th centuries
B. 11th–13th centuries
C. 14th–16th centuries
D. 17th–19th centuries

POOR: 10. The first time a company issues new stock to the public is referred to as an

A. initial public offering.
B. price-earnings ratio.
C. stock split.
D. interest rate hike.

Why Is It Poor?
The article "an" leads to discarding choices b and c even if a student does not know the answer.

GOOD: 10. The first time a company issues new stock to the public is called

A. an initial public offering.
B. its price-earnings ratio.
C. a stock split.
D. an interest rate hike.

POOR: 11. A varietal wine refers to

A. a wine that is labeled with the different varieties of grapes used to produce it.
B. a wine that is labeled with the different years in which its grapes were harvested.
C. a wine that is labeled with the predominant grape used to produce it.
D. a wine that is labeled with the different vineyards where it was produced.

Why Is It Poor?
The stem should have included the phrase "a wine that is labeled with the" instead of including this phrase in each option and thus making the options overly wordy.

GOOD: 11. A varietal wine refers to a wine that is labeled with the

A. different varieties of grapes used to produce it.
B. years in which its grapes were harvested.
C. predominant grape used to produce it.
D. name of the vineyards where it was produced.

POOR: 12. The calculated mean of a sample

A. is never equal to the mean of the population.
B. is always equal to the mean of the population.
C. is always equal to the population median.
D. is an estimate of the population mean.

Why Is It Poor?
Words such as "never" and "always" are seldom true and thus provide clues regarding which options to discard. Also, if the item is constructed this way (with the stem and each option forming one complete sentence), the word "is" should be in the stem instead of in each option.

GOOD: 12. Which of the following statements best describes the statistical importance of a sample mean?

A. It cannot equal the mean of the population.
B. It equals the mean of the population.
C. It equals the population median.
D. It represents an estimate of the population mean.

Table 14.5 on page 522 provides examples of good and poor matching questions.

■ **FILL-IN-THE-BLANK AND SHORT-ANSWER ITEMS** Fill-in-the-blank and short-answer items (also called completion items) require the test-taker to complete a statement by filling in the missing information or to compose a short answer to a question. Teachers often prefer this type of item because it seems easy to write a good item based on statements

TABLE 14.4 Examples of Poor Versus Good True/False Questions

POOR: 1. There are six stages of moral development. T/F	**GOOD:** 1. According to Kohlberg's theory, there are six stages of moral development. T/F
Why Is It Poor? Without specifying whose theory is being referred to, one could argue that the statement is either true or false (e.g., Piaget's theory of moral development does not have six stages).	
POOR: 2. The automobile was invented before the sewing machine and the phonograph. T/F	**GOOD:** 2. The automobile was invented before the phonograph. T/F
Why Is It Poor? There should be one comparison—not two—for clarity.	
POOR: 3. There are 12 innings in a baseball game, 4 quarters in a football game, but only 2 periods in a basketball game. T/F	**GOOD:** 3. There are 12 innings in a baseball game. T/F There are 4 quarters in a football game. T/F There are 2 periods in a basketball game. T/F
Why Is It Poor? It contains both true and false choices mixed together.	
POOR: 4. Abraham Lincoln was bigger than Ulysses S. Grant. T/F	**GOOD:** 4. In terms of height, Abraham Lincoln was bigger than Ulysses S. Grant. T/F
Why Is It Poor? Without specifying that the relevant dimension is height, one could assume some other dimension was being tested (e.g., popularity).	
POOR: 5. The keyboard is composed of 88 keys. T/F	**GOOD:** 5. The keyboard of a modern piano is composed of 88 keys. T/F
Why Is It Poor? Keyboards differ for different instruments.	
POOR: 6. Judaism and Christianity are monotheistic religions, but Islam believes in many deities. T/F	**GOOD:** 6. Judaism, Christianity, and Islam are all monotheistic religions. T/F
Why Is It Poor? It mixes both true and false assertions and the wording is confusing. Also, a religion does not itself believe in one or more deities; people who adhere to the religion may.	
POOR: 7. Mozart was a genius. T/F	**GOOD:** 7. With respect to his musical capabilities, many people consider Mozart a genius. T/F
Why Is It Poor? Without specifying that the relevant dimension is musical ability, one could argue that Mozart was not a genius.	

in a textbook: You can take a statement of fact or a description, remove a key portion, and ask the student to supply the missing portion. Although this procedure seems very straightforward to teachers who know the answer they are seeking, for the student, items requiring the completion of missing information can be very confusing.

First, there are often several potentially correct answers you may not have considered. If a student gives a correct answer that is not what the teacher seeks, the answer may inappropriately be marked as wrong. Astute students recognize that their task is not only to think about how to complete the statement, but also to decide what the teacher is looking for before answering. To eliminate such problems, teachers often resort to writing items in a very simple form where there is less opportunity for ambiguity. Avoiding complexity when writing items often leads to items that measure only lower-level thinking or basic knowledge. Because of all these potential drawbacks, fill-in-the-blank and short-answer items should be used sparingly (Gronlund, 1993).

If you do choose to use completion items, keep the following points in mind:

- Each question should have one main point and should contain only one blank—or several, in order, if responses constitute a list—for the student to complete. More than one blank separated by portions of a sentence can cause confusion.
- All blanks should be the same length, thereby ensuring you do not give students clues about the relative lengths of correct answers.
- The question should be specific about the form of the answer you seek, without giving the answer away; this way, students will know what is expected of them.

THINKING PRACTICALLY

Write three good completion items that test material from this chapter.

SUGGESTION: To get you started, three examples from among many possibilities appear here:

Evaluations of students that focus on real-world performances are known as _____ (authentic assessments).

Three frequently used types of objective test questions are _____, _____, and _____ (multiple choice, true/false, matching).

Two basic approaches to grading are _____ and _____ (norm referenced, criterion referenced).

TABLE 14.5 Examples of Poor Versus Good Matching Questions

POOR: 1. Match the state in column A with its source of wealth in column B.

Column A	Column B
____ New York	1. agriculture
____ Alaska	2. mining
____ Florida	3. manufacturing
____ Nebraska	4. information processing
____ New Jersey	5. fabrication
____ Wisconsin	6. trucking
____ California	7. insurance
	8. education
	9. endowments

Why Is It Poor?
The question and the options are ambiguous and confusing.

GOOD: 1. Match the state capital in Column B to the appropriate state in Column A.

Column A	Column B
____ New York	1. Juno
____ Alaska	2. Lincoln
____ Florida	3. Madison
____ Nebraska	4. Tallahassee
____ New Jersey	5. Sacramento
____ Wisconsin	6. Trenton
____ California	7. Albany

POOR: 2. Match the two columns so that the composer is matched with the work he composed.

Column A	Column B
____ Mozart	1. Verdi
____ *The Daughter of the Regiment*	2. *Porgy and Bess*
____ *Barber of Seville*	3. Donizetti
____ Gershwin	4. *Marriage of Figaro*
____ *Aida*	5. Rossini

Why Is It Poor?
It mixes composers and works in the same column, thus making it confusing.

GOOD: 2. Match the composer in Column B to his work in Column A.

Column A	Column B
____ *The Daughter of the Regiment*	1. Rossini
____ *Marriage of Figaro*	2. Gershwin
____ *Porgy and Bess*	3. Donizetti
____ *Aida*	4. Mozart
____ *The Barber of Seville*	5. Verdi

POOR: 3. Match the number of the cognitive development stage proposed by Piaget with the developmental achievement given below.

a. During the ____ stage, object permanence is achieved.

b. A child is able to solve abstract problems once he or she reaches the ____ stage.

c. A child is able to perform symbolic play for the first time during the ____ stage.

d. The ____ stage is when the principle of conservation is acquired.

1. formal operational
2. sensorimotor
3. preoperational
4. concrete operational

Why Is It Poor?
It is overly wordy and confusingly structured.

GOOD: 3. Match the number associated with the cognitive stage of development proposed by Piaget with the developmental achievement given below.

____ Object permanence is achieved.	1. Sensorimotor
____ Abstract problems can be solved.	2. Preoperational
____ Symbolic play is performed.	3. Concrete operational
____ Conservation is acquired.	4. Formal operational

Table 14.6 provides examples of good and poor completion questions. Table 14.7 provides examples of confusing questions that should be avoided.

■ **EVALUATING OBJECTIVE ITEMS** Once you have developed an objective test and proofread it carefully, you may think the test is ready to administer. Before moving forward, however, you should show the draft of the test to a colleague as an outside check on your thinking, and then pilot the test on a friend, or, ideally, on a student who is not in your class and who will not reveal the answers. If you cannot find an outsider to help you evaluate the test, put it aside for a few days and then read it again, with a more critical eye.

Once you have administered a test for which you wrote the items, remain alert to potential problems with individual items. A large number of student questions about a particular item, for example, indicates a problem. If many students answer an item

TABLE 14.6 Examples of Poor Versus Good Completion Questions

POOR: 1. Complementary angles _____.	**GOOD:** 1. Complementary angles add up to _____ degrees.
Why Is It Poor? Without specifying the sum of angles' degrees, one could validly respond in many ways (e.g., "are so-called because they complement each other").	
POOR: 2. _____, _____, and _____ have all won the Nobel Prize in chemistry.	**GOOD:** 2. Name three people who have received the Nobel Prize in chemistry: _____, _____, and _____.
Why Is It Poor? It is confusing to present blanks before the question—the question should come first.	
POOR: 3. The _____ War lasted from _____ to 1865.	**GOOD:** 3. The Civil War began in the year _____ and ended in the year _____.
Why Is It Poor? It is confusing and poorly worded.	
POOR: 4. John Steinbeck received the Pulitzer Prize for _____ _____ _____ _____.	**GOOD:** 4. Which of John Steinbeck's literary works received the Pulitzer Prize? _____
Why Is It Poor? The length of the lines is proportional to the words that fit them (*The Grapes of Wrath*), thus providing a clue to the correct answer.	
POOR: 5. Water is composed of one part _____ and _____ part(s) oxygen.	**GOOD:** 5. Water is composed of one part _____ and two parts _____.
Why Is It Poor? The answer called for mixes the name of the element (hydrogen) and the number of parts of the other element (oxygen) and is thus confusing.	
POOR: 6. _____ refers to random access memory.	**GOOD:** 6. The computer term *RAM* stands for _____ _____ _____.
Why Is It Poor? By failing to limit the question to computer terminology, one could argue for other correct answers.	
POOR: 7. _____ are indigenous to Australia.	**GOOD:** 7. Kangaroos are indigenous to _____.
Why Is It Poor? Many things are indigenous to Australia besides kangaroos (e.g., aborigines, platypuses, koalas)	
POOR: 8. _____ tells the musician to play loudly.	**GOOD:** 8. *Forte* indicates that a musical selection should be played _____.
Why Is It Poor? By failing to specify a musical term, it is possible to give several answers that are valid (e.g., "The audience," "A conductor").	
POOR: 9. Plant cells have _____.	**GOOD:** 9. Unlike animal cells, plants contain the photosynthesis-related molecule _____.
Why Is It Poor? Plant cells have many features that can be listed.	
POOR: 10. _____ was assassinated in 1963.	**GOOD:** 10. U.S. president John F. Kennedy was assassinated in the year _____.
Why Is It Poor? There may have been other persons assassinated in 1963 besides a U.S. president.	

incorrectly, or if they misread the item (for example, if their answers are consistent for a different reading of the item than the reading you had in mind), the item itself may be flawed. Keep a record (on a clean copy of the test) of the student input you get in response to each item. The best items are clear and discriminate between those students who did well overall on the test and those students who did poorly overall on the test.

As you are grading tests, be alert to unfair items you should rewrite or even eliminate from the test before you use it in the future. With some practice, you will be able to eliminate sources of bias from the objective tests you create.

TABLE 14.7 Examples of Deliberately Confusing or Poorly Worded Test Questions That Should Be Avoided

1. Question: How many three-cent stamps are in a dozen?
   Answer: Twelve.

Why Is It Poor?
This is a trick question rather than an attempt to find out if a student understands how many things make a dozen.

2. Question: What do the following pairs of letters represent? RD ST ND
   Answer: The letter pairs are the ending of the following words: THIRD FIRST SECOND

Why Is It Poor?
These three letter pairs stand for an infinite number of other possibilities.

3. Question: If you were to take two apples from three apples, how many would you have?
   Answer: Two apples. What you take is what you have.

Why Is It Poor?
This question tests the ability to understand confusing wording rather than testing arithmetic and, therefore, is a trick question.

4. Question: As a rule, how long will a so-called eight-day clock run without winding?
   Answer: If the clock isn't wound, it won't run at all.

Why Is It Poor?
It tests the student's willingness to accept the question as a challenge to come up with alternative schemes, rather than attempting to find out what a student knows about the length of a clock cycle.

5. Question: What are the next two letters in the following series? A E F H I K L M
   Answer: N and T. These are the next two letters in the alphabet composed only of straight lines.

Why Is It Poor?
It requires the student to read the mind of the person who came up with this arbitrary feature of letters.

DEVELOPING ESSAY TESTS

Now, we consider a more subjective way to assess student learning—the essay test. Essay tests require students to be actively involved in defining a question as they answer it, and in composing and defending their answer. Guessing is no longer an option. Students cannot easily hide behind incomplete knowledge and understanding of the material, although they can answer in generalities. To account for students' different learning styles, you should vary the types of questions you use on a test to give all students a chance to show what they know. Essays are best used for measuring high-level, complex learning (Gronlund, 1993). Some students naturally gravitate toward essay writing; others have trouble expressing their knowledge in this format. Expert teachers remember these issues when they compose tests.

One study examined the success of students in college if they either scored high on essay questions and scored low on multiple-choice questions, or vice versa (Bridgeman & Morgan, 1996). The authors found that both groups of students were equally successful across different subject areas (history, English, and biology). Both groups had equivalent course grades, although students in the high-scoring multiple-choice group performed much better on the multiple-choice portions of tests across subjects (including the verbal portion of the SAT), whereas students in the high-scoring essay group performed much better on essay portions of tests across subjects. Obviously, students have differing styles that are reflected in better performance on certain types of test questions. Nevertheless, in general, students with one style are neither smarter nor prone to doing better in school than students with other styles.

Because essay tests are subjective, different teachers may grade the same response differently. Thus, when they score essays, expert teachers ensure that they follow appropriate guidelines regarding fair grading policies and procedures. In addition, they carefully consider and review their questions before administering an essay test. Well-designed essay tests delve much deeper into student learning than objective tests. Essay questions also take longer to answer; as a consequence, teachers can cover less content by administering an essay test than they can with an objective test of the same duration. Often, the best compromise is to include both objective questions and essay questions on the same test.

Next, we review a few suggestions for the best use of the essay format (Gronlund, 1993).

WRITING GOOD ESSAY QUESTIONS The essay question is the best format for probing student understanding and reasoning at a complex level.

- A good essay question is clear and unambiguous and defines a specific question or set of questions.
- When writing essay questions, provide clear input about what the answer should cover, so the essays do not drift from the main point.
- In deciding how much time to give students to compose their answers, remember that some students may have the appropriate knowledge and understanding but be slow writers. To be sure essay questions do not primarily test the ability to write under pressure, provide ample time for their completion.
- When including more than one question, suggest how students should divide their time among the questions.
- When writing essay questions, craft the questions carefully and read them over—and have others read them—to spot inconsistencies or areas that can be misread.
- Stress higher-order thinking skills by asking students to compare and contrast, or to analyze the antecedents and consequences of an event. Tell students to list facts to defend their answers.
- As with objective test items, piloting an essay test is always a good idea.
- Avoid making essay tests too long, particularly for younger students, to keep fatigue and writer's block from undermining students' ability to show what they know.

Table 14.8 provides examples of good and poor essay questions.

THINKING PRACTICALLY

Write three good essay test questions covering material from this chapter.

SUGGESTION: Compare and contrast traditional and authentic assessment. Describe the strengths and weaknesses of criterion-versus norm-referenced grading systems. Describe three specific methods teachers can use to ensure that their tests are fair.

TABLE 14.8 Examples of Poor Versus Good Essay Questions

POOR: 1. What is the general tone of the essays written by Huxley and Snow?

Why Is It Poor?
It is vague with regard to what is being tested. For example, does the question mean "tone" in the sense of affect (optimistic), style (choppy versus fluid), beliefs (decency of man), or something else?

GOOD: 1. The essays of Huxley and Snow are both concerned with "the future of man." Do you find these writers generally optimistic or pessimistic? Point out the similarities and differences in their views, and present your views of the future of civilization in the context of these two writers.

POOR: 2. List all of the differences between Piaget's and Vygotsky's theories of cognitive development.

Why Is It Poor?
The word "list" encourages students simply to make a list without defining or analyzing significant issues. Also, the word "all" makes the question potentially impossible to answer and again encourages students to make a list of differences between the two theories with no analysis.

GOOD: 2. Define, discuss, and defend what you believe to be the three most important differences between Piaget's and Vygotsky's theories of cognitive development.

POOR: 3. Describe the life course of a patient with Alzheimer's disease in terms of defining changes.

Why Is It Poor?
It is ambiguous as to what is being sought—life course is a broad concept and a student could write almost anything.

GOOD: 3. Identify the six stages of the Phase Model with respect to the life course of a patient with Alzheimer's disease. For at least three of the stages, give an example of a defining behavioral and/or physical change seen in a patient in that stage.

POOR: 4. Why did Harriet Beecher Stowe write *Uncle Tom's Cabin*?

Why Is It Poor?
The question is vague and allows students to respond in numerous ways that have little to do with the most significant aspects of the book. Authors have many potential reasons for writing books—including personal reasons—that are not nearly as important for students to understand as the broader societal impact of the book.

GOOD: 4. Describe the social and political atmosphere in the United States at the time when Harriet Beecher Stowe wrote *Uncle Tom's Cabin*, and state three social and/or political changes that resulted from the publication of this book.

POOR: 5. Describe social mechanisms among chimpanzees.

Why Is It Poor?
It is overly broad and not specific as to which mechanisms are being tested.

GOOD: 5. Describe social mechanisms among chimpanzees in terms of dependent rank, strategic intelligence, and reciprocity. For two of these, give an example of a behavior among chimpanzees that exemplifies that social pattern.

■ **WHEN TO USE ESSAY QUESTIONS** Elementary school students can begin to answer brief essay questions only after they have mastered written language. In their first few years at school, most children need the guidance of true/false, multiple-choice, and fill-in questions; an open essay is intimidating. By fourth or fifth grade, students are able to do well on essays if the questions are clear, the essay length is specified, and they have been assigned homework and classwork requiring writing essays. As students progress through school, the use of essays becomes increasingly more appropriate; by high school, most students are well accustomed to writing their answers in essay form.

Essays are often the best way to measure higher-order critical thinking. In most cases, for well-crafted questions, students cannot study for and do well on an essay test simply by memorizing vast amounts of information: Instead, they must learn how to reason actively and process information.

Essay testing does have some drawbacks, however. First, scoring essay tests takes far longer than scoring objective tests. Scoring can be highly subjective, although expert teachers take care to eliminate unnecessary bias. In addition, students' writing ability is likely to be a strong contributor to their grades on an essay. If a test seeks to evaluate writing ability as well as content-related knowledge, this is not a problem. But sometimes students with good knowledge and critical-thinking skills do not write well, or they make spelling and grammatical errors that significantly lower their scores, despite their superior understanding. Conversely, students with excellent writing ability may be able to write an immaculate essay that largely misses the point. In general, be careful to use fair scoring procedures that give appropriate weight to both content and form of essays.

THINKING PRACTICALLY

Have you ever written what you believed was a good response to an essay question and then received a poor grade? Why do you think this happened? What could your teacher have done to help avoid this problem?

SUGGESTION: Sometimes a difference of opinion with a teacher can create such a situation, such as when a student writes a political essay and the teacher opposes the position taken by the writer. Sometimes a teacher may expect a certain type of response and react negatively to other types of responses. Expert teachers take steps to ensure that their grading of essays is not biased by asking other teachers to read essays that seem problematic, or by asking students to discuss and clarify their responses.

■ **EVALUATING ESSAY TESTS** The most challenging aspect of an objective test is writing good items; the grading is generally simple. The most difficult part of an essay test, however, is ensuring that grading is fair and accurate. Develop criteria for scoring an essay test in advance, unless you have no experience with a particular group of students or a particular grade level. In the latter case, first read the essays and then put them aside while you develop a grading scheme. If you intend to give each essay two grades—one for content and the other for style, for example—inform students of this fact in advance, so they understand the grading scheme you will use.

At least three approaches ensure fair grading (Williams, Blythe, White, Li, Sternberg, & Gardner, 1996). For situations in which there is one long essay rather than multiple short essays, follow these steps:

- First read through all of the essays and then divide them into piles. Using five piles works well. The first pile should contain the best essays and the fifth pile the worst; the piles in between contain the essays corresponding to intermediate levels of quality.
- After sorting the essays, skim the piles once again to ensure you have sorted fairly. Finally, award grades that correspond to the piles—A's to the essays in pile 1, B's to the essays in pile 2, and so on.

A second approach to grading essays follows this scheme:

- Begin by writing a model answer to each question that contains all the facts and main issues you want your students to cover.
- Allocate point totals that a student will earn for having each portion of the correct answer.
- Allow for good writing to earn more credit by awarding a certain number of points for it. This scoring technique is well suited to grading essays that are designed to elicit factual recall and direct exposition; however, more complex essay topics do not allow as easily for the use of this technique.

A third approach to grading essays takes this tack:

- Begin by developing a generic scoring key that can be used for many different types of essays. This scoring key consists of anchors explaining what each score reflects Many teachers use a 1-to-5 scale. A 1 reflects a poor essay that makes few or no appropriate points and is nearly incomprehensible; a 5 reflects an excellent essay that is well argued,

TABLE 14.9 A Grading Scheme for Essay Tests

Grading on a 1-to-5 Scale	
5	Excellent essay in every respect—well written, clear, well organized, overall excellent use of written English. Excellent understanding and organization of relevant knowledge. Shows level of comprehension, analysis, and synthesis of ideas and concepts that goes beyond simply repeating what was learned in a well-organized way.
4	Very good essay. Some elements may be lacking, but generally a solid effort evidencing good command of written English. Very good understanding and organization of relevant knowledge. (The presence of two or more errors turns a 5 into a 4; a 5 should be reserved for excellent essays with only minor errors.)
3	Good essay. It flows and is readable, but it is marked by some flaws in grammar, sentence structure, vocabulary, clarity of expression, and so on. Good understanding and organization of relevant knowledge. (Many serious flaws mean that the essay should be given a 2.)
2	Poor essay. An effort was made, but the quality is generally low. Many errors are apparent; the student could clearly use extra work in writing. Poor command of relevant knowledge.
1	Very poor essay or essentially blank. Nothing much to work with. The student obviously performs very poorly in writing and could clearly use a substantial amount of help. Almost no command of relevant knowledge.

well written, and filled with numerous facts that support its arguments. Intermediate numbers correspond to intermediate levels of essay quality. By developing such a scoring key in advance, you can begin grading without reading through all of the essays. However, always shuffle the essays and read a few of them before beginning to get an idea of the range in quality of the responses.

- To ensure you are grading the essays fairly, score all students' answers to one question before moving on to score the next question. This procedure prevents bias because of a good or poor first answer on a given student's paper. The student may have done a far better (or worse) job on the second question than on the first question, and grading all answers to a particular question in a row prevents you from developing a general impression of the student's performance based on answers you read first. Such a general impression may unfairly advantage or disadvantage students whose answers vary in quality.
- Try to grade all responses to a particular question at a single sitting.
- Have students place their names on the backs of their papers, so you are not biased by knowing the identity of the students during grading.

Table 14.9 shows a sample grading scheme for essay tests.

Essay tests measure what students know by asking them to actively demonstrate their knowledge and reasoning ability. Much of what makes essay tests appealing in comparison to objective tests is that, in the real world after graduation from school, students will not be given questions to answer followed by lists of options containing the right answer. Thus essay questions are considered to be a better reflection of the ability to think actively and independently about all information, and to formulate a persuasive argument on one's own.

IMPLICATIONS FOR TEACHING

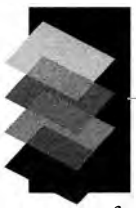
- **Count on well-designed traditional assessments to provide valuable information about student learning and progress.** There is a rich history regarding all aspects of traditional assessment, which has been the testing mode of choice in most schools for decades. You can draw on numerous sources of information to refine your understanding and use of traditional assessments.
- **Plan well-organized lessons and tailor assessment questions to the level and content of classwork and homework.** Tests are effective only when they target the

appropriate material at the appropriate level. Careful planning and integration of instruction and assessment are key.

- **Use frequent, short assessments.** These help students improve and result in greater learning and retention of material. Giving one big test creates intense pressure on students when the big test comes around, but allows for slacking off in the meantime. Expert teachers use tests to motivate good studying behavior, and they prevent single tests from becoming the sole means for a student to show what he or she knows.
- **Use objective test questions to assess a wide range of student learning in a short time.** Well-written objective questions—especially multiple-choice questions—can be remarkably effective; poorly written questions can be disastrous. Broad coverage of the material is possible with well-written objective questions.
- **In using essay tests, be careful to ensure uniform and fair grading of essays.** Evaluation of essays sometimes confuses writing skill with knowledge of the subject matter itself—and the two do not necessarily always go hand in hand. Writing good essay questions is challenging and takes practice. Ensuring fairness in grading essays requires rigorous application of the techniques discussed in this chapter.

CONSTRUCTING YOUR OWN LEARNING

Write a rough draft of a final exam that reflects the material you have learned in this course. Make sure the test includes at least two of each of the following types of questions: multiple-choice, fill-in-the-blank, matching, true/false, and essay. Read your test over and try to imagine what it would be like to take the test. Is it fair? Are the questions clear and unambiguous? Now find a friend in the class to whom to give your test. Ask this person to read through the questions and comment on their fairness and appropriateness. Does your friend think the test is clear? How would she or he improve it? What does this demonstration tell you about the process of writing a test for the students you teach?



Authentic Assessments

Many educators believe that the entire premise of classroom testing—as well as standardized testing—is flawed: These people argue that tests should reflect the types of real-world performances for which schools are preparing students (Boud & Falchikov, 2006; Herrington & Herrington, 2006; Wiggins, 1989). Such **authentic assessments** ask students to use skills and knowledge to solve problems in the same manner as if they were completing real-world tasks. For example, the written test you took to get a driver's license was a typical standardized test, but the road test you took was an authentic assessment. The idea was to observe people actually behind the wheel before giving them driver's licenses, and it makes excellent sense. After all, how comfortable would you be on the road if licenses were awarded solely on the basis of scores on the written test?

The goal of authentic assessment is to give a better picture of how students will perform in actual meaningful activities while using their new skills and knowledge (Wolf, 1998; Wolf, Bixby, Glenn, & Gardner, 1991). Given students' individual differences and the range of learning styles, some students who do not score high on traditional tests perform better on authentic assessments—the nature of the performance required may be a better match to these students' abilities and talents.

TYPES OF AUTHENTIC ASSESSMENTS

Norman Gronlund (1988) describes four types of performance tests that simulate real-world performances to differing degrees. The least like a real-world performance is the traditional paper-and-pencil test, with which we are all familiar. Next is the identifica-

THE FLEXIBLE EXPERT

TEACHING AND LEARNING ABOUT CLASSROOM ASSESSMENTS

IN EACH CHAPTER OF THE TEXT, WE INTRODUCE YOU TO A FEW SPECIFIC STRATEGIES—ANALYTICAL, CREATIVE, AND PRACTICAL—USED BY BOTH EXPERT TEACHERS AND EXPERT STUDENTS.

THE ANALYTICAL TEACHER: Raman writes one or two test questions every day in the teacher's lounge after class, to be sure his tests mirror what he taught.

THE CREATIVE TEACHER: To make his assessments more interesting to students, Raman writes essay questions that ask students to take the perspectives of students from different parts of the world.

THE PRACTICAL TEACHER: Raman gives students practice quizzes that he doesn't even collect and then goes over the right answers in class, so as to prepare students for tests.

THE ANALYTICAL STUDENT: Crystal completes the practice tests in her textbook under the same conditions that she will face during the actual test (by timing herself, not resting in between questions, and so on).

THE CREATIVE STUDENT: Crystal draws up practice tests for herself to take and hands them in to her teacher for her comments.

THE PRACTICAL STUDENT: Crystal gets together with several of her friends, and they ask themselves which types of test questions the teacher is likely to ask on the next test as they work through the answers together.

tion test, in which students are asked to describe things to show their knowledge (for example, the bones in the human body for a medical student, the uses of different tools for a sculpting student, and the parts of an engine for a student of auto mechanics). Next is the simulated performance, in which students perform under conditions created to simulate the real world (for example, learning CPR on a dummy or practicing diving jumps on a trampoline while wearing a harness). Finally, there is the work-sample assessment, in which real-world performances are scored as assessments (for example, a musical performance before an audience or an autopsy performed by a veterinary student on a dead animal).

Perhaps you have taken an authentic assessment. For example, you may have played a musical instrument in a recital, or you may have played on a sports team that entered a competition. In these domains, we are used to thinking in terms of authentic assessments. How much would it mean if you knew the results of a paper-and-pencil test taken by an athlete who wished to join your team or by a music student who wished to play in your band? In other domains, however, we are not used to thinking in terms of authentic assessments. For example, you might not think of the idea of giving grade school children math tests that consisted of their actually buying items with play money and making proper change, their dividing a recipe in half to cook for only two rather than four people, or their using a bus schedule to figure out when they would arrive in a neighboring town. Even so, these are legitimate math tests, because they ask children to apply their math skills to solve real-world problems.

Of course, authentic assessments can also be paper-and-pencil tests. Teachers can design tests that ask students to complete tasks with real-world relevance—for example, writing a persuasive letter to an elected official or developing architectural plans for a house. Thus authentic assessments can take many forms; the key is that such tests always assess real-world skills. For example, research has shown that creative artwork by K–12 students can be empirically assessed using quantitative measures that tap into authentic learning, and that these measures can reliably assess student art growth (Dorn, Madeja, & Sabol, 2004). Authentic assessment approaches have even been used successfully with preschool children, documenting their progress toward early learning standards (Grisham-Brown, Hallam, & Brookshire, 2006).

THINKING PRACTICALLY

Describe three situations not discussed in the text in which authentic assessments can be used.

SUGGESTION: Screening potential leads for the school play; giving a full in-box to job applicants and asking them to prioritize the work; asking a potential hairdresser to show what he can do (on someone else!) before hiring him.

CHARACTERISTICS OF GOOD AUTHENTIC ASSESSMENTS

What are the characteristics of good authentic assessments? How can teachers be sure that authentic assessments are valid, reliable, and as objective and fair as possible?

■ **PLANNING AUTHENTIC ASSESSMENTS** Often an authentic assessment has an open-ended time allotment. Although the final performance may be timed, in general, ample time to prepare and rehearse is provided. In other words, authentic assessments do not usually involve working against the clock, unless the assessment reflects a naturally speed-related performance (such as jumping horses in a competition or singing a fast song). In addition, authentic assessments often require collaboration with other people in the planning, developing, or enacting of the performance. (One drawback of group performances is the difficulty of separating out the performances of individual team members for evaluation purposes.) These assessments should mimic as closely as possible the real-world tasks that students will complete outside of school. They should challenge students to learn, grow, and develop as they push themselves to attain greater levels of ability. Good authentic assessments also give students leeway to customize or select particular aspects of their performances to show their own individual contribution. Beginning teachers (or any teacher who wishes to learn more) can consult books entirely devoted to the principles and practices of authentic assessment (for example, Khattri, Reeve, & Kane, 1998).

■ **GRADING AUTHENTIC ASSESSMENTS** How are authentic assessments graded fairly? The criteria must be well thought through and must match important aspects of the skills on display—handwriting should not matter, for example, in judging the quality of a play script that is being acted out. Authentic assessments are best graded on a criterion-referenced system, wherein grades are based on independent sets of standards defining good performances. A good authentic assessment is graded on criteria the students themselves perceive as being meaningful to the performance. The types of grades given should reflect multiple aspects of the performance. Consequently, a teacher or panel of teachers might give multiple grades for different facets of the performance. Sometimes, the quality of a performance may not be uniform across the different aspects. For example, the content of the writing on which a speech is based may be good, but the delivery weak. By giving multiple grades, you can reward and acknowledge those aspects of performances that deserve it.

■ **GOALS OF AUTHENTIC ASSESSMENT** The best authentic assessments allow all students to show what they know. These assessments make it possible for diligent effort to produce a good final product, even if the student lacks natural gifts in the area. In other words, if the goal is to evaluate general understanding of music, an assessment of singing ability is not fair to an unmusical child. Conversely, an assessment of a general music project is fair, if this general project consists of a report on a musician along with a live presentation of a recording and an analysis of the person's music. Good authentic assessments energize students about showing what they know. They are especially adept at providing opportunities for those students who do not always do well on objective tests or essay tests to display their special gifts. A final quality of good authentic assessments is that they require students to listen to feedback on their performance, and then to react to that feedback and strengthen the performance.

Baxter, Elder, and Glaser (1996) studied the role of performance assessments in making relevant cognitive activity apparent to teachers and students. They found that students' performance on a science authentic assessment demonstrated critical differences between those students who could think and reason well, and those students who could not. Differences in the quality of explanations, adequacy of problem representation, appropriateness of solution strategies, and frequency and flexibility of self-monitoring all varied among the students who participated in this study. In their own classrooms, teachers can observe these types of cognitive characteristics of effective performance on an authentic assessment. Expert teachers then use this information for purposes of planning instruction and grading students.

One study looked at the relationship between student performance on a senior-level vocational authentic assessment, students' opinions about the authenticity of the assessment, and the degree of match between the assessment and the instruction students received (Gulikers, Bastiaens, Kirschner, & Kester, 2006). The authors wanted to know if higher levels of authenticity and matching would result in deeper learning and skill development. Results showed that deeper learning and greater skill development occurred when (1) the assessment task was more

authentic, (2) the context in which the task was performed was more authentic, (3) the form of the assessment task was more authentic, and (4) all of the preceding qualities matched the types of instruction students had received.

PORTFOLIOS

A **portfolio** is a collection of student work that demonstrates the student's abilities, efforts, accomplishments, and growth in an area or areas. In addition to being a type of authentic assessment, a portfolio is a method of instruction that assists students in their learning and development. A portfolio can represent the student's own selections of work (influenced by teacher advice), the teacher's selections, or some of both; it should contain a statement of the student's goals and progress toward achieving these goals. Collins (1992) recommends that teachers define the categories a portfolio should contain, and allow students to select the exact contents within each category. A portfolio can be changed and adapted as a student moves through a course or semester so as to reflect the student's growth over time. Often, students are given the task of reflecting on the contents of their portfolio to assess their progress and chart their goals for the future.

Tom Watson/Merrill

Teachers should define the categories a portfolio should contain but allow students to select the exact contents within each category.

■ **TYPES AND CONTENT OF PORTFOLIOS** Two common types of portfolios you are probably familiar with are artistic portfolios and writing portfolios. For example, when an artist applies to a graduate program, she typically must supply a portfolio she has designed to show the range of her talents and her development as an artist. The portfolio often includes a written statement of her professional goals as well. Similarly, when a fashion model solicits a job, he shows a portfolio of photographs that displays his range of poses and his best physical features. A writer's portfolio consists of a selection of short stories, poems, essays, or critical pieces of work that show that writer's range and strengths. These artistic and creative arenas are not the only places in which portfolios are appropriate, however.

A student can prepare a portfolio in any area of study—science, social studies, foreign language, mathematics, or health and nutrition. A portfolio's contents are influenced by the nature of the area being reflected. For example, a portfolio in biology class might include samples of insects and plants with descriptions, as well as laboratory reports and data analyses. A portfolio in social studies might include copies of old newspaper articles the student has analyzed, along with an explanation of the student's analyses; photographs of historical sites with student descriptions of them; and transcripts of interviews with people from different countries—and analyses of these interviews—conducted by the student. A mathematics portfolio might include a record and description of math problems the student attempted and solved at different points in the semester, showing how her methods of analysis became more sophisticated. Portfolio content is also influenced by the age of the student and whether she is grouped with same-age peers or in multi-age teams (Hall & Hewitt-Gervais, 2000).

THINKING PRACTICALLY

Name three additional situations in which portfolios would be appropriate.

SUGGESTION: A pastry chef could displays photo of his creations, a teacher might create a portfolio containing samples of lesson plans and novel approaches to instruction, and a carpenter could assemble a photo album showing his past woodworking projects.

■ **CREATING PORTFOLIOS** Portfolios can include work from one course, a group of courses, or even out-of-school activities. When you use portfolios to assess and instruct students, remember that students should take primary responsibility for creating their portfolios. Encourage them to include pieces of work that represent self-reflection, improvement, and the ability to learn from criticism. Portfolios should include material that reflects the different activities the students engaged in while doing various kinds of coursework (for example, laboratory reports, library assignments, and foreign language stories). Expert teachers stress that students' portfolios are personal statements and explicitly recognize that students should be given a substantial say about what to include. At the same time, the expert teacher provides guidelines to ensure that students are including work from a range of areas and of a

range of types (in other words, not just their journal entries for the semester, or not just their chemistry lab write-ups). Students must understand that their portfolios should not include everything they have done, but rather should encompass a sample of work across several content areas.

■ **ADVANTAGES OF PORTFOLIOS** Any type of learning task can become the basis for a portfolio collected and managed by the student. One of the advantages of portfolios is that they engender pride in the students who have developed them. Seeing the growth of one's collection provides a feeling of accomplishment that is often lost when the work is never collected and displayed in one place. Also, in their portfolios students can be encouraged to show improvements in their work; this process helps build confidence by reminding students of their ability to persevere and overcome obstacles. Because of all of these advantages, expert teachers incorporate the use of portfolios into their assessment. Use of portfolios as assessments is most effective if these portfolios are classroom based rather than being assembled solely for large-scale testing and evaluation of students (Freedman, 1993).

EXHIBITIONS

Another type of authentic assessment is a student exhibition or performance. You are probably familiar with exhibitions: Vocal recitals, plays, book reports, skits, and other types of exhibitions are common in today's classrooms. An **exhibition** is a public performance whose audience may include people who will judge the performance.

Exhibitions that represent good authentic assessments will reflect a great deal of time and preparation, and this preparation will have helped the student understand a wide range of material. For example, to earn a graduate degree, a person must often complete an oral qualifying examination that lasts for several days (with breaks for meals and sleep). This authentic assessment is actually an exhibition of what the student has learned, often in a public forum. Because exhibitions can be nerve-wracking for some students, it is wise to use them with portfolios, which do not entail on-the-spot performances.

EVALUATING PERFORMANCE ON AUTHENTIC ASSESSMENTS

The evaluation of either a portfolio or an exhibition should be based on an analysis of whether the portfolio or exhibition has met established criteria. Points can be assigned for the portions of the work that can be judged as correct or incorrect. Points can also be assigned for the portions requiring written work, such as analyses and essays, following the guidelines already provided for grading essays. For the portions of work that involve artistic displays, either the teacher can be the sole judge or, preferably, a panel of educators, students, and even parents can make judgments. As with all assessments, the proper use of authentic assessments includes giving students clear feedback and directions for future improvements:

Index Open

Students present a martial arts show for parents, teachers, and schoolmates.

TABLE 14.10 Example of Scoring Protocol for an Authentic Assessment

Task: Writing and performing a skit about preventing teen suicide.

Assign points on a 1-to-5 scale for each of the following aspects of the performance.

1. Displays understanding of nature of problem.
2. Displays knowledge of national statistics.
3. Portrays troubled teens in realistic, convincing manner.
4. Story makes sense and rings true.
5. Performance reaches audience members and holds their attention.
6. Performance communicates valuable lessons.
7. Dialogue moves quickly and is well edited.
8. Student actors are convincing.
9. Student actors know their lines and are well rehearsed.
10. Performers look straight ahead and speak clearly and convincingly.
11. Costuming is appropriate.
12. Performance shows effective teamwork.

Students should be told not only what they have done well, but also what they could have done better, why, and how.

Like traditional assessments, authentic assessments can be biased, unreliable, and invalid. To avoid these problems, develop and enforce rigorous standards for judging the work relative to objective criteria of quality. By following this path, you ensure that all students have an equal chance to do well if they apply themselves.

Herman, Gearhart, and Baker (1993) examined issues of reliability and validity in portfolio scoring. They showed that it is possible to score portfolios consistently by giving a single score of overall quality, and by using a common rating scale to score different classroom assignments of a similar type. However, the degree to which these scores are meaningful and can be generalized is questionable. The Herman et al. (1993) study also found significant differences when students' performance was judged based on a standard writing assignment, individual student work, and portfolios. The scores doled out depended on the rating and summing procedure used.

All scoring schemes carry with them value judgments about what is an important and meaningful accomplishment, so teachers who use portfolios as means of authentic assessment must recognize that their own subjectivity in grading can be a significant hurdle to overcome. When experienced raters use well-designed scoring schemes, reliability improves (Herman & Winters, 1994). One way to reduce subjectivity in the scoring of authentic assessments is to develop ahead of time clear and unambiguous scoring guides that are uniformly applied to every student's performance (see Table 14.10 for an example).

Another source of low reliability in the grading of authentic assessments can be uneven student performance. Some performances or work samples are often better than others, particularly for those students whose work varies widely from day to day. Consider a broad range of work samples for portfolio inclusion to ensure that the student's best work is represented, and ensure that every judge (if there are multiple judges) scores the same work samples.

THINKING ANALYTICALLY

Which factors might bias the grade given to a student for an exhibition?

SUGGESTION: If the teacher likes the student and/or knows her well; if the student has rehearsed the performance for the teacher several times and has gotten the teacher's pledge of approval; if the teacher is in a particularly good or bad mood that day or is angry with the student, for example.

FORUM

WHICH TYPES OF ASSESSMENTS ARE BEST?

Are traditional assessments adequate to evaluate students? Or should schools switch to authentic and performance assessments?

FIRST VIEW: Traditional assessments are time-honored, reliable, and valid ways to evaluate student learning. Traditional assessments, which consist mostly of objective and essay classroom tests, are the best way to evaluate the knowledge that students have acquired. It may sometimes be boring or repetitive for students to memorize basic facts

and figures, but this basic knowledge provides the foundation for higher-order learning of concepts, principles, and relations among concepts. Regardless of how talented students are, they need this foundation, which is created by hard work and cannot be evaluated as well with authentic assessments as it can be evaluated with traditional assessments. Students must be helped, by their teachers and their parents, to understand that the foundation they create while young will be there to support their intellectual activities for their entire lives. Traditional testing increases student motivation and enhances learning, and it is part of a system that prepares students for the future.

Compared to traditional assessments, alternative methods of assessment are unreliable and do not provide a clear picture of student learning that is comparable from student to student. Thus evaluations based on authentic assessments are unfair and potentially flawed. Traditional assessments are more objective and represent the most defensible measures of student learning.

SECOND VIEW: Authentic and performance assessments are the only types of tests that meaningfully evaluate student learning and performance. Knowledge is fine, but the type of knowledge reflected in traditional assessments is often inert knowledge: Students memorize and then repeat answers under time pressure, but weeks later they have often forgotten the knowledge. Furthermore, when they prepare for traditional tests, students never learn how to apply the knowledge to solve real-world problems.

In comparison, authentic assessments map student learning and performance onto real-world performances and challenges that are relevant to students' lives outside of school. They challenge students to use their creative and practical talents as well as their analytical talents to expand their capabilities. In this way, these assessments encourage autonomy and self-directedness. Competent performance on authentic assessments means far more than simply getting 50 multiple-choice questions correct.

THIRD VIEW: A SYNTHESIS. Both traditional and authentic assessments are useful in evaluating students. It is true that authentic assessments are good learning and development experiences for students, but relying solely on these assessments may allow students to pass through school without acquiring the basic facts and figures that form the foundation for later thinking and accomplishments. Furthermore, authentic assessments suffer from a lack of reliability and validity in scoring; it is often difficult or even impossible to identify what a correct answer consists of. Because of this inability to distinguish performances that do or do not show whether a student has learned important information, authentic assessments may result in students progressing through school without learning essential information. Traditional assessments, however, may short-change the types of learning and integration students must do in life after graduation from school.

Clearly, both types of assessments are important and useful. Used in tandem, traditional assessments encourage students to study and learn the basic information they need, and performance-based assessments allow students to apply their knowledge and expand on this knowledge base to solve real-world problems. Both types of assessments, and the experiences they create, are essential. The goal for teachers is to incorporate both types of assessments into the curriculum, so students display a wide range of performances.

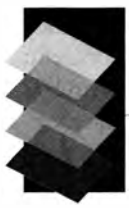
Now that we have discussed at length the use of traditional and authentic assessments for evaluating student learning, we consider how the grades based on students' performance on these assessments should be determined and reported.

*i*MPLICATIONS FOR TEACHING

- **Use authentic assessments to test students on skills and knowledge required to solve real-world problems and complete real-world tasks.** Like traditional assessments, authentic assessments can be either well or poorly constructed; they may also reflect

either a great deal or very little about student competence. At their best, authentic assessments represent an essential method for evaluating real-world performance.

- **Recognize the diversity of authentic assessment options and take advantage of different testing formats.** Authentic assessments take many forms, from paper-and-pencil tasks to identification tasks to actual performances. Different types of competence can best be evaluated through different types of performances. Students will gravitate toward those formats that best match their patterns of abilities, preferences, and experiences.
- **Score authentic assessments, including portfolios and exhibitions, as objectively and rigorously as possible.** This care will help ensure that they are truly fair evaluations of student learning. A frequent criticism is that because authentic assessments are difficult to score, they are good in theory but fall short in practice. Expert teachers recognize and take steps to address this inherent pitfall when using authentic assessment techniques.



Grading and Reporting

Once you have planned your instruction, conducted your classes and activities, and designed and administered fair assessments, you must now master the complex issues of grading and reporting to communicate student achievement to students, their parents, and the society at large (Gullickson, 2003). As a student yourself, you understand how important grades are to students and their parents. As students develop, grades become essential criteria for selection to specialized programs and schools. Because students agonize over their grades, it is imperative that as a teacher you implement accurate and fair grading policies. Grading is not a task to approach haphazardly: Expert teachers develop grading systems well in advance to ensure that their grading and reporting practices are sound. As Jing Xu learned, students are heavily invested in getting good grades, and they often complain if they perceive unfairness or any lack of carefulness in how grading was conducted.

THE IMPORTANCE OF GRADES TO STUDENTS

Before you choose a grading system to use in your classrooms, consider the effect of a grading system on student learning and motivation. Remember that the importance you assign to different types of work—tests, quizzes, homework, reports—during grading will directly influence how much importance students assign to these activities when completing them. If you emphasize homework's importance by allowing student grades on homework to count for 20 percent of their final grade, students will believe their homework assignments are important. Conversely, if you verbally emphasize homework by stating how important it is and then fail to count it in computing your final grades, students will quickly realize homework is less important than you say it is. In addition, if you act as though a grade is a final judgment of a student's ability, rather than simply a reflection of a student's performance at a particular point in time, you will encourage students to view bad grades as an irreparable disaster rather than as evidence of the need for more focused hard work and improvement. Some (but not all) teachers allow students to redo homework or retake tests that led to low grades to emphasize that these poor performances are signs the students must work harder next time.

In general, your grading system should emphasize in varying proportions the types of work and performances you believe are most important to maximize student learning. The right proportions naturally vary for different teachers, classes, and levels of students. In grading, expert teachers remember that words should equal actions. In other words, if teachers stress conceptual understanding in class, they must also stress it on tests, and give weight to this kind of understanding in computing final grades. The entire system, beginning with what is taught and how different skills are stressed, should lead to an assessment program that evaluates students' performance on the skills that have been stressed. Ultimately, grades should be computed in a manner that also emphasizes the same skills

THINKING PRACTICALLY

Based on your experience, describe three ways you could make the grading process less stressful for students.

SUGGESTION: Discuss your grading procedures clearly and fully in advance, answer questions about the grading process thoroughly, and be open to student suggestions for changes to the process.

stressed in instruction. A smooth and consistently applied teaching, assessment, and grading system is essential to maintaining student enthusiasm and effort.

GENERAL GRADING GUIDELINES

Expert teachers follow basic guidelines to ensure that the grades they assign are fair. As a teacher, you should base students' grades on multiple sources of information—on performance on different types of test questions, on performance on both oral reports and written ones, and on performance on both homework and tests. Stressing one source of information at the expense of others biases the grading process in favor of those students who are most competent in that one particular mode of performance. Always check with other teachers and the principal and school administrators to ensure your grading systems comply with school policies.

■ **WHEN AND HOW TO GRADE** Grade only when you have determined that a grade is really necessary. Perhaps assignments that would normally be graded can sometimes be left ungraded, or perhaps they can be graded by the students themselves. The form in which feedback on grading is reported to students is also important. A simple B+ is not sufficient; students require and deserve more elaborate feedback detailing where and why they made errors and how they can improve in the future. This feedback may take either written or verbal form. Research has shown little difference between verbal and written reports in their effects upon students (Wagner & Valtin, 2003).

More generally, help each student feel that he or she is capable of working toward learning goals, by stressing effort and improvement and by being encouraging. Effective teachers also remember that students may not always share the teacher's own views, opinions, or methods. When there is more than one correct answer to a question, these teachers reward students who disagree as long as the students defend their positions. There will always be some students who are more compliant, but it is important to evaluate skilled performance and not mere compliance.

THINKING ANALYTICALLY

Describe three problems that might result if you fail to explain the grading system to students.

SUGGESTION: Misunderstandings can lead to student complaints to other teachers or even to the principal, involvement of students' parents, and students' earning lower grades than they might have if they had understood the system.

■ **EXPLAINING THE GRADING SYSTEM** Regardless of the specific grading system you use, explain the system clearly to the students, perhaps by distributing a written guide to the grading system. If your explanation takes an oral form, rehearse it often with the students. New teachers should review their systems with experienced teachers to assess the appropriateness of the system. Evaluate your students at the start of a class to gain an idea of their prior level of training and level of understanding. Base all evaluations of students on evidence that can be documented to another teacher, administrator, or parent, if necessary.

■ **DOCUMENTING GRADING** No matter which grading system they use, expert teachers rarely allow themselves to be either cajoled or browbeaten into raising a student's grade, whether by the student or by a parent. (The exception to this rule is if you discover an error in scoring or grading, you missed an answer on the back of a page, or you were otherwise in error.) These teachers keep their students informed of their performance relative to the other students in the class; otherwise, students may be surprised to learn they are doing poorly in comparison to classmates. Such a situation can create problems for you, not only with the student, but also with the administration and parents.

THINKING PRACTICALLY

What might be the consequences if you do not document the reasons for failing a student?

SUGGESTION: Students and their parents might take legal action and you would then be called on to document and substantiate your decisions. All records could potentially be made public.

Finally, as with any grading system, remember that you may be called on to document individual students' performance. Information on grades and the basis for these grades must be made available to students and parents who request this information, under the terms of the Family Educational Rights and Privacy Act of 1974 and the Educational Amendments Act of 1974 (also called the Buckley amendment). You must be prepared to defend all grading decisions with objective evidence.

RELATIVE IMPROVEMENT VERSUS ABSOLUTE PERFORMANCE

All teachers must determine how to reward improvement in their classes. Suppose you begin the year with two students: Tim, who performed poorly at the beginning of the term but rose

to doing above-average work by the end of the term, and José, who began by doing above-average work and ended by doing the same level of above-average work as Tim. The two students' performances on the final examination were equivalent; they ended the year at the same level of competence. However, their averages over the course of the entire term are not equivalent, because Tim started out with lower grades. Tim showed significant improvement over the term, and José basically held steady at a B level of performance. Do the two boys deserve the same grade?

If you have rewarded Tim with a higher final grade, you have been unfair to José, who scored just as high as Tim on the final. However, Tim seems to have worked harder to earn his ultimate level of competence. (Alternatively, Tim may have started out working less hard and ended up working equally hard.) Expert teachers often seek to reward effort so as to encourage further effort—although this practice is certainly not universal among effective teachers. If you give José a higher grade, you may insult Tim, who has worked hard to bring his performance up to the above-average level, despite beginning with a lower level of competence in the class. What should you do in this situation?

Although individual teachers will have different opinions regarding how to handle this case, one effective way is to assign two grades to each boy. The first grade represents the uncorrected absolute performance grade for the class; therefore, Tim's is a B– and José's is a B. The second grade reflects effort and improvement. For this grade, expressed as a number, Tim receives a 1 (meaning excellent), and José receives a 2 (meaning average) or even a 3 (meaning poor), depending on exactly how much effort the teacher perceives he made.

If the school does not offer this type of grading policy, you might assign grades on the basis of absolute performance but couple them with extensive written feedback that details your perceptions about effort expended in achieving the given performance. Some report cards have space for such comments. If not, you can design a comment sheet that you send home with each report card (or at other intervals). You can photocopy these sheets and then write in comments about each student's expenditure of effort and attitude in class. The idea is to provide information that goes beyond that reflected in the basic grade. This information will be useful to students, to parents, and to you when it is reviewed at a later time.

In practice, teachers often incorporate an estimate of a student's effort into their calculation of the student's final grade. However, this system can be biased against students whom the teacher does not know well, or who are quieter and about whom the teacher has little information. A more formal system of separately rewarding absolute levels of performance, on the one hand, and relative improvement, on the other hand, is usually fairer than an often subjective judgment.

CRITERION-REFERENCED AND NORM-REFERENCED GRADING SYSTEMS

Earlier in this chapter, we discussed criterion- and norm-referenced grading. Criterion-referenced grading evaluates the student's performance against a set of success or mastery criteria. Norm-referenced grading compares each student's performance to that of the other students in the class.

A goal of the expert teacher: Totally immersed in the educational process, students in a classroom enthusiastically offer answers to a difficult question.

Larry Hamill/Merrill

■ **CRITERION-REFERENCED SYSTEMS** Many teachers—and particularly teachers in the lower grades—use a criterion-based grading system. In such a system, the teacher describes to the students which levels of competence are associated with individual grades on each test, project, and assignment, and in the course in general. For example, the teacher might state that 80 percent correct answers on a test or homework assignment will earn a B and then compute final grades based on the students' total progress toward meeting learning goals.

In this type of system, every student theoretically can earn an A if he or she works very hard, although it

EXPERT TEACHER INTERVIEW

FOCUS ON: AUTHENTIC ASSESSMENT, PORTFOLIOS, AND INVOLVING STUDENTS IN ASSESSMENT

CAROL STRICKLAND: EMPORIA HIGH SCHOOL, EMPORIA, KANSAS—GRADES 9–12, COMMUNICATION, ENGLISH, FORENSICS

Carol Strickland is a veteran teacher with more than 30 years of experience in the classroom. For the past five years, she has taught a communication class for students with limited English proficiency. She emphasizes preparing students to improve communication skills as they enter the work world. Strickland uses a variety of assessment methods to ensure that each student's strengths emerge.

What are some methods you use to assess your students' progress?

I use a variety of assessment methods. I give students tests, and they write reports. Students are graded on their participation in class discussion. I also try to make my classes as "real world" as possible through the projects I assign and the way I grade them on their projects.

Can you describe some of these real-world projects?

In the Applied Communication class I teach, students are assigned to work on teams as though they were business teams planning to introduce a new product or service. They must describe the product or service: What is it? How will it be made? How much will it cost? How will they market it? Students are graded on the quality of their proposal and on their participation in the process.

In other classes, students conduct mock job interviews. They are graded on their performance as well as on their level of preparation and participation. The class participates in the grading, deducting points for poor posture or eye contact. We try to make the grading reflect the things that real employers are judging when they interview candidates.

I've had some wonderful success stories. One Hispanic student, for example, learned interview skills that got him his first job, as a dishwasher in a local restaurant. Like some other Hispanic students, he had some trouble with eye contact. He always looked down out of deference and respect—a reflection of his culture. Many Hispanic kids also don't shake hands and are not accustomed to a strong handshake. I worked with him after school on some of these skills. The employer was impressed with his assertiveness. The successful experience motivated this student to continue to do well. He has been promoted three times at that restaurant and plans to attend technical college in gourmet cooking or restaurant management.

> Assessment shouldn't be a barrier. It should be a way to help students learn.

Do your students create portfolios of their work?

Students in the school-to-work program create a portfolio or notebook. Throughout the term, we work through several drafts to create résumés. Students also have to fill out four or five different types of job application forms. They collect their résumés and applications in a notebook. They are graded on how well they followed the directions on the form, as well as grammar and content of their answers.

THINKING PRACTICALLY

How can you ensure that your criterion-based grading system is fair?

SUGGESTION: You can look at other teachers' systems and ask them for feedback on your own; ask students for input; consider alternative criteria and defend your choices.

is rare in practice that every student achieves this goal. For a course as a whole, an A might correspond to overall excellent performance and the completion of every assignment and report; a B might correspond to very good performance and the completion of all except one assignment or report; and so on. It is up to the individual teacher to determine the precise levels of performance that will translate into specific grades. When making these determinations, teachers must also take into account schoolwide standards (which they should confirm with the principal), and must use defensible systems that make sense if questioned by a parent, other teacher, or administrator. One way to handle grading with a criterion-referenced system is to give students specific grades on many individual objectives, rather than one overall grade, to show the extent to which a student has mastered each objective. With this approach, an overall grade in a given subject might not even be computed.

■ **CONTRACT SYSTEMS** One application of a criterion-referenced grading system is called a **contract system,** in which the teacher creates a contract with the class and establishes specific standards that correspond to specific final grades. The key to a successful contract system is specific guidelines about the quality and quantity of individual pieces of work. The students may be involved in deciding exactly what the contract will consist of.

For my media class, the students keep a weekly notebook on what's happening in the media; they label and annotate the notebook. These annotations get them points every week, and the points go toward their grade for the class.

How do you individualize assessments to encourage success for students at different levels?

I have students with behavioral or learning disabilities included in my classes side by side with regular and gifted students. I also have to realize the limits on students' time. They remind me often that they have other classes besides mine! Many of my students are also working or may even have children of their own.

That's why I include a variety of assessment opportunities throughout the term, different ways for students to show they are learning. In addition to tests, projects, and reports, students receive points for taking part in discussions. If a student puts her head down and tunes out, she doesn't get points for the discussion. All the students are able to participate by watching videos and reading daily newspapers and magazines, which we discuss at the beginning of class. In a discussion, if a student has read the material and is willing to take a risk and share ideas, he or she gets points. Even if they say the "wrong" thing, at least they are contributing and giving ideas to others. Students are motivated to participate because they are rewarded for taking risks.

When I give assignments, we do as much of the work in class as possible, so that all students have time to complete the work and show what they can do. I often give assignments that include multiple levels; students can earn extra points for doing more work or more challenging work.

How do you get students involved in assessments?

Kids should feel some ownership in the assessment. I often ask students to tell me what they think should be on a test. As they start to answer this question they may not realize that they are reviewing what they've learned in class.

Students are involved in grading each other during some projects, such as mock job interviews. Sometimes, groups grade themselves on their performance in small-group discussions. I provide a checklist and ask each member to check off the contributions of everyone in the group.

What advice would you offer new teachers?

My general advice to new teachers is to be honest and be yourself. Kids will figure out quickly if you're phony or have a fake attitude. It helps if you really like teaching and you let it show! Many new teachers also need to be more firm with students. Often, they try to make friends with their students, and do not enforce rules consistently. Teachers need to get the respect of their students by being fair and consistent.

My specific advice about assessments focuses on fairness, too. Students should be able to see the fairness of a test, project, or grade, and understand the reason for it. Don't use a test as a threat or punishment for the students. Assessment shouldn't be a barrier—it should be a way to help students learn.

Once explained completely to the students, the terms of the contract are explicit, and students know exactly what they must accomplish to receive a particular grade. Thus the requirements for earning a given grade are demystified, and students tend to have less anxiety about grades and evaluations. Table 14.11 shows a contract between a ninth-grade Spanish teacher and her students.

A good contract system should not be so lenient as to make it easy for students to receive the higher grades. Students receiving the highest grades should have completed a substantial amount of high-quality work that demonstrates clear understanding and mastery of the material. Part of the attraction of a contract system is that students feel more in control of their grades and their destiny in a class. Students know that more hard work will pay off; when queried, students working in classes using the contract system report a higher level of ownership of the tasks they must complete. Explicit criteria are essential to make the system work, as is the case with any criterion-referenced grading system.

One difficulty with a contract system is its potential to result in disappointment for those students who complete all of the work with enthusiasm, but who lack the ability to do high-quality work and, therefore, may receive a lower than expected final grade. Another difficulty is that a teacher may become overwhelmed with a high volume of written work to grade, but this is often considered a measure of success by all but the most overworked teachers.

THINKING CREATIVELY

Design a contract system for your educational psychology class.

SUGGESTION: Ideas include a sampling of student requirements from the following list. Choose four different requirements that will then constitute the contract: four 10-page papers throughout the term, one portfolio of written work, five 10-minute quizzes, three 1-hour exams, one performance (teaching a class), three lesson plans, and so on.

TABLE 14.11 Contract Offered to Students by a Ninth-Grade Spanish Teacher

To earn the stated grade, you must do all of the work described.

Grade of A: Regular attendance (doctor's note for absences); participate at least once per class; hand in all homework assignments except two on time, with a grade of check-plus on all except two; take all tests and receive grade of A– or better; complete four short papers on time; prepare, recite, and interpret one Spanish poem for class.

Grade of B: Regular attendance (doctor's note for absences); participate in class at least three days per week; hand in three-fourths of all homework assignments on time, with a grade of check-plus on half of them; take all tests and receive grade of B– or better; compete three short papers on time.

Grade of C: Attend three-fourths of classes; participate once per week; hand in at least half of all homework assignments, with grade of check; take all tests except one and receive grade of C– or better; complete two short papers on time.

Grade of D or F: Attend class when you feel like it; never or rarely participate; hand in less than half of homework assignments; take half or fewer tests with grades of C– on them; complete one or no short papers.

■ **NORM-REFERENCED SYSTEMS** Norm-referenced grading is more common in high school and college-level courses. With this system, called **grading on the curve,** you grade students in comparison to other students, so that how others do affects a given student's grade. To use this grading approach, you would grade the tests and then determine the average grade (say, a 75 out of 100). Next, you would sort the papers from highest to lowest, and assign a grade to people scoring within a certain range of this middle grade. For example, the middle one-third of the class would receive a C. Students with scores above this middle range would receive a B if they scored in the group just above the middle third, and an A if they scored in the highest group. Similarly, students scoring below the middle group would receive a D or an F.

USING THE NORMAL CURVE. The statistical principle behind the concept of norm-referenced grading is called the *normal curve.* As we discussed in Chapter 13 on standardized assessments, in a normal curve two-thirds (68 percent) of the distribution of scores fall within one standard deviation of the mean. In an exact application of the normal curve to grading, the middle two-thirds of the scores receive grades of C. This can be interpreted as a harsh standard, especially in a class in which many students are working hard and performing well. Thus a more typical use of grading on the curve is to establish a somewhat higher average grade than a C. In the past (the years from 1920 to 1960, for example), average grades of C were common, and a C was not viewed as representing a bad grade. However, grade inflation has pushed up the average grades awarded to students, so that today a C strikes most students as a poor grade indeed.

PROBLEMS WITH GRADING ON THE CURVE. One problem with grading on the curve is that often only one point (corresponding to one correct answer) on an entire test may separate students receiving a B– and a C+. Thus teachers often search for better break points between two grades than the arbitrary point determined by the "one-third get the average score" rule. For example, a teacher might give a B to a couple of additional students who score just at the break point between a C and a B, because their scores were four points higher than the next-lowest-scoring student.

Another problem with grading on the curve (discussed in Chapter 13) is that sometimes a teacher has a small class or a class whose students are generally excellent or generally poor. In these situations, it is not meaningful to assign grades based on class distribution. For example, a class of all excellent students, if graded on a curve, can result in a student who would have scored a B in a large class of diverse students and might now score a C. In such circumstances, expert teachers do not grade on a curve, or else they use the scores and corresponding performances of students in other classes on the same or closely related tests and assignments to determine a fair way to assign letter grades to the distribution in their class.

TOTAL-POINT GRADING SYSTEMS

One way for teachers to determine final grades is to base them on the total number of points a student has earned in a class. Such a **total-point system** resembles the contract system

described earlier. To establish this system, the teacher decides how many points each test, paper, report, assignment, and so on, is worth. Theoretically, a student earning a perfect score on every assessment then earns every possible point. Some teachers even award some points for attitude, attendance, effort, and other criteria relevant to performance. When using this system, you should ensure that any two tests or assignments worth the same number of points cover the same amount of material and are approximately equal in difficulty.

Two straightforward approaches are used to compute final grades by means of a point system. First, add up the total number of points earned by each student, and then rank the students. Assign letter grades based on the percentage of students receiving each letter grade that is customary for your classes and for the school as a whole. Alternatively, convert each score on each test and assignment to a percentage, and then appropriately weight and average the percentages, rank the students, and assign letter grades. (The weighting of percentages is discussed in the following section.)

THINKING PRACTICALLY

Have you ever been graded on a total-point system? Do you consider the system fair and effective at promoting learning? Why or why not?

SUGGESTION: Many students like such systems because they are clear and straightforward, and because they encourage students to think in terms of "accumulating points."

PERCENTAGE GRADING SYSTEMS

A **percentage grading system** consists of assigning grades on the basis of the percentage of the material a student has learned. The teacher scores each test or assignment on a zero-to-100 percent scale, representing the percentage of the knowledge a student has demonstrated. Thus a student might earn an 85 percent on one test on which she did well, and a 70 percent on a report on which she did less well. Typically, teachers using this system average all the grades they assigned to compute a final average, which they then translate into a letter grade.

Most of us have probably been graded on a percentage system. It is a simple system for teachers to use. Unfortunately, it also has problems and can be unfair to students, for several reasons. First, some teachers fail to assign appropriate weight to different tests and assignments when they compute a student's overall percentage score. (This same problem plagues other types of grading systems as well: It is a mistake not to assign different weights to different types of tests and assignments when computing grades.) Thus bigger tests carry the same weight as smaller reports or assignments, and good performance on a major test can be offset by poor performance on one minor assignment. Clearly, this scheme is not fair to students who did well on the big test.

Another potential problem with a percentage system is that it is not possible to know how much total knowledge a student has mastered in a specific area. The percentages look so scientific that some teachers may be fooled into thinking the numbers possess a degree of accuracy they actually do not. Percentages are just estimates of student learning. When used appropriately, they can be interpreted as indicators of knowledge and can be weighted properly in computing the final grades—but they are not the final word on a student's learning.

THINKING ANALYTICALLY

Name three ways you can ensure the fairness of a percentage grading system.

SUGGESTION: Make tests all the same general length with the same number, mixture, and level of difficulty of items.

Another problem with percentages concerns the difficulty of the tests on which the percentage grades are based. A test on a given sample of material may be easy or hard, yielding different distributions of scores. Easy tests may yield all grades of 80 percent and higher, with most students scoring near the top; hard tests may result in a range of 40 percent correct to 100 percent correct, with students' scores spread out between the extremes.

To use a percentage grading system fairly, you should average percentages only for assignments or tests that are similar in difficulty and are weighted similarly in computing final grades. (Make decisions on relative weighting of tests and assignments on the basis of the comparative importance, length, and difficulty of the different types of tests and assignments.) Averaging percentages is a popular grading system because it is simple to use and because teachers, parents, and students are familiar with it and believe it makes intuitive sense. In many cases, however, the total point system is often a fairer and more objective way to evaluate and grade students.

Expert teachers are aware of many different types of grading systems, and they often customize their system to fit the characteristics of their students and their classes in a given school year. Figure 14.2 provides an example of one creative expert teacher's grading system, which is designed to avoid the pitfalls of both criterion-referenced and norm-referenced systems and take advantage of the benefits of both. This system was well received by students, teachers, and administrators alike.

FIGURE 14.2 Example of an Expert Teacher's Creative Grading Scheme

Grading Policy. No grading system that aims to translate the complex processes involved in learning into a single number or letter grade is perfect. Therefore, I use a unique and interesting policy for determining students' grades. I make two assumptions:

1. I assume that some tests are harder than others so individuals with the same level of preparation will do worse on one than they might on another even if both are tests of the same material. Thus, if a test is so difficult that the highest scoring student does not achieve a perfect score (as is nearly always the case), then the highest student's score becomes 100 percent. (In this case we are talking about classes containing numerous gifted students, and so we can be certain that at least some of the students have worked very hard and have the ability to achieve highly.) For example, if the highest student answered only 50 percent of the questions correctly, then 50 percent correct becomes an A+. (Thus, functionally speaking, the highest number of questions answered correctly becomes the total number of questions on the test, for the sake of computing grades.) The scoring system is therefore sensitive to test difficulty and the student is not penalized by an unreasonably difficult test because it is scaled down to the level of the top student's performance.

2. I assume that the lowest passing grade on a test must demonstrate at least half of the knowledge demonstrated by the highest scoring student, after correction for chance guessing. Admittedly, this is an arbitrary cutoff and I might have just as easily decided on a different figure (say, 30 percent or 70 percent). But there is an intuitive appeal to insisting that one demonstrate at least half as much knowledge as the best student in order to pass a test.

An example will help explain my system. Suppose the top student on a particular multiple-choice test answered 30 out of 40 questions correctly. Someone without any knowledge could have answered 10 questions correctly simply by guessing (i.e., if there were four choices for each of the 40 questions). Thus the lowest passing score that reflects at least half of the knowledge of the student who answered 30 correctly (after correction for guessing) is: $1/2\ (30 - 10) + 10 = 20$. Someone answering fewer than 20 questions correctly has failed to demonstrate at least half of the knowledge demonstrated by the highest scoring student, after correcting for chance. If you extend this line of reasoning, you will understand how final grades are determined: If you add up all of the questions that were correctly answered on all of the exams by the highest scoring student(s), and correct this score for guessing, then one-half of that figure becomes the lowest passing score for the course.

iMPLICATIONS FOR TEACHING

- **Take grades as seriously as your students do.** Grades carry enormous significance for students, who prepare for, think about, and worry about them. Some critics believe that grades have taken on too much importance in our society. Nevertheless, you are generally expected to report on your students' achievement through grades, so you must learn to use grades appropriately and fairly.
- **Employ defensible, objective criteria when assigning grades.** Taking care with the criteria you use will help ensure fairness for all students. With the responsibility of assigning grades comes power over students' lives, and expert teachers are careful to use this power wisely and constructively.
- **Assign grades separately to both effort/improvement and absolute performance.** Some teachers believe only absolute performance should matter in grading; others believe that effort is most important. Given these different perspectives, beginning teachers should ensure that their approach is appropriate for the school in which they teach by consulting with other teachers and school administrators.
- **Review the various grading systems and speak to your principal and colleagues before choosing one.** Do not make such decisions alone and without the input of colleagues and school officials, who can inform a beginning teacher about school policy.

SUMMING IT UP

WHY UNDERSTANDING CLASSROOM ASSESSMENTS IS IMPORTANT TO TEACHERS

- Classroom assessments provide feedback to teachers and students, increase student motivation and learning, and result in students benefiting more from their time spent in school.
- Formal assessments consist of information collected in a uniform manner on all students. Such assessments include tests, quizzes, book reports, and assigned presentations. Informal assessments include observations teachers make of students while they are participating in the classroom, doing work, and talking to the teacher or to other students. Both types of assessments are part of a teacher's assessment system. These observations and measurements are collected by teachers and used in making evaluations of students.
- Formative assessment discovers strengths and weaknesses in prior learning; summative assessment is a final test of student learning in a particular area. Criterion-referenced grades represent a specific set of accomplishments; norm-referenced grades represent how well a student has done compared to other students.

TRADITIONAL ASSESSMENTS

- Traditional assessments are tests containing multiple-choice, fill-in, true/false, sentence-completion, matching, and essay questions. Teachers need to know how to design and write each type of test item to make tests reliable, valid, and fair.
- In administering tests, the extent of coverage and the why and how of testing are key issues. Tests should cover the same material taught in class, with more items being devoted to what was stressed more heavily in class. A behavior–content matrix lists the topics the teacher covered and the types of thinking the students should be able to engage in for each topic. Frequent, shorter tests result in more and better learning and greater retention of material than do infrequent, longer tests.
- Both objective tests and subjective tests are useful assessment tools. Multiple-choice items are usually preferable to the other types of objective test items. Essay questions are more subjective than the other types of questions used on traditional tests. However, essay questions work best for measuring higher-order thinking, and if care is used in grading, they can be fair reflections of learning.

AUTHENTIC ASSESSMENTS

- Authentic assessments are closer to real-world performances than are traditional assessments. They ask students to use skills and knowledge to solve problems in the same manner as if the students were completing real-world tasks.
- Several types of authentic assessment are possible. A portfolio is a collection of student work that demonstrates the student's abilities, efforts, accomplishments, and growth in an area or areas. An exhibition is a public performance before an audience that may involve people who will judge the performance. Evaluations of portfolios and exhibitions are based on whether established standards have been met.

GRADING AND REPORTING

- Grading should be conducted with great care because of the importance most students place on grades and the effect grades can have on student motivation. Both relative improvement and absolute performance are important considerations in computing grades.
- Contract systems are criterion-referenced grading systems in which students agree to complete a specified amount and type of work to earn a specific grade. Grading on the curve is a norm-referenced grading system in which students are graded in comparison with other students.
- Total-point grading systems allow students to earn points on each test, quiz, or assignment toward their final grade. A percentage grading system assigns grades on the basis of the percentage of total material a student has learned, but unfortunately may be used unfairly.

KEY TERMS AND DEFINITIONS

- **Assessment system** All of the ways teachers gather information on their students. Page 509
- **Authentic assessments** Assessments that ask students to use skills and knowledge to solve problems in the same manner as if the students were completing real-world tasks. Page 528
- **Classroom assessment** Every type of information a teacher takes in about students in the classroom—including test results, grades on homework and class presentations, and the informal conversations teachers have with their students over the course of the year. Page 509
- **Contract system** Criterion-referenced grading system in which the teacher creates with the class a contract that specifies standards that correspond to specific final grades. Page 538
- **Criterion-referenced grading system** System in which a grade represents a specific set of accomplishments, which can be identified for one student independently of the performances of other students (for example, getting 80 percent of the questions right). Page 511
- **Distractors** Incorrect options following the stem in a multiple-choice question. Page 517

- **Evaluation** Uses to which measurements are put by teachers. Page 510
- **Exhibition** Public performance before an audience that may involve people who will judge the performance. Page 532
- **Formal assessments** Objective and rigorous methods for obtaining information about student learning, such as tests, quizzes, book reports, and assigned in-class presentations. Page 509
- **Formative assessment** Assessment with the purpose of discovering the strengths and weaknesses in prior learning that reveal a student's developmental stage in the area being tested. Page 510
- **Grading on the curve** Norm-referenced grading system in which students are graded in comparison with other students; thus how well others do affects a given student's grade. Page 540
- **Informal assessments** Observations teachers make of students while they are participating in the classroom, doing work, and talking to the teacher or to other students. Sometimes information in written form that teachers obtain from some students. Page 509
- **Measurements** Data on student performance and learning that are collected by teachers. Page 510
- **Norm-referenced grading system** System that represents how well a student has done compared with other students. Page 511
- **Objective tests** Tests in which there is a single, known, correct answer. Page 517
- **Percentage grading system** System in which grades are assigned on the basis of the percentage of the material a student has learned. Page 541
- **Portfolio** Type of authentic assessment consisting of a collection of student work that demonstrates the student's abilities, efforts, accomplishments, and growth in an area or areas. Page 531
- **Stem** Question or incomplete statement that begins a multiple-choice item. Page 517
- **Subjective tests** Tests in which there is no one correct answer and in which different teachers are likely to award different grades for the same response. Page 517
- **Summative assessment** Typical final exam type of assessment; a final test of student learning in a particular area. Page 510
- **Total-point system** Grading system in which final grades are based on the total number of points a student has earned in a class. Page 540

QUESTIONS AND PROBLEMS

Apply the concepts you have learned in this chapter to the following problems of classroom practice.

IN ELEMENTARY SCHOOL

1. Your first-grade students have never taken a test before. You would like to explain what tests are all about, and you would like to teach these children good test-taking attitudes. Which steps can you take to accomplish this goal?
2. Your third-grade students become extremely anxious about taking tests. At present, you give one test every four weeks during the school year. What might you do to reduce student anxiety?
3. A parent of a fifth-grade student has complained to the principal about your unfair testing practices. What should you do to protect your reputation and defend your practices?
4. How can you decide what to include on a science test for your fourth-grade class?
5. At what point (in what grade) can you start asking essay questions of your elementary school–aged students? At what point can you ask a fill-in question? A multiple-choice question?

IN MIDDLE SCHOOL

1. Your seventh-grade class says that your tests are much harder than those given by the other seventh-grade science teacher. Upon doing some detective work, you learn your colleague has, in fact, been giving much easier tests and awarding much higher grades. What should you do?
2. Your eighth-grade students are obsessed with their test scores—so much so that they tease the low scorers in the class and talk incessantly about their scores. How can you help these students place tests into a healthier perspective?
3. How can you design an authentic assessment for your ninth-grade language arts class? What might the assessment consist of?
4. Some of your seventh-grade students have such severe writer's block that they are virtually unable to complete an essay question. Which steps might you take to help them?
5. Which steps might you take to ensure that authentic assessments are graded fairly and consistently?

IN HIGH SCHOOL

1. Two of your twelfth-grade biology students claim the last test was scored incorrectly. Upon looking at the test, you see that each of them lost credit for the same answers to a problem that other students were given credit for. What should you do?
2 A tenth-grade math student seems to have lost all motivation. When you speak to him and ask if he is studying hard for the final exam, he says there is no point because he is already doomed to fail, given the way points are totaled to compute the final grade. What should you do to help this student?

3. Your ninth-grade social studies students seem disinterested in their schoolwork. The subject matter just does not come alive for them. How can you use assessment to motivate the students?
4. Describe an effective grading system for a class of disadvantaged—some socially, and some physically—eleventh-grade students.
5. Your high school students never seem to think your tests are fair, regardless of how hard you work on them. Which specific steps can you take to change their perception?

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