CHAPTER MAP

COGNITIVE DEVELOPMENT

THE DEVELOPING THOUGHTS OF ADOLESCENTS

The thoughts of youth are long, long thoughts.
—Henry Wadsworth Longfellow
American Poet, 19th Century

When you were a young adolescent, what was your thinking like? Were your thinking skills as good as they are now? Could you solve difficult, abstract problems and reason logically about complex topics? Or did such skills improve in your high school years? Can you come up with any ways your thinking now is better than it was in high school?

Many young adolescents begin to think in more idealistic ways. How idealistic was your thinking when you were in middle school and high school? Did you think more about what is ideal versus what is real as an adolescent or as a child? Has your thinking gotten less idealistic now that you are in college, or do you still think a lot about an ideal world and how you might achieve it?

When we think about thinking, we usually consider it in terms of school subjects like math and English, or solving intellectual problems. But people's thoughts about social circumstances are also important. Psychologists are increasingly studying how adolescents think about social matters.

One of my most vivid memories of the adolescence of my oldest daughter, Tracy, is from when she was 12 years of age. I had accompanied her and her younger sister, Jennifer (10 at the time), to a tennis tournament. As we walked into a restaurant to have lunch, Tracy bolted for the restroom. Jennifer and I looked at each other, wondering what was wrong. Five minutes later Tracy emerged looking calmer. I asked her what had happened. Her response: "This one hair was out of place and every person in here was looking at me!"

Consider two other adolescents—Margaret and Adam. During a conversation with her girlfriend, 16-year-old Margaret says, "Did you hear about Catherine? She's pregnant. Do you think I would ever let that happen to me? Never." Thirteen-year-old Adam describes himself: "No one understands me, especially my parents. They have no idea of what I am feeling. They have never experienced the pain I'm going through." These experiences of Tracy, Margaret, and Adam represent the emergence of egocentric thought in adolescence. Later in the chapter we will explore adolescent egocentrism in greater detail.

CHAPTER LEARNING GOALS

WHEN PEOPLE THINK ABOUT CHANGES in adolescents, they often focus on the biological changes of puberty and socioemotional changes, such as independence, identity, relations with parents and peers, and so on. However, as you will see in this chapter, adolescents also undergo some impressive cognitive changes. When you have completed this chapter, you should be able to reach these learning goals:

1   Discuss Piaget's theory

2   Understand Vygotsky's theory

3   Evaluate the information-processing view

4   Explain the psychometric/intelligence view

5   Describe changes in social cognition

THE COGNITIVE
DEVELOPMENTAL VIEW

Piaget's
Theory

Vygotsky's
Theory
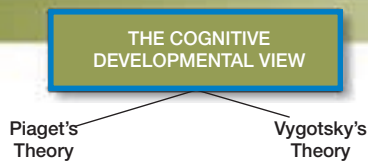
THE COGNITIVE DEVELOPMENTAL VIEW

In chapter 2, "The Science of Adolescent Development," we briefly examined Piaget's theory ◀ᴵᴵᴵᴵ P. 46. Here we will explore his theory in more detail and describe another cognitive developmental theory that is receiving increased attention, that of Lev Vygotsky.

Piaget's Theory

Piaget had a number of things to say about adolescents' thinking being different from children's. We begin our coverage of Piaget's theory by describing its basic nature and the cognitive processes involved. Then we turn to his cognitive stages, giving special attention to concrete operational and formal operational thought.

Piaget's Theory
http://www.mhhe.com/santrocka9

The Nature of Piaget's Theory and Cognitive Processes   Piaget's theory is the most well known, most widely discussed theory of adolescent cognitive development. Piaget stressed that adolescents are motivated to understand their world because doing so is biologically adaptive. In Piaget's view, adolescents actively construct their own cognitive worlds; information is not just poured into their minds from the environment. To make sense out of their world, adolescents organize their experiences. They separate important ideas from less important ones. They connect one idea to another. They not only organize their observations and experiences, they also adapt their thinking to include new ideas because additional information furthers understanding.

In actively constructing their world, adolescents use schemas. A **schema** *is a concept or framework that exists in an individual's mind to organize and interpret information.* Piaget's interest in schemas focused on how children and adolescents organize and make sense out of their current experiences.

Piaget (1952) said that two processes are responsible for how children and adolescents use and adapt their schemas: assimilation and accommodation.

Assimilation *occurs when individuals incorporate new information into existing knowledge.* In assimilation, the schema does not change. **Accommodation** *occurs when individuals adjust to new information.* In accommodation, the schema changes. Suppose that a 16-year-old girl wants to learn how to use a computer. Her parents buy her a computer for her birthday. She has never had the opportunity to use one. From her experience and observation, though, she realizes that software discs are inserted in a slot and a switch must be pressed to turn the computer on. Thus far she has incorporated her behavior into a conceptual framework she already had (assimilation). As she strikes several keys, she makes some errors. Soon she realizes that she needs to get someone to

schema
A concept or framework that exists in the individual's mind to organize and interpret information, in Piaget's theory.

assimilation
The incorporation of new information into existing knowledge.

accommodation
An adjustment to new information.

help her learn to use the computer efficiently or take a class on using a computer at her high school. These adjustments show her awareness of the need to alter her concept of computer use (accommodation).

Equilibration *is a mechanism in Piaget's theory that explains how children or adolescents shift from one state of thought to the next. The shift occurs as they experience cognitive conflict or a disequilibrium in trying to understand the world. Eventually, the child or adolescent resolves the conflict and reaches a balance, or equilibrium, of thought.* Piaget believed there is considerable movement between states of cognitive equilibrium and disequilibrium as assimilation and accommodation work in concert to produce cognitive change. For example, if a child believes that the amount of a liquid changes simply because the liquid is poured into a container with a different shape, she might be puzzled by such issues as where the "extra" liquid came from and whether there is actually more liquid to drink. The child will eventually resolve these puzzles as her thought becomes more advanced. In the everyday world, the child is constantly faced with such counterexamples and inconsistencies.

Stages of Cognitive Development   Piaget said that individuals develop through four main cognitive stages: sensorimotor, preoperational, concrete operational, and formal operational. Each of the stages is age related and consists of distinct ways of thinking. It is the *different* way of understanding the world that makes one stage more advanced than the other; knowing *more* information does not make the adolescent's thinking more advanced, in the Piagetian view. This is what Piaget meant when he said that the person's cognition is *qualitatively* different in one stage compared to another. We will briefly again define the first two stages in Piaget's theory, which were first introduced in chapter 2, and then explain concrete and formal operational thought.

Sensorimotor and Preoperational Thought   The **sensorimotor stage,** *which lasts from birth to about 2 years of age, is the first Piagetian stage. In this stage, infants construct an understanding of the world by coordinating sensory experiences (such as seeing and hearing) with physical, motoric actions—hence the term* sensorimotor. At the beginning of this stage, newborns have little more than reflexive patterns with which to work. By the end of the stage, 2-year-olds have complex sensorimotor patterns and are beginning to operate with primitive symbols.

The **preoperational stage,** *which lasts approximately from 2 to 7 years of age, is the second Piagetian stage. In this stage, children begin to represent the world with words, images, and drawings.* Symbolic thought goes beyond simple connections of information and action.

Concrete Operational Thought   The **concrete operational stage,** *which lasts approximately from 7 to 11 years of age, is the third Piagetian stage. In this stage, children can perform operations. Logical reasoning replaces intuitive thought as long as the reasoning can be applied to specific or concrete examples.*

Piaget said that concrete operational thought involves *operations*—mental actions that allow the individual to do mentally what was done before physically. And he said that the concrete operational thinker can engage in mental actions that are reversible. For example, the concrete operational thinker can mentally reverse liquid from one beaker to another and understand that the volume is the same even though the beakers differ in height and width. In Piaget's most famous task, a child is presented with two identical beakers, each filled with the same amount of liquid (see figure 4.1 on p. 108). Children are asked if these beakers have the same amount of liquid, and they usually say yes. Then, the liquid from one beaker is poured into a third beaker, which is taller and thinner than the first two (see figure 4.1 on p. 108). Children are then asked if the amount of liquid in the tall, thin beaker is equal to that which remains in one of the original beakers. Concrete operational thinkers answer yes and justify their answers appropriately. Preoperational thinkers (usually children under the age of 7) often answer no and justify their answer in terms of the differing height and width of the beakers. This example reveals the ability of the concrete operational thinker to decenter and

equilibration

A mechanism in Piaget's theory that explains how children or adolescents shift from one state of thought to the next. The shift occurs as they experience cognitive conflict or a disequilibrium in trying to understand the world. Eventually, the child or adolescent resolves the conflict and reaches a balance, or equilibrium.

We are born capable of learning.
—Jean-Jacques Rousseau
  Swiss-Born French Philosopher,
  18th Century

sensorimotor stage

Piaget's first stage of development, lasting from birth to about 2 years of age. In this stage, infants construct an understanding of the world by coordinating sensory experiences with physical, motoric actions.

preoperational stage

Piaget's second stage, which lasts approximately from 2 to 7 years of age. In this stage, children begin to represent their world with words, images, and drawings.

concrete operational thought

Piaget's third stage, which lasts approximately from 7 to 11 years of age. In this stage, children can perform operations. Logical reasoning replaces intuitive thought as long as the reasoning can be applied to specific or concrete examples.

◼ FIGURE 4.1
Piaget's Conservation Task

The beaker test is a well-known Piagetian test to determine whether the child can think operationally—that is, can mentally reverse actions and show conservation of the substance. (*I*) Two identical beakers are presented to the child. Then the experimenter pours the liquid from B into C, which is taller and thinner than A or B. (*II*) The child is now asked if these beakers (A and C) have the same amount of liquid. The preoperational child says no. When asked to point to the beaker that has more liquid, the preoperational child points to the tall, thin beaker.
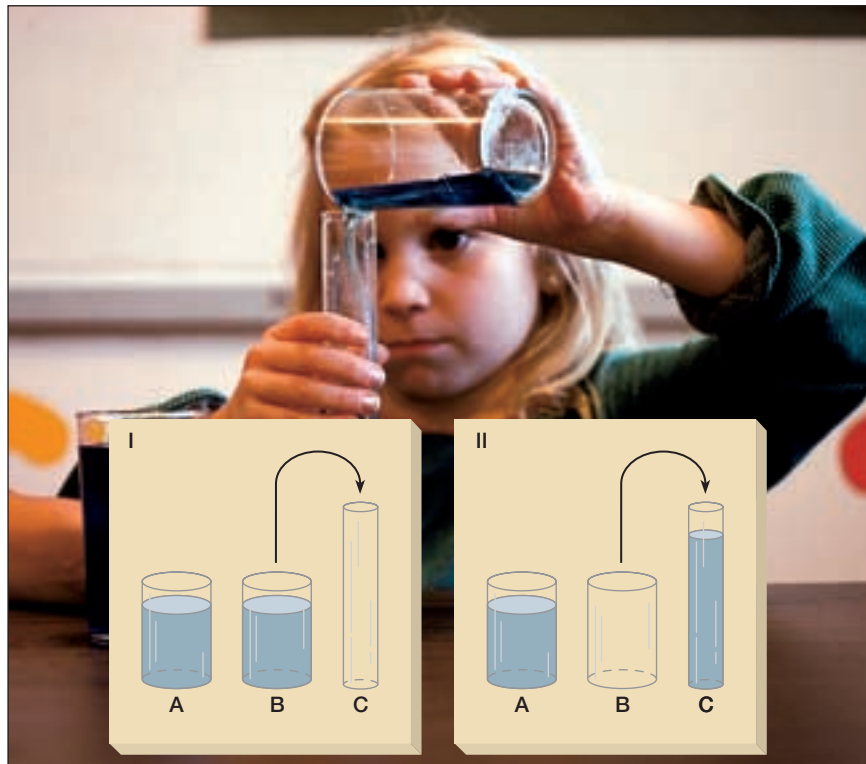
coordinate several characteristics (such as height and width), rather than focusing on a single property of an object (such as height).

Conservation is Piaget's term for an individual's ability to recognize that the length, number, mass, quantity, area, weight, and volume of objects and substances do not change through transformations that alter their appearance.

Classification, or class inclusion reasoning, is Piaget's concept of concrete operational thought, in which children systematically organize objects into hierarchies of classes and subclasses.

Although concrete operational thought is more advanced than preoperational thought, it has limitations. Logical reasoning replaces intuitive thought as long as the principles can be applied to specific, *concrete* examples. For example, the concrete operational child cannot imagine the steps necessary to complete an algebraic equation, which is too abstract for thinking at this stage of cognitive development. A summary of the characteristics of concrete operational thought is shown in figure 4.2 on p. 109.
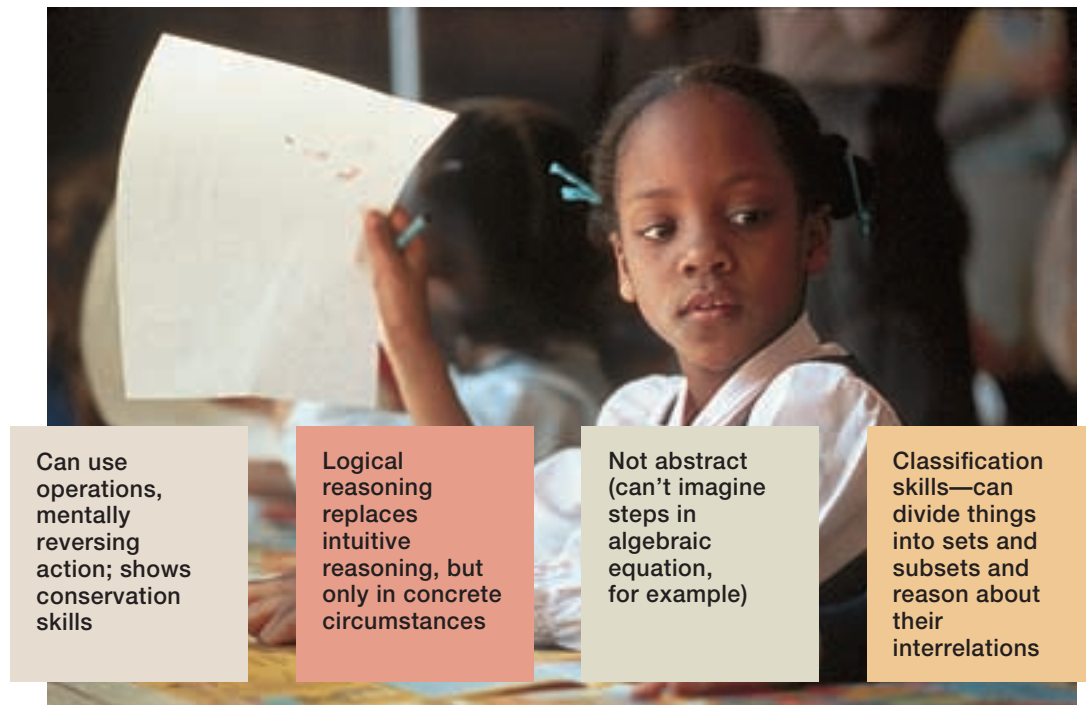
formal operational stage

Piaget's fourth and final stage of cognitive development, which he believed emerges at 11 to 15 years of age. It is characterized by abstract, idealistic, and logical thought.

Formal Operational Thought   The **formal operational stage** *is Piaget's fourth and final stage of cognitive development. Piaget believed that this stage emerges at 11 to 15 years of age.* Adolescents' developing power of thought opens up new cognitive and social horizons. What are the characteristics of formal operational thought, which Piaget believed develops in adolescence? Most significantly, formal operational thought is more *abstract* than concrete operational thought. Adolescents are no longer limited to actual, concrete experiences as anchors for thought. They can conjure up make-believe situations—events that are purely hypothetical possibilities or strictly abstract propositions—and try to reason logically about them.

The abstract quality of the adolescent's thought at the formal operational level is evident in the adolescent's verbal problem-solving ability. While the concrete operational thinker would need to see the concrete elements A, B, and C to be able to make the logical inference that if A = B and B = C, then A = C, the formal operational thinker can solve this problem merely through verbal presentation.

Another indication of the abstract quality of adolescents' thought is their increased tendency to think about thought itself. One adolescent commented, "I began thinking

| Can use operations, mentally reversing action; shows conservation skills | Logical reasoning replaces intuitive reasoning, but only in concrete circumstances | Not abstract (can't imagine steps in algebraic equation, for example) | Classification skills—can divide things into sets and subsets and reason about their interrelations |

FIGURE 4.2
Characteristics of Concrete Operational Thought

about why I was thinking what I was. Then I began thinking about why I was thinking about why I was thinking about what I was." If this sounds abstract, it is, and it characterizes the adolescent's enhanced focus on thought and its abstract qualities. Later in the chapter we will further discuss thinking about thinking, which is called *metacognition.*

Accompanying the abstract nature of formal operational thought in adolescence is thought full of idealism and possibilities. While children frequently think in concrete ways, or in terms of what is real and limited, adolescents begin to engage in extended speculation about ideal characteristics—qualities they desire in themselves and in others. Such thoughts often lead adolescents to compare themselves and others in regard to such ideal standards. And during adolescence, the thoughts of individuals are often fantasy flights into future possibilities. It is not unusual for the adolescent to become impatient with these newfound ideal standards and become perplexed over which of many ideal standards to adopt.

At the same time adolescents think more abstractly and idealistically, they also think more logically. Adolescents begin to think more like a scientist thinks, devising plans to solve problems and systematically testing solutions. This type of problem solving has an imposing name. **Hypothetical-deductive reasoning** *is Piaget's term for adolescents' ability, in the stage of formal operational thought, to develop hypotheses, or best guesses, about ways to solve problems, such as an algebraic equation. They then systematically deduce, or conclude, the best path to follow in solving the problem.* By contrast, children are more likely to solve problems in a trial-and-error fashion.

One example of hypothetical-deductive reasoning involves a version of the familiar game "Twenty Questions." Individuals are shown a set of 42 color pictures displayed in a rectangular array (six rows of seven pictures each) and asked to determine which picture the experimenter has in mind (that is, which is "correct"). The subjects are only allowed to ask questions to which the experimenter can answer yes or no. The object of the game is to select the correct picture by asking as few questions as possible.

Adolescents who are deductive hypothesis testers formulate a plan and test a series of hypotheses, which considerably narrows the field of choices. The most effective plan

hypothetical-deductive reasoning

Piaget's term for adolescents' ability, in the formal operational stage, to develop hypotheses, or best guesses, about ways to solve problems; they then systematically deduce, or conclude, the best path to follow in solving the problem.

THINKING CRITICALLY

Formal Operational Thought, Politics, and Ideology

The development of formal operational thought expands adolescents' worlds by allowing them to consider possibilities, to conduct experiments and test hypotheses, and to think about thoughts. Part of the cognitive expansion of their worlds involves constructing theories involving politics and ideology. During adolescence, for the first time individuals become adept at generating ideas about the world as it *could* be. In the realm of moral development, adolescents often quickly make a leap from how the world could be to how it *should* be. And many adolescents believe the world *should* be transformed in the direction of some utopian ideal.

Suppose an 8-year-old and a 16-year-old are watching a political convention on television. In view of where each is likely to be in terms of Piaget's stages of cognitive development, how would their perceptions of the political proceedings likely differ? What would the 8-year-old "see" and comprehend? What Piagetian changes would these differences reflect?

"*and give me good abstract-reasoning ability, interpersonal skills, cultural perspective, linguistic comprehension, and a high sociodynamic potential.*"

is a "halving" strategy (Q: Is the picture in the right half of the array? A: No. Q: OK. Is it in the top half? And so on.). A correct halving strategy guarantees the answer to this problem in seven questions or less. In contrast, the concrete operational thinker might persist with questions that continue to test some of the same possibilities that previous questions could have eliminated. For example, they might ask whether the correct picture is in row 1 and be told that it is not, then later ask whether the picture is *x,* which is in row 1.

Thus, formal operational thinkers test their hypotheses with judiciously chosen questions and tests. Concrete operational thinkers, on the other hand, often fail to understand the relation between an hypothesis and a well-chosen test of it, stubbornly clinging to ideas that already have been discounted.

Piaget believed that formal operational thought is the best description of how adolescents think. A summary of formal operational thought's characteristics is shown in figure 4.3 on p. 111. As we see next, though, formal operational thought is not a homogeneous stage of development.

Not all adolescents are full-fledged formal operational thinkers. Some developmentalists believe that formal operational thought consists of two subperiods: early and late (Broughton, 1983). In *early formal operational thought,* adolescents' increased ability to think in hypothetical ways produces unconstrained thoughts with unlimited possibilities. In this early period, formal operational thought submerges reality, and there is an excess of assimilation as the world is perceived too subjectively and idealistically. *Late formal operational thought* involves a restoration of intellectual balance. Adolescents now test out the products of their reasoning against experience, and a consolidation of formal operational thought takes place. An intellectual balance is restored, as the adolescent accommodates to the cognitive upheaval that has occurred. Late formal operational thought may appear during the middle adolescent years. In this view, assimilation of formal operational thought marks the transition to adolescence; accommodation to formal operational thought marks a later consolidation (Lapsley, 1990).

Piaget's (1952) early writings indicated that the onset and consolidation of formal operational thought are completed during early adolescence, from about 11 to 15 years of age. Later, Piaget (1972) revised his view and concluded that formal operational thought is not completely achieved until later in adolescence, between approximately 15 and 20 years of age. As we see next, many developmentalists believe that there is considerable individual variation in adolescent cognition.

Piaget's theory emphasizes universal and consistent patterns of formal operational thought. His theory does not adequately account for the unique, individual differences that characterize the cognitive development of adolescents (Overton & Byrnes, 1991). These individual variations in adolescents' cognitive development have been documented in a number of investigations (Neimark, 1982).

Some individuals in early adolescence are formal operational thinkers; others are not. A review of formal operational thought investigations revealed that only about one of every three eighth-grade students is a formal operational thinker (Strahan, 1983). Some investigators find that formal operational thought increases with age in adolescence; others do not. Many college students and adults do not think in formal operational ways either. For example, investigators have found that from 17 to 67 percent of college students think in formal operational ways (Elkind, 1961; Tomlinson-Keasey, 1972).
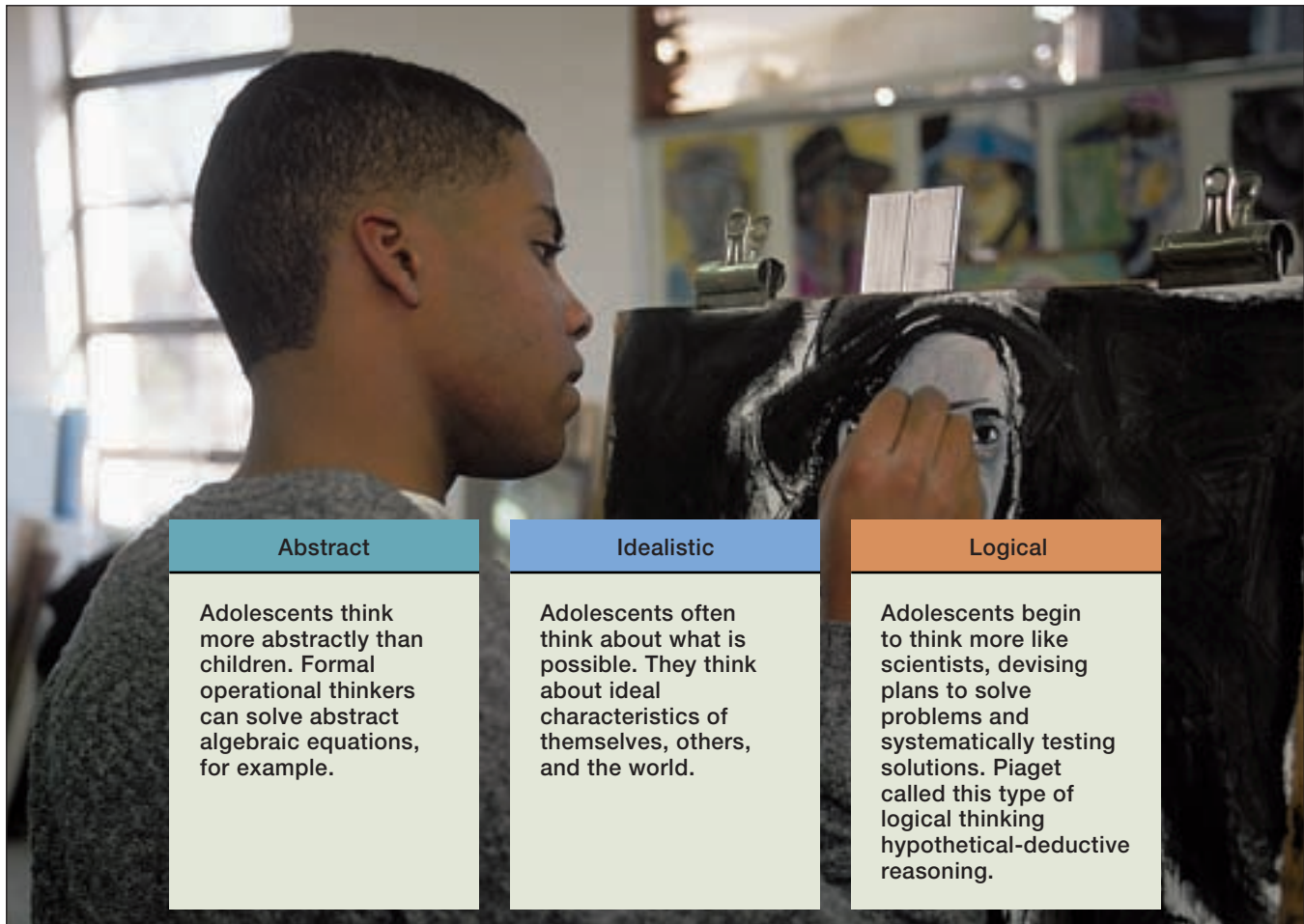
Many young adolescents are at the point of consolidating their concrete operational thought, using it more consistently than in childhood. At the same time, many

| Abstract	Idealistic	Logical
Adolescents think more abstractly than children. Formal operational thinkers can solve abstract algebraic equations, for example.	Adolescents often think about what is possible. They think about ideal characteristics of themselves, others, and the world.	Adolescents begin to think more like scientists, devising plans to solve problems and systematically testing solutions. Piaget called this type of logical thinking hypothetical-deductive reasoning.

FIGURE 4.3

Characteristics of Formal Operational Thought

Adolescents begin to think more as scientists think, devising plans to solve problems and systematically testing solutions. Piaget gave this type of thinking the imposing name of hypothetical-deductive reasoning.

young adolescents are just beginning to think in a formal operational manner. By late adolescence, many adolescents are beginning to consolidate their formal operational thought, using it more consistently. And there often is variation across the content areas of formal operational thought, just as there is in concrete operational thought in child-hood. A 14-year-old adolescent might reason at the formal operational level when analyzing algebraic equations but not do so with verbal problem solving or when reasoning about interpersonal relations.

Formal operational thought is more likely to be used in areas in which adolescents have the most experience and knowledge. Children and adolescents gradually build up elaborate knowledge through extensive experience and practice in various sports, games, hobbies, and school sub-jects, such as math, English, and science. The development of expertise in different domains of life may make pos-sible high-level, developmentally mature-looking thought. In some instances, the sophisticated reasoning of formal operational thought might be responsible. In other in-stances, however, the thought might be largely due to the accumulation of knowledge that allows more automatic,

THROUGH THE EYES OF ADOLESCENTS
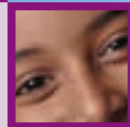
We Think More Than Adults Think We Do

"I don't think adults understand how much kids think today. We just don't take something at face value. We want to understand why things are the way they are and the reasons behind things. We want it to be a better world and we are thinking all of the time how to make it that way. When we get to be adults, we will make the world better."

—Jason, Age 15
  Dallas, Texas

memory-based processes to function. Some developmentalists wonder if the acquisition of knowledge could account for all cognitive growth. Most, however, argue that *both* cognitive changes in such areas as concrete and formal operational thought *and* the development of expertise through experience are at work in understanding the adolescent's cognitive world.

Piaget's Theory and Adolescent Education

Piaget's theory has been widely applied to education, although more extensively with children than with adolescents. Piaget was not an educator and never pretended to be. But he did provide a sound conceptual framework from which to view educational problems. What principles of Piaget's theory of cognitive development can be applied to education? David Elkind (1976) described two.

First, the foremost issue in education is *communication*. In Piaget's theory, the adolescent's mind is not a blank slate. To the contrary, the adolescent has a host of ideas about the physical and natural world. Adolescents come to school with their own ideas about space, time, causality, quantity, and number. Educators need to learn to comprehend what adolescents are saying and to respond to their ideas. Second, adolescents are, by nature, knowing creatures. The best way to nurture this motivation for knowledge is to allow adolescents to spontaneously interact with the environment. Educators need to ensure that they do not dull adolescents' eagerness to know by providing an overly rigid curriculum that disrupts adolescents' rhythm and pace of learning.

Why have applications to adolescent education lagged behind applications to children's education? Adolescents who are formal operational thinkers are at a level similar to that of their teachers and of the authors of textbooks. In Piaget's model, it is no longer necessary to pay attention to qualitative changes in cognition. Also, the structure of education itself changes considerably between elementary and secondary levels. For children, the basic focus of education is the classroom. Children might be involved with, at most, several teachers during the day. In secondary schools, the focus shifts to subject-matter divisions of curriculum. Each teacher sees a student for 45 to 60 minutes a day in connection with one content area (English, history, math, for example). Thus, both teachers and texts can become more focused on the development of curriculum than on the developmental characteristics of students. And when teachers *are* concerned about students' developmental characteristics in adolescence, they pay more attention to social-personality dimensions than to cognitive dimensions.

One main argument that has emerged from the application of Piaget's theory to education is that instruction may too often be at the formal operational level, even though the majority of adolescents are not actually formal operational thinkers. That is, the instruction might be too formal and too abstract. Possibly, it should be less formal and more concrete. Researchers have found that adolescents construct a view of the world on the basis of observations and experiences and that educators should take this into account when developing a curriculum for adolescents (Linn, 1991).

Evaluating Piaget's Theory

What were Piaget's main contributions? Has his theory withstood the test of time?

Contributions   Piaget is a giant in the field of developmental psychology. We owe to him the present field of cognitive development and a long list of masterful concepts of enduring power and fascination: assimilation, accommodation, conservation, hypothetical-deductive reasoning, and others. We also owe to him the current vision of children as active, constructive thinkers (Vidal, 2000).

Piaget also was a genius when it came to observing children. His careful observations showed us inventive ways to discover how children act on and adapt to their world. Piaget showed us some important things to look for in cognitive development, such as the shift from preoperational to concrete operational thinking. He also showed us how children need to make their experiences fit their schemas (cognitive frameworks) yet simultaneously adapt their schemas to experience. Piaget also revealed how cognitive change is likely to occur if the context is structured to allow gradual

movement to the next-higher level. And we owe him the current belief that a concept does not emerge all of a sudden, full-blown, but instead develops through a series of partial accomplishments that lead to increasingly comprehensive understanding (Haith & Benson, 1998).

Criticisms   Piaget's theory has not gone unchallenged. Questions are raised about these areas:

- *Estimates of children's competence.* Some cognitive abilities emerge earlier than Piaget thought. For example, as noted above, some aspects of object permanence emerge earlier than he believed. Even 2-year-olds are nonegocentric in some contexts. When they realize that another person will not see an object, they investigate whether the person is blindfolded or looking in a different direction. Conservation of number has been demonstrated as early as age 3, although Piaget thought it did not emerge until 7. Young children are not as uniformly "pre-" this and "pre-" that (precausal, preoperational) as Piaget thought.

  Other cognitive abilities can emerge later than Piaget thought. Many adolescents still think in concrete operational ways or are just beginning to master formal operations. Even many adults are not formal operational thinkers. In sum, recent theoretical revisions highlight more cognitive competencies of infants and young children and more cognitive shortcomings of adolescents and adults (Flavell, Miller, & Miller, 2001; Wertsch, 2000).
- *Stages.* Piaget conceived of stages as unitary structures of thought. Thus, his theory assumes developmental synchrony: various aspects of a stage should emerge at the same time. However, some concrete operational concepts do not appear in synchrony. For example, children do not learn to conserve at the same time as they learn to cross-classify. Thus, most contemporary developmentalists agree that children's cognitive development is not as stagelike as Piaget thought (Kuhn, 2000a).
- *Training children to reason at a higher level.* Some children who are at one cognitive stage (such as preoperational) can be trained to reason at a higher cognitive stage (such as concrete operational). This poses a problem for Piaget's theory. Piaget argued that such training is only superficial and ineffective, unless the child is at a maturational transition point between the stages (Gelman & Williams, 1998).
- *Culture and education.* Culture and education exert stronger influences on development than Piaget envisioned. The age at which individuals acquire conservation skills is associated to some extent with the degree to which their culture provides relevant practice (Cole, 1997). And in many developing countries, formal operational thought is rare. Shortly, you will read about Lev Vygotsky's theory of cognitive development in which culture and education are given more prominent roles than in Piaget's theory.

Piaget, shown sitting on a bench, was a genius at observing children. By carefully observing and interviewing children, Piaget constructed his comprehensive theory of children's cognitive development. *What are some other contributions, as well as criticisms, of Piaget's theory?*

One group of cognitive developmentalists believe that Piaget's theory needs to be modified. These **neo-Piagetians** *argue that Piaget got some things right, but that his theory needs considerable revision. In their revision of Piaget, they give more emphasis to how children process information through attention, memory, and strategies and to more precise explanations of cognitive changes.* They especially believe that a more accurate vision of children's and adolescents' thinking requires more knowledge of strategies, how fast and automatically information is processed, the particular cognitive task involved, and dividing cognitive problems into smaller, more precise steps.

The leading proponent of the neo-Piagetian view is Canadian developmental psychologist Robbie Case (1992, 1998, 2000). He accepts Piaget's four main stages of cognitive development but believes that more precise description of changes within each

neo-Piagetians
Theorists who argue that Piaget got some things right but that his theory needs considerable revision. In their revision, they give more emphasis to information processing that involves attention, memory, and strategies; they also seek to provide more precise explanations of cognitive changes.

stages needs to be carried out. Case also argues that as children's and adolescents' ability to process information more efficiently is linked to their brain growth and memory development. He especially cites the increasing ability to hold information in working memory (a workbench for memory similar to short-term memory) and manipulate it more effectively as critical to understanding cognitive development.

Is There a Fifth, Postformal Stage?   As we saw earlier in the chapter, Piaget did not believe there is a fifth, postformal stage. He argued that formal operational thought is the highest *qualitative* stage of thought and that it is entered in early adolescence. However, some theorists argue that Piaget was wrong about formal operations being the most advanced stage of thought. They believe that young adults can enter a fifth, postformal stage.

postformal thought

A form of thought, proposed as a fifth stage, that is qualitatively different from Piaget's formal operational thought. It involves understanding that the correct answer to a problem can require reflective thinking, that the correct answer can vary from one situation to another, and that the search for truth is often an ongoing, never-ending process.

Postformal thought *is qualitatively different from Piaget's formal operational thought. Postformal thought involves understanding that the correct answer to a problem requires reflective thinking and can vary from one situation to another, and that the search for truth is often an ongoing, never-ending process.* Also part of the fifth stage is the belief that solutions to problems need to be realistic and that emotion and subjective factors can influence thinking (Kitchener & King, 1981). Researchers have found that young adults are more likely to engage in this postformal thinking than adolescents are (Commons & others, 1989).

As young adults engage in more reflective judgment when solving problems, they might think deeply about many aspects of politics, their career and work, relationships, and other areas of life (Labouvie-Vief & Diehl, 1999). They might understand that what might be the best solution to a problem at work (with a co-worker or boss) might not be the best solution at home (with a romantic partner). Many young adults also become more skeptical about there being a single truth and often are not willing to accept an answer as final. They also often recognize that thinking can't just be abstract but rather has to be realistic and pragmatic. And many young adults understand that emotions can play a role in thinking—for example, that one likely thinks more clearly in a calm, collected state than in an angry, highly aroused state.

How strong is the research evidence for a fifth, postformal stage of cognitive development? The fifth stage is controversial, and some critics argue that the research evidence has yet to be provided to document it as clearly a qualitatively more advanced stage than formal operational thought.

William Perry (1970, 1999) especially believes that changes in reflective and relativistic thinking take place as individuals make the transition from adolescence to adulthood, a time referred to as emerging adulthood. He said that younger adolescents tend to view the world in terms of polarities—right/wrong, we/they, good/bad. As adolescents make the transition to adulthood, they gradually move away from this type of absolute thinking. This change occurs as they become aware of the diverse opinions and multiple perspectives of others.

Perry said that college is a pivotal time for the change from absolute to more relativistic thinking. Indeed, researchers have found that individuals who go to college think in more relativistic ways than those who do not attend college (King & Kitchener, 1994). This likely occurs because of the exposure to instructors and peers with views that are quite different than one's own.

Vygotsky's Theory

We introduced Vygotsky's theory in chapter 2, "The Science of Adolescent Development." Here we expand on those ideas ◀▥ P. 47.

Vygotsky's (1962) theory has stimulated considerable interest in the view that knowledge is *situated* and *collaborative* (Greeno, Collins, & Resnick, 1996; Rogoff, 1998)—that knowledge is distributed among people and environments, which include objects, artifacts, tools, books, and the communities in which people live. This suggests that knowing can best be advanced through interaction with others in cooperative activities (Gojdamaschko, 1999; Kozulin, 2000).

One of Vygotsky's most important concepts is the **zone of proximal development (ZPD),** *which refers to the range of tasks that are too difficult for an individual to master alone, but that can be mastered with the guidance and assistance of adults or more-skilled peers.* Thus, the lower level of the ZPD is the level of problem solving reached by the adolescent working independently. The upper limit is the level of additional responsibility the adolescent can accept with the assistance of an able instructor (see figure 4.4). Vygotsky's emphasis on the ZPD underscored his belief in the importance of social influences on cognitive development.

In Vygotsky's approach, formal schooling is but one cultural agent that determines adolescents' growth (Keating, 1990). Parents, peers, the community, and the technological orientation of the culture are other forces that influence adolescents' thinking. For example, the attitudes toward intellectual competence that adolescents encounter through relationships with their parents and peers affect their motivation for acquiring knowledge. So do the attitudes of teachers and other adults in the community. Media influences, especially through the development of television and the computer, play increasingly important roles in the cognitive socialization of adolescents. For example, does television train adolescents to become passive learners and detract significantly from their intellectual pursuit? We will consider television's role in adolescent development in chapter 8.

The cognitive socialization of adolescents can be improved through the development of more cognitively stimulating environments and additional focus on the role of social factors in cognitive growth (Brown, Metz, & Campione, 1996). Approaches that take into account adolescents' self-confidence, achievement expectations, and sense of purpose are likely to be just as effective as, or even more effective than, more narrow cognitive approaches in shaping adolescents' cognitive growth. For example, a knowledge of physics could be of limited use to inner-city youth with severely limited prospects of employment (Keating, 1990).

Exploring Some Contemporary Concepts

A number of contemporary concepts are compatible with Vygotsky's theory. These include the concepts of scaffolding, cognitive apprenticeship, tutoring, cooperative learning, and reciprocal teaching.

Scaffolding   *Scaffolding* refers to changing the level of support over the course of a teaching session: a more-skilled person (teacher or more-advanced peer of the adolescent) adjusts the amount of guidance to fit the adolescent's current level of performance. When the task the adolescent is learning is new, direct instruction might be used. As the adolescent's competence increases, less guidance is provided. Think of scaffolding in learning as like the scaffolding used to build a bridge—it is used for support when needed, but is adjusted or removed as the project unfolds.

Cognitive Apprenticeship   Barbara Rogoff (1990, 1998) believes that an important aspect of learning is *cognitive apprenticeship,* in which an expert stretches and supports the novice's understanding of and use of the culture's skills. The term *apprenticeship* underscores the importance of activity in learning and highlights the situated nature of learning. In a cognitive apprenticeship, adults often model strategies for adolescents then support their efforts at doing the task. Finally, they encourage adolescents to work independently.
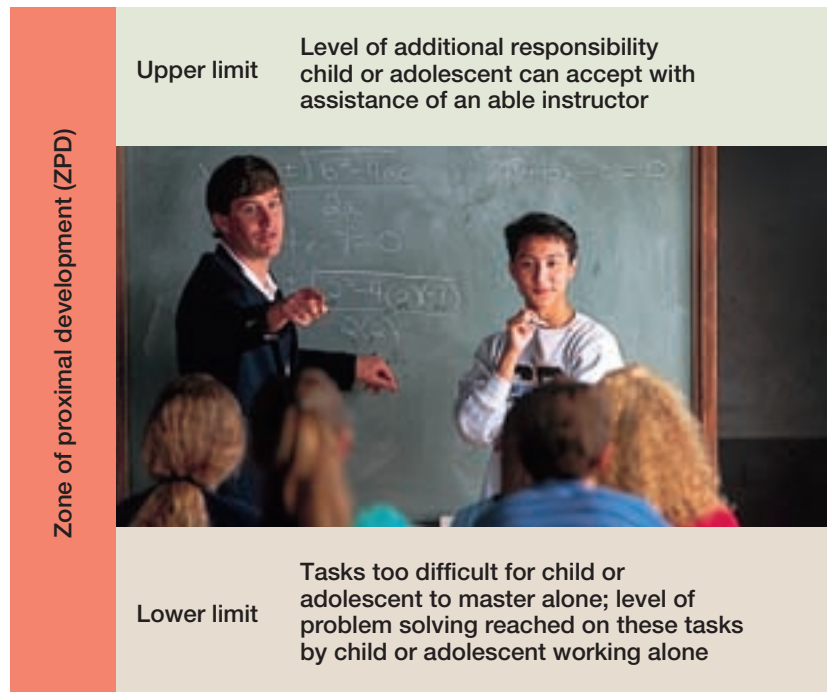
zone of proximal development (ZPD)
Vygotsky's concept that refers to the range of tasks that are too difficult for an individual to master alone, but that can be mastered with the guidance or assistance of adults or more-skilled peers.

Lev Vygotsky: Revolutionary Scientist
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	Upper limit	Level of additional responsibility child or adolescent can accept with assistance of an able instructor
Zone of proximal development (ZPD)		
	Lower limit	Tasks too difficult for child or adolescent to master alone; level of problem solving reached on these tasks by child or adolescent working alone

■ FIGURE 4.4
Vygotsky's Zone of Proximal Development (ZPD)

Vygotsky's zone of proximal development has a lower limit and an upper limit. Tasks in the ZPD are too difficult for the child or adolescent to perform alone. They require assistance from an adult or a more-skilled youth. As children and adolescents experience the verbal instruction or demonstration, they organize the information in their existing mental structures so they can eventually perform the skill or task alone.

A key aspect of a cognitive apprenticeship is the expert's evaluation of when the learner is ready to take the next step with support from the expert. In one study of secondary school science and math students, experts used the timing of the students' participation in discourse to infer student understanding of the points of the lesson; the experts provided pauses to allow students to take responsibility for an idea by anticipating or completing the experts' ideas (Fox, 1993). Experts also used information regarding the length of each response opportunity students passed up and what the students were doing during the passed-up opportunity (such as calculating or expressing a blank stare). When students passed up two or three opportunities, experts continued with an explanation. If no evidence of understanding occurred during the explanation, the expert repeated or reformulated it. The experts also used "hint" questions to get students unstuck and observed the looks on their faces and how they responded to questions for discerning their understanding.

Tutoring   Tutoring involves a cognitive apprenticeship between an expert and a novice. Tutoring can take place between an adult and an adolescent or between a more-skilled adolescent and a less-skilled adolescent. Fellow students can be effective tutors. Cross-age tutoring usually works better than same-age tutoring. Researchers have found that peer tutoring often benefits students' achievement (Mathes & others, 1998). And tutoring can benefit the tutor as well as the tutee, especially when the older tutor is a low-achieving student. Teaching something to someone else is one of the best ways to learn.

Cooperative Learning   *Cooperative learning* involves students working in small groups to help each other learn. Cooperative learning groups vary in size, although a typical group will have about four students. Researchers have found that cooperative learning can be an effective strategy for improving achievement, especially when these two conditions are met (Slavin, 1995): (1) group rewards are generated (these help group members see that it is in their best interest to help each other learn), and (2) individuals are held accountable (that is, some method of evaluating an individual's contribution, such as an individual quiz, is used). Cooperative learning helps promote interdependence and connection with other students. In chapter 7, "Schools," we will further examine the concept of cooperative learning.

Reciprocal Teaching   *Reciprocal teaching* involves students taking turns leading a small-group discussion. Reciprocal teaching also can involve an adult and an adolescent. As in scaffolding, the teacher gradually assumes a less active role, letting the student assume more initiative. This technique has been widely used to help students learn to read more effectively. For example, Ann Brown and Annimarie Palinscar (1984) used reciprocal teaching to improve students' abilities to enact certain strategies to improve their reading comprehension. In this teacher-scaffolded instruction, teachers worked with students to help them *generate questions* about the text they had read, *clarify* what they did not understand, *summarize* the text, and *make predictions.*

Ann Brown's most recent efforts focused on transforming schools into communities of thinking and learning. Her ideas have much in common with Vygotsky's emphasis on learning as a collaborative process.

Comparing Piaget and Vygotsky   Awareness of Vygotsky's theory came later than awareness of Piaget's, so it has not yet been thoroughly evaluated. However, Vygotsky's theory has been embraced by many teachers and successfully applied to education. His view of the importance of sociocultural influences on development fits with the current belief in the importance of contextual factors in learning (Greenfield, 2000). However, criticisms of his theory have emerged; for example, it has been argued that he overemphasized the role of language in thinking.

Vygotsky's and Piaget's theories are constructivist. *Constructivism* emphasizes that individuals actively construct knowledge and understanding. In the constructivist view, information is not directly given to children and adolescents and

THROUGH THE EYES OF PSYCHOLOGISTS

Barbara Rogoff
University of California–Santa Cruz

"Cognitive development occurs as new generations collaborate with older generations in varying forms of interpersonal engagement and institutional practices."

Topic	Vygotsky	Piaget
Constructivism	Social constructivist	Cognitive constructivist
Stages	No general stages of development proposed	Strong emphasis on stages (sensorimotor, preoperational, concrete operational, and formal operational)
Key processes	Zone of proximal development, language, dialogue, tools of the culture	Schema, assimilation, accommodation, operations, conservation, classification, hypothetical-deductive reasoning
Role of language	A major role; language plays a powerful role in shaping thought	Language has a minimal role; cognition primarily directs language
View on education	Education plays a central role, helping children learn the tools of the culture.	Education merely refines the child's cognitive skills that already have emerged.
Teaching implications	Teacher is a facilitator and guide, not a director; establish many opportunities for children to learn with the teacher and more skilled peers	Also views teacher as a facilitator and guide, not a director; provide support for children to explore their world and discover knowledge

■ FIGURE 4.5
Comparison of Vygotsky's and Piaget's Theories

poured into their minds. Rather, they are encouraged to explore their world, discover knowledge, and think critically (Perkins, 1999).

Distinctions can be drawn between cognitive and social constructivist approaches. In a *cognitive constructivist approach,* emphasis is on the individual's cognitive construction of knowledge and understanding. Piaget's theory is cognitive constructivist. In a *social constructivist approach,* emphasis is on collaboration with others to produce knowledge and understanding. Vygotsky's theory is social constructivist.

In Piaget's and Vygotsky's theories, teachers serve as facilitators and guides rather than directors and molders of learning. Figure 4.5 on p. 117 provides a comparison of Piaget's and Vygotsky's theories.

At this point we have studied a numbers of ideas about Piaget's and Vygotsky's theories. This review should help you to reach your learning goals related to these topics.

■ FOR YOUR REVIEW

Learning Goal 1
Discuss Piaget's theory

- Piaget's widely acclaimed theory stresses adaptation, schemas, assimilation, accommodation, and equilibration.
- Piaget said that individuals develop through four cognitive stages: sensorimotor, preoperational, concrete operational, and formal operational. Formal operational thought, which Piaget believed appears from 11 to 15 years of age, is characterized by abstract, idealistic, and hypothetical-deductive thinking. Some experts argue that formal operational thought has two phases: early and late. Individual variation in adolescent cognition is extensive. Many young adolescents are still consolidating their concrete operational thought or are early formal operational thinkers rather than full-fledged ones.
- Although Piaget was not an educator, his constructivist ideas have been applied to education.
- In terms of Piaget's contributions, we owe to him the entire field of cognitive development and a masterful list of concepts. He also was a genius at observing children. Criticisms of Piaget's theory focus on estimates of competence, stages, training to reason at higher stages, and the role of culture and education. Neo-Piagetians have proposed some substantial changes in Piaget's theory.
- Piaget did not believe there is a fifth, postformal stage of thought. However, some theorists argue that this stage is entered by many young adults. Perry believed that emerging adulthood is a time when individuals think more reflectively and relativistically, especially if they go to college.

Learning Goal 2
Understand Vygotsky's theory

- Vygotsky's view stimulated considerable interest in the idea that knowledge is situated and collaborative. One of his important concepts is the zone of proximal development, which involves guidance by more-skilled peers and adults. Vygotsky argued that learning the skills of the culture is a key aspect of development.
- Some contemporary concepts linked with Vygotsky's theory include scaffolding, cognitive apprenticeship, tutoring, cooperative learning, and reciprocal teaching.
- Piaget's and Vygotsky's views are both constructivist—Piaget's being cognitive constructivist, Vygotsky's social constructivist. In both views, teachers should be facilitators, not directors, of learning.

Now that we have discussed the cognitive developmental views of Piaget and Vygotsky, we will turn our attention to another major framework for understanding adolescent cognition: information processing.

THE INFORMATION-PROCESSING VIEW

In chapter 2, "The Science of Adolescent Development," we briefly described the information-processing view ◀▥ P. 48. We indicated that information processing includes how information gets into adolescents' minds, how it is stored, and how it is retrieved to think about and solve problems.
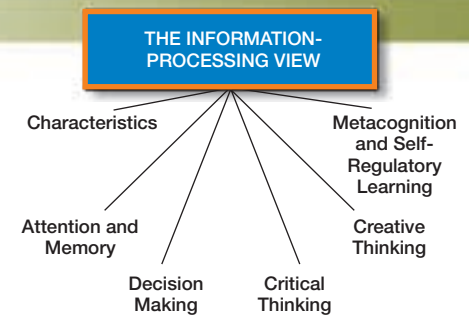
Information processing is both a framework for thinking about adolescent development and a facet of that development. As a framework, the information-processing view includes certain ideas about how adolescents' minds work and the best methods for studying this (Logan, 2000). As a facet of development, different aspects of information processing change as children make the transition through adolescence to adulthood. For example, changes in attention and memory are essentially changes in the way individuals process information. In our exploration of information processing, we will discuss developmental changes in attention and memory, as well as other cognitive processes, but first let's examine some basic characteristics of the information-processing approach.

Characteristics

Robert Siegler (1998) described three main characteristics of the information-processing approach:

- *Thinking.* In Siegler's view, thinking is information processing. In this regard, Siegler provides a broad perspective on thinking. He says that when adolescents perceive, encode, represent, and store information from the world, they are engaging in thinking. Siegler believes that thinking is highly flexible, which allows individuals to adapt and adjust to many changes in circumstances, task requirements, and goals. However, the human's remarkable thinking abilities have some constraints. Individuals can attend to only a limited amount of information at one point in time, and they are constrained by how fast they can process information.
- *Change mechanisms.* Siegler (2000) argues that the information-processing approach should focus on the role of mechanisms of change in development. He believes that four main mechanisms—encoding, automatization, strategy construction, and generalization—work together to create changes in children's and adolescents' cognitive skills. *Encoding* is the process by which information gets into memory. Siegler states that a key aspect of solving problems is encoding the relevant information and ignoring the irrelevant parts. Because it often takes time and effort to construct new strategies, children and adolescents must practice them in order to eventually execute them automatically and maximize their effectiveness. The term *automaticity* refers to the ability to process information with little or no effort. With age and experience, information processing becomes increasingly automatic on many tasks, allowing children and adolescents to detect connections among ideas and events that they otherwise would miss. An able 12-year-old zips through a practice list of multiplication problems with little conscious effort, and a 16-year-old picks up the newspaper and quickly scans the entertainment section for the location and time of a movie. In both cases, the information processing of these adolescents is more automatic and less effortful than that of children.

Recall that earlier in the chapter we described Robbie Case's neo-Piagetian view. Case's view includes an emphasis on changes in the way that adolescents process information differently than children. His view includes an aspect of information processing emphasized by Siegler: automaticity. In Case's (1992, 1998, 2000) view adolescents have more cognitive resources available to them because of automaticity, increased information-processing capacity, and more familiarity with a range of content knowledge. These advances in information processing reduce the load on cognitive systems, allowing adolescents to hold in mind several dimensions of a topic or a problem simultaneously. In contrast, children are more prone to focus on only one dimension.

THE INFORMATION-PROCESSING VIEW

Characteristics

Attention and Memory

Decision Making

Critical Thinking

Metacognition and Self-Regulatory Learning

Creative Thinking

The third and fourth change mechanisms proposed by Siegler are strategy construction and generalization. *Strategy construction* involves the discovery of a new procedure for processing information. Siegler says that adolescents need to encode key information about a problem and coordinate the information with relevant prior knowledge to solve the problem. To fully benefit from a newly constructed strategy, adolescents need to generalize it, or apply it to other problems.

• *Self-modification.* The contemporary information-processing approach argues, as does Piaget's theory of cognitive development, that adolescents play an active role in their development. They use knowledge and strategies that they have learned in previous circumstances to adapt their responses to a new learning situation. In this manner, adolescents build newer and more sophisticated responses from prior knowledge and strategies.

Attention and Memory

Although the bulk of research on information processing has been conducted with children and adults, the information-processing perspective is important in understanding adolescent cognition. As we saw in the example of the adolescent solving an algebraic equation, attention and memory are two important cognitive processes.

Attention   *Pay attention* is a phrase children and adolescents hear all of the time. Just what is *attention? Attention* is the concentration and focusing of mental effort. Attention also is both selective and shifting. For example, when adolescents take a test, they must attend to it. This implies that they have the ability to focus their mental effort on certain stimuli (the test questions) while excluding other stimuli, an important aspect of attention called *selectivity.* When selective attention fails adolescents, they have difficulty ignoring information that is irrelevant to their interest or goals. For example, if a television set is blaring while the adolescent is studying, the adolescent could have difficulty concentrating.

Not only is attention selective, but it is also *shiftable.* If a teacher asks students to pay attention to a certain question and they do so, their behavior indicates that they can shift the focus of their mental effort from one stimulus to another. If the telephone rings while the adolescent is studying, the adolescent may shift attention from studying to the telephone. An external stimulus is not necessary to shift attention. At any moment, adolescents can shift their attention from one topic to another, virtually at will. They might think about the last time they went to a play, then think about an upcoming musical recital, and so on.

In one investigation, 12-year-olds were markedly better than 8-year-olds and slightly worse than 20-year-olds at allocating their attention in a situation involving two tasks (Manis, Keating, & Morrison, 1980). Adolescents might have more resources available (through increased processing speed, capacity, and automaticity), or they might be more skilled at directing these resources.

Memory   There are few moments when adolescents' lives are not steeped in memory. Memory is at work with each step adolescents take, each thought they think, and each word they utter. *Memory* is the retention of information over time. It is central to mental life and to information processing. To successfully learn and reason, adolescents need to hold on to information and to retrieve the information they have tucked away. Three important memory systems are short-term memory, working memory, and long-term memory.

Short-Term Memory   *Short-term memory* is a limited-capacity memory system in which information is retained for as long as 30 seconds, unless the information is rehearsed, in which case it can be retained longer. A common way to assess short-term memory is to present a list of items to remember, which is often referred to as a memory span task. If you have taken an IQ test, you probably were asked to remember a string of numbers or words. You simply

What changes in attention characterize adolescence?

hear a short list of stimuli—usually digits—presented at a rapid pace (one per second, for example). Then you are asked to repeat the digits back. Using the memory span task, researchers have found that short-term memory increases extensively in early childhood and continues to increase in older children and adolescents, but at a slower pace. For example, in one investigation, memory span increased by 1½ digits between the ages of 7 and 13 (Dempster, 1981). Keep in mind, though, memory span's individual differences, which is why IQ and various aptitude tests are used.

How might short-term memory be used in problem solving? In a series of experiments, Robert Sternberg and his colleagues (Sternberg, 1977; Sternberg & Nigro, 1980; Sternberg & Rifkin, 1979) attempted to answer this question by giving third-grade, sixth-grade, ninth-grade, and college students analogies to solve. The main differences occurred between the younger (third- and sixth-grade) and older (ninth-grade and college) students. The older students were more likely to complete the information processing required to solve the analogy task. The children, by contrast, often stopped their processing of information before they had considered all of the necessary steps required to solve the problems. Sternberg believes that information processing was incomplete because the children's short-term memory was overloaded. Solving problems such as analogies requires individuals to make continued comparisons between newly encoded information and previously coded information. Sternberg argues that adolescents probably have more storage space in short-term memory, which results in fewer errors on problems like analogies.

In addition to more storage space, are there other reasons adolescents might perform better on memory span tasks and in solving analogies? Though many other factors could be involved, information-processing psychologists believe that changes in the speed and efficiency of information processing are important, especially the speed with which information can be identified.

Working Memory   An increasing number of psychologists believe that the way short-term memory has been historically described is too passive and does not do justice to the amount of cognitive work that is done over the short term in memory (Kail & Hall, 2001; Murdock, 1999). They prefer the concept of working memory to describe how memory works on a short-term basis (Sussman, 2001; Waters & Caplan, 2001). British psychologist Alan Baddeley (1992, 2000) proposed the concept of *working memory,* which is a kind of "mental workbench" where information is manipulated and assembled to help make decisions, solve problems, and comprehend written and spoken language.

In one recent study across the life span, the performances of individuals from 6 to 57 years of age were examined on both verbal and visuospatial working memory tasks (Swanson, 1999). The two verbal tasks were auditory digit sequence (the ability to remember numerical information embedded in a short sentence, such as "Now suppose somebody wanted to have take them to the supermarket at 8651 Elm Street") and semantic association (the ability to organize words into abstract categories). In the semantic association task, the participant was presented with a series of words and then asked to remember how they go together (such as shirt, saw, pants, hammer, shoes, and nails).

The two visuospatial tasks used in this study involved mapping/directions and a visual matrix. In the mapping/directions task, the participant was shown a street map in which the lines connected to a number of dots illustrated the direction of the bicycle (child/young adolescent) or car (adult) would go to get through the city. The dots represented stoplights and the lines the direction of the vehicle. After briefly looking at the map, participants were asked to draw the directions and dots on a blank map. In the visual matrix task, participants were asked to remember visual sequences within a matrix that involved a series of dots. After looking at the visual matrix for five seconds, it was removed and the participants were asked questions about the location of the dots.

As shown in figure 4.6 on p. 122, there was a substantial increase in the working memory of individuals from 8 through 24 years of age on all four tasks. Thus, it is likely that the adolescent years are an important developmental time frame for improvement

I come into the fields and spacious palaces of my memory, where are treasures of countless images of things of every manner.
—St. Augustine
Christian Church Father, 5th Century

Memory Links
http://www.mhhe.com/santrocka9
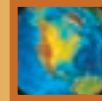
FIGURE 4.6
Developmental Changes in Working Memory

Note: The scores shown here are the means for each age group and the age also represents a mean age. Higher scores reflect superior working memory performance.

	Task			
	Verbal		Visuospatial	
Age	Semantic Association	Digit/ Sentence	Mapping/ Directions	Visual Matrix
8	1.33	1.75	3.13	1.67
10	1.70	2.34	3.60	2.06
13	1.86	2.94	4.09	2.51
16	2.24	2.98	3.92	2.68
24	2.60	3.71	4.64	3.47
Highest Working Memory Performance				
	3.02 (age 45)	3.97 (age 35)	4.90 (age 35)	3.47 (age 24)

in working memory and that working memory continues to improve through the transition to adulthood and beyond.

Long-Term Memory   *Long-term memory* is a relatively permanent memory system that holds huge amounts of information for a long period of time. Long-term memory increases substantially in the middle and late childhood years and likely continues to improve during adolescence, although this has not been well documented by researchers. If anything at all is known about long-term memory, it is that it depends on the learning activities engaged in when learning and remembering information (Pressley & Schneider, 1997; Siegler, 1996). Most learning activities fit under the category of *strategies,* activities under the learner's conscious control. They sometimes are also called control processes. There are many of these activities, but one of the most important is organization, the tendency to group or arrange items into categories. We will have more to say about strategies shortly.

Attention and memory are important dimensions of information processing, but other dimensions also are important. Once adolescents attend to information and retain it, they can use the information to engage in a number of cognitive activities, such as making decisions, thinking critically, and thinking creatively. Let's begin our exploration of these cognitive activities by examining what is involved in decision making.

Decision Making

Adolescence is a time of increased decision making—about the future, which friends to choose, whether to go to college, which person to date, whether to have sex, whether to buy a car, and so on (Byrnes, 1997; Galotti & Kozberg, 1996). How competent are adolescents at making decisions? In some reviews, older adolescents are described as more competent than younger adolescents, who, in turn, are more competent than children (Keating, 1990). Compared to children, young adolescents are more likely to generate options, to examine a situation from a variety of perspectives, to anticipate the consequences of decisions, and to consider the credibility of sources.

One study documents that older adolescents are better at decision making than younger adolescents are (Lewis, 1981). Eighth-, tenth-, and twelfth-grade students were presented with dilemmas involving the choice of a medical procedure. The oldest students were most likely to spontaneously mention a variety of risks, to recommend

consultation with an outside specialist, and to anticipate future consequences. For example, when asked a question about whether to have cosmetic surgery, a twelfth-grader said that different aspects of the situation need to be examined along with its effects on the individual's future, especially relationships with other people. In contrast, an eighth-grader presented a more limited view, commenting on the surgery's effects on getting turned down for a date, the money involved, and being teased by peers.

In sum, older adolescents often make better decisions than do younger adolescents, who, in turn, make better decisions than children do. But the decision-making skills of older adolescents are far from perfect, as are those of adults (Klaczynski, 1997). Indeed, some researchers have recently found that adolescents and adults do not differ in their decision-making skills (Quadrel, Fischoff, & Davis, 1993).

Being able to make competent decisions does not guarantee that one will make them in everyday life, where breadth of experience often comes into play (Jacobs & Potenza, 1990; Keating, 1990). For example, driver-training courses improve adolescents' cognitive and motor skills to levels equal to, or sometimes superior to, those of adults. However, driver training has not been effective in reducing adolescents' high rate of traffic accidents (Potvin, Champagne, & Laberge-Nadeau, 1988). An important research agenda is to study the ways adolescents make decisions in practical situations.

Adolescents need more opportunities to practice and discuss realistic decision making (Jones, Rasmussen, & Moffitt, 1997). Many real-world decisions occur in an atmosphere of stress that includes such factors as time constraints and emotional involvement. One strategy for improving adolescent decision making about real-world choices involving such matters as sex, drugs, and daredevil driving is for schools to provide more opportunities for adolescents to engage in role-playing and group problem solving related to such circumstances.

Another strategy is for parents to involve their adolescents in appropriate decision-making activities. In one study of more than 900 young adolescents and a subsample of their parents, adolescents were more likely to participate in family decision making when they perceived themselves as in control of what happens to them and if they thought that their input would have some bearing on the outcome of the decision-making process (Liprie, 1993).

Critical Thinking

Closely related to making competent decisions is engaging in critical thinking, a current buzzword in education and psychology (Brooks & Brooks, 1999; Halonen, 1995) P. 28. **Critical thinking** *involves thinking reflectively and productively and evaluating the evidence.* In a recent study of fifth-, eighth-, and eleventh-graders, critical thinking increased with age but still only occurred in 43 percent of even the eleventh-graders, and many adolescents showed self-serving biases in their reasoning (Klaczynski & Narasimham, 1998).

Adolescence is an important transitional period in the development of critical thinking (Keating, 1990). Among the cognitive changes that allow improved critical thinking in adolescence are:

- Increased speed, automaticity, and capacity of information processing, which free cognitive resources for other purposes
- More breadth of content knowledge in a variety of domains
- Increased ability to construct new combinations of knowledge
- A greater range and more spontaneous use of strategies or procedures for applying or obtaining knowledge, such as planning, considering alternatives, and cognitive monitoring

Although adolescence is an important period in the development of critical-thinking skills, if a solid basis of fundamental skills (such as literacy and math skills) is

critical thinking
Thinking reflectively and productively and evaluating the evidence.

Exploring Critical Thinking
Critical Thinking Resources
Odyssey of the Mind
http://www.mhhe.com/santrocka9

CAREERS IN ADOLESCENT DEVELOPMENT

Laura Bickford
Secondary School Teacher

Laura Bickford teaches English and journalism in grades 9 to 12 and she is Chair of the English Department at Nordhoff High School in Ojai, California.

Laura especially believes it is important to encourage students to think. Indeed, she says that "the call to teach is the call to teach students how to think." She believes teachers need to show students the value in asking their own questions, in having discussions, and in engaging in stimulating intellectual conversations. Laura says that she also encourages students to engage in metacognitive strategies (knowing about knowing). For example, she asks students to comment on their learning after particular pieces of projects have been completed. She requires students to keep reading logs so they can observe their own thinking as it happens.

Laura Bickford, working with students writing papers.

The Jasper Project
Teresa Amabile's Research
http://www.mhhe.com/santrocka9

creativity
The ability to think in novel and unusual ways and come up with unique solutions to problems.

convergent thinking
A pattern of thinking in which individuals produce one correct answer; characteristic of the items on conventional intelligence tests; coined by Guilford.

divergent thinking
A pattern of thinking in which individuals produce many answers to the same question; more characteristic of creativity than convergent thinking; coined by Guilford.

not developed during childhood, such critical-thinking skills are unlikely to mature in adolescence. For the subset of adolescents who lack such fundamental skills, potential gains in adolescent thinking are not likely.

Considerable interest has recently developed in teaching critical thinking in schools. Cognitive psychologist Robert J. Sternberg (1985) believes that most school programs that teach critical thinking are flawed. He thinks that schools focus too much on formal reasoning tasks and not enough on the critical-thinking skills needed in everyday life. Among the critical-thinking skills that Sternberg believes adolescents need in everyday life are these: recognizing that problems exist, defining problems more clearly, handling problems with no single right answer or any clear criteria for the point at which the problem is solved (such as selecting a rewarding career), making decisions on issues of personal relevance (such as deciding to have a risky operation), obtaining information, thinking in groups, and developing long-term approaches to long-term problems.

One educational program that embodies Sternberg's recommendations for increased critical thinking in schools is the *Jasper Project,* twelve videodisc-based adventures that focus on solving real-world math problems. The Jasper Project is the brainchild of the Cognition and Technology Group at Vanderbilt (1997). Figure 4.7 on p. 125 shows one of the Jasper adventures. For students in grades 5 and up, Jasper helps them make connections with other disciplines including science, history, and social studies. Jasper's creators think that students need to be exposed to authentic, real-world problems that occur in everyday life. As students work together over several class periods, they have numerous opportunities to communicate about math, share their problem-solving strategies, and get feedback from others that refines their thinking. Jasper videodiscs for science also have been created.

For many years, the major debate in teaching critical thinking has been whether critical thinking skills should be taught as general entities or in the context of specific subject matter instruction (math, English, or science, for example). A number of experts on thinking believe the evidence has come down on the side of teaching critical thinking embedded in a rich subject matter (Kuhn, 1999, 2000a).

Today, another debate regarding critical thinking has emerged. On the one side are traditionalists who see critical thinking as a set of mental competencies that reside in adolescents' heads. On the other side are advocates of a situated-cognition approach to critical thinking who regard intellectual skills as social entities that are exercised and shared within a community (Resnick & Nelson-Gall, 1997; Rogoff, 1998). This ongoing debate has not yet been resolved.

Creative Thinking

Creativity *is the ability to think in novel ways and come up with unique solutions to problems.* Thus, intelligence, which we will discuss shortly, and creativity, are not the same thing. This was recognized by J. P. Guilford (1967), who distinguished between **convergent thinking,** *which produces one correct answer and is characteristic of the kind of thinking required on a conventional intelligence test,* and **divergent thinking,** *which produces many answers to the same question and is more characteristic of creativity.* For

example, a typical item on a conventional intelligence test is "How many quarters will you get in return for 60 dimes?" In contrast, the following questions have many possible answers: "What image comes to mind when you hear the phrase *sitting alone in a dark room?*" or "Can you think of some unique uses for a paper clip?"

Are intelligence and creativity related? Although most creative adolescents are quite intelligent, the reverse is not necessarily true. Many highly intelligent adolescents are not very creative.

An important goal is to help adolescents become more creative (Csikszentmihalyi, 2000). Here are some good strategies for accomplishing this goal:

• *Have adolescents engage in brainstorming and come up with as many meaningful ideas as possible. Brainstorming* is a technique in which individuals are encouraged to come up with creative ideas in a group, play off each other's ideas, and say practically whatever comes to mind about a particular topic. Whether in a group or on an individual basis, a good creativity strategy is to generate as many new ideas possible. The famous twentieth-century Spanish artist Pablo Picasso produced more than 20,000 works of art. Not all of them were masterpieces. The more ideas adolescents produce, the better are their chance of creating something unique (Rickards, 1999).

• *Provide adolescents with environments that stimulate creativity.* Some settings nourish creativity, others depress it. People who encourage adolescents' creativity rely on adolescents' natural curiosity. Science and discovery museums offer rich opportunities for the stimulation of adolescents' creative thinking.

• *Don't overcontrol.* Telling adolescents exactly how to do things leaves them feeling that any originality is a mistake and any exploration is a waste of time (Amabile, 1993). Letting adolescents select their interests and supporting their inclinations is less likely to destroy their natural curiosity than dictating which activities they should pursue (Conti & Amabile, 1999; Runco, 2000).

• *Encourage internal motivation.* Excessive use of prizes, such as money, can stifle creativity by undermining the intrinsic pleasure adolescents derive from creative activities. Creative adolescents' motivation is the satisfaction generated by the work itself.

• *Foster flexible and playful thinking.* Creative thinkers are flexible and play with ideas and problems—which gives rise to a paradox: Although creativity takes effort, the effort goes more smoothly if adolescents take it lightly. In a way, humor can grease the wheels of creativity (Goleman, Kaufmann, & Ray, 1993). When adolescents are joking around, they are more likely to consider unusual solutions to problems (O'Quin & Dirks, 1999).

• *Introduce adolescents to creative people.* Poet Richard Lewis (1997) visits classrooms in New York City. He brings with him only the glassy spectrum that is encased in a circular glass case. He lifts it above his head so that every student can see its colored charm, asking "Who can see something playing inside?" Then he asks students to write about what they see. One middle school student named Snigdha wrote that she sees the rainbow rising and the sun sleeping with the stars. She also wrote that she sees the rain dropping on the ground, stems breaking, apples falling from trees, and the wind blowing the leaves.

• *Talk with adolescents about creative people or have them read about them.* Mihaly Csikszentmihalyi (pronounced ME-high CHICK-sent-me-high-ee) (1995) interviewed 90 leading figures in the sciences, government, business, and education about their creativity. One such individual was Mark Strand, a U.S. poet laureate, who said that his most creative moments come when he loses a sense of time and becomes totally absorbed in what he is doing. He commented that the absorbed state comes and goes; he can't stay in it for an

"Blueprint for Success"

Christina and Marcus, two students from Trenton, visit an architectural firm on Career Day. While learning about the work of architects, Christina and Marcus hear about a vacant lot being donated in their neighborhood for a playground. This is exciting news because there is no place in their downtown neighborhood for children to play. Recently, several students have been hurt playing in the street. The challenge is for students to help Christina and Marcus design a playground and ballfield for the lot.

■ **FIGURE 4.7**
A Problem-Solving Adventure in the Jasper Project

Harvard Project Zero
Csikszentmihalyi's Ideas
http://www.mhhe.com/santrocka9

"What do you mean 'What is it?' It's the spontaneous, unfettered expression of a young mind not yet bound by the restraints of narrative or pictorial representation."

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metacognition
Cognition about cognition, or "knowing about knowing."

entire day. When Strand gets an intriguing idea, he focuses intensely on it and transforms it into a visual image.

We have discussed some important aspects of the way adolescents process information, but we still need to explore adolescents' monitoring of their information processing and self-regulatory learning strategies.

Metacognition and Self-Regulatory Learning

What is metacognition? How can adolescents develop better information-processing and self-regulatory learning strategies?

What Is Metacognition?   Earlier in the chapter when we discussed Piaget's theory, we indicated that adolescents' increase their thinking about thinking. Today, cognitive psychologists define **metacognition** *as cognition about cognition, or "knowing about knowing"* (Flavell, 1999; Flavell & Miller, 1998).

Metacognitive skills have been taught to students to help them solve math problems (Cardelle-Elawar, 1992). In each of thirty daily lessons involving math story problems, a teacher guided low-achieving students in learning to recognize when they did not know the meaning of a word, did not have all of the necessary information to solve a problem, did not know how to subdivide the problem into specific steps, or did not know how to carry out a computation. After the thirty daily lessons, the students who were given the metacognitive training had better math achievement and attitudes toward math.

One expert on thinking, Deanna Kuhn (2000b), believes that metacognition should be a stronger focus of efforts to help individuals become better critical thinkers, especially at the middle school and high school levels. She distinguishes between first-order cognitive skills that enable adolescents to know about the world (such skills have been the main focus of critical thinking programs) and second-order cognitive skills—*meta-knowing skills*—that entail knowing about one's own (and others') knowing.

Exploring Strategies and the Self-Regulation of Strategies   In the view of Michael Pressley (1983; McCormick & Pressley, 1997), the key to education is helping students learn a rich repertoire of strategies that result in solutions to problems. Good thinkers routinely use strategies and effective planning to solve problems. Good thinkers also know when and where to use strategies (they have metacognitive knowledge about strategies). Understanding when and where to use strategies often results from the learner's monitoring of the learning situation.

Pressley argues that when students are given instruction about effective strategies that are new to them, they often can apply these strategies on their own. However, some strategies are not effective for young children. For example, young children cannot competently use mental imagery. Pressley emphasizes that students benefit when the teacher models the appropriate strategy and overtly verbalizes the steps in the strategy. Then, students subsequently practice the strategy. Their practice of the strategy is guided and supported by the teacher's feedback until the students can effectively execute the strategy autonomously. When instructing students about employing the strategy, it also is a good idea to explain to them how using the strategy will benefit them.

Having practice in the new strategy usually is not enough for students to continue to use the strategy and transfer it to new situations. For effective maintenance and transfer, encourage students to monitor the effectiveness of the new strategy relative to their use of old strategies by comparing their performance on tests and other assessments. Pressley says that it is not enough to say "Try it, you will like it;" you need to say "Try it and compare."

Learning how to use strategies effectively usually takes time and requires guidance and support from the teacher. With practice, strategies are executed faster and more competently. "Practice" means using the effective strategy over and over again until it is

automatically performed. For learners to execute the strategies effectively, they need to have the strategies in long-term memory, and extensive practice makes this possible. Learners also need to be motivated to use the strategies.

Do children and adolescents use one strategy or multiple strategies in memory and problem solving? They often use more than one strategy (Schneider & Bjorklund, 1998; Siegler, 1998). Most children and adolescents benefit from generating a variety of alternative strategies and experimenting with different approaches to a problem, discovering what works well, when, and where (Schneider & Bjorklund, 1998).

Self-Regulatory Learning   **Self-regulatory learning** *consists of the self-generation and self-monitoring of thoughts, feelings, and behaviors to reach a goal.* These goals might be academic (improving comprehension while reading, becoming a more organized writer, learning how to do multiplication, asking relevant questions) or they might be socioemotional (controlling one's anger, getting along better with peers). What are some of the characteristics of self-regulated learners? Self-regulatory learners (Winne, 1995, 1997; Winne & Perry, 2000):

• Set goals for extending their knowledge and sustaining their motivation
• Are aware of their emotional makeup and have strategies for managing their emotions
• Periodically monitor their progress toward a goal
• Fine-tune or revise their strategies based on the progress they are making
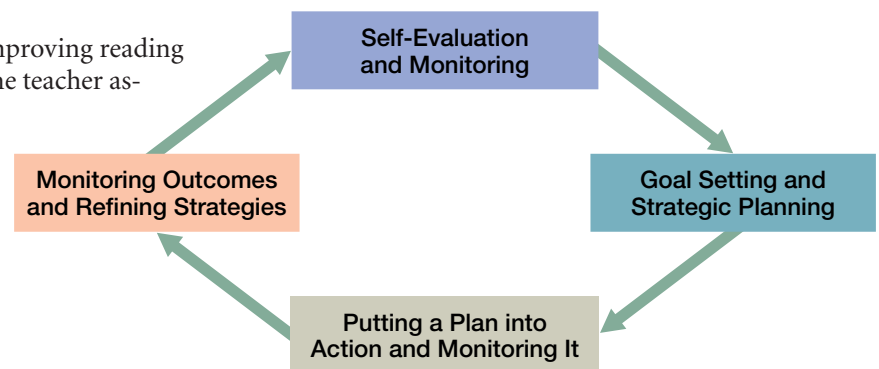• Evaluate obstacles that arise and make the necessary adaptations

Researchers have found that most high-achieving students are self-regulatory learners (Paris & Paris, 2001; Pressley, 1995; Rudolph & others, 2001; Schunk & Zimmerman, 1994; Zimmerman, 2000). For example, compared with low-achieving students, high-achieving students set more specific learning goals, use more strategies to learn, self-monitor their learning more, and more systematically evaluate their progress toward a goal (Schnuk & Ertmer, 2000).

Teachers, tutors, mentors, counselors, and parents can help students become self-regulatory learners. Barry Zimmerman, Sebastian Bonner, and Robert Kovach (1996) developed a model of turning low-self-regulatory students into students who engaged in these multistep strategies: (1) self-evaluation and monitoring, (2) goal setting and strategic planning, (3) putting a plan into action and monitoring it, and (4) monitoring outcomes and refining strategies (see figure 4.8).

They describe a seventh-grade student who is doing poorly in history and apply their self-regulatory model to her situation. In step 1, she self-evaluates her studying and test preparation by keeping a detailed record of them. The teacher gives her some guidelines for keeping these records. After several weeks, the student turns in the records and traces her poor test performance to low comprehension of difficult reading material.

In step 2, the student sets a goal, in this case of improving reading comprehension, and plans how to achieve the goal. The teacher assists her in breaking down the goal into component parts, such as locating main ideas and setting specific goals for understanding a series of paragraphs in her textbook. The teacher also provides the student with strategies, such as focusing initially on the first sentence of each paragraph and then scanning the others as a means of identifying main ideas. Another support the teacher might offer the student is adult or peer tutoring in reading comprehension if it is available.

In step 3, the student puts the plan into action and begins to monitor her progress. Initially she

self-regulatory learning
The self-generation and self-monitoring of thoughts, feelings, and behaviors to reach a goal.

Self-Regulatory Learning
http://www.mhhe.com/santrocka9
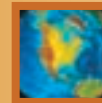
FIGURE 4.8
A Model of Self-Regulatory Learning

might need help from the teacher or tutor in identifying main ideas in the reading. This feedback can help her monitor her reading comprehension more effectively on her own.

In step 4, the student monitors her improvement in reading comprehension by evaluating whether it has had any impact on her learning outcomes. Most importantly: Has her improvement in reading comprehension led to better performance on history tests?

Since the last review, we have examined a number of ideas about the information-processing view. These questions should help you to reach your learning goals related to this topic.

■ FOR YOUR REVIEW

Learning Goal 3
Evaluate the information-processing view

- Siegler states that the information-processing view emphasizes thinking, change mechanisms (encoding, automaticity, strategy construction, and generalization), and self-modification.
- Adolescents typically have better attentional skills than children do. They also have better short-term memory, working memory, and long-term memory than children.
- Adolescence is a time of increased decision making. Older adolescents make better decisions than younger adolescents, who in turn are better at this than children are. Being able to make competent decisions, however, does not mean they actually will be made in everyday life, where breadth of experience comes into play.
- Critical thinking involves thinking reflectively, productively, and evaluating the evidence. Adolescence is an important transitional period in critical thinking because of such cognitive changes as increased speed, automaticity, and capacity of information processing; more breadth of content knowledge; increased ability to construct new combinations of knowledge; and a greater range and spontaneous use of strategies. Debates about critical thinking involve whether it should be taught in a general way or tied to specific subject matter and whether it resides in adolescents' heads or involves situated cognition.
- Thinking creatively is the ability to think in novel and unusual ways and come up with unique solutions to problems. Guilford distinguished between convergent and divergent thinking. A number of strategies, including brainstorming, can be used to stimulate creative thinking.
- Metacognition is cognition about cognition, or knowing about knowing. In Pressley's view, the key to education is helping students learn a rich repertoire of strategies that results in solutions to problems. Kuhn argues that metacognition is the key to developing critical-thinking skills. Self-regulatory learning consists of the self-generation and self-monitoring of thoughts, feelings, and behaviors to reach a goal. Most high-achieving students are self-regulatory learners.

So far in this chapter we have explored two major approaches to adolescent cognition: cognitive developmental and information processing. Next, we will explore a third major approach: psychometric/intelligence.

THE PSYCHOMETRIC/
INTELLIGENCE VIEW

Intelligence
Tests

Controversies
and Issues in
Intelligence

Theories of
Multiple
Intelligences

Emotional
Intelligence
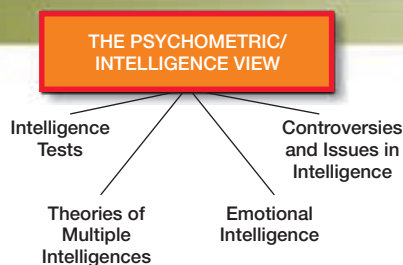
psychometric/intelligence view
A view that emphasizes the importance of individual differences in intelligence; many advocates of this view also argue that intelligence should be assessed with intelligence tests.

THE PSYCHOMETRIC/INTELLIGENCE VIEW

The two views of adolescent cognition that we have discussed so far—cognitive developmental and information processing—do not emphasize IQ tests or individual variations in intelligence. The **psychometric/intelligence view** *does emphasize the importance of individual differences in intelligence, and many advocates of this view argue that intelligence should be assessed with intelligence tests.* An increasing issue in the field of intelligence involves pinning down what the components of intelligence really are (Embretson & McCollom, 2000).

Twentieth-century English novelist Aldous Huxley said that children are remarkable for their curiosity and intelligence. What did Huxley mean when he used the word *intelligence?* Intelligence is one of our most prized possessions, yet even the most intelligent people have not been able to agree on what intelligence is. Unlike height, weight, and age, intelligence cannot be directly measured. You can't peer into a student's head

and observe the intelligence going on inside. We only can evaluate a student's intelligence *indirectly* by studying the intelligent acts that it generates. For the most part, we have relied on written intelligence tests to provide an estimate of a student's intelligence (Kail & Pellegrino, 1985; Kaufman, 2000a).

Some experts describe intelligence as including verbal ability and problem-solving skills. Others describe it as the ability to adapt to and learn from life's everyday experiences. Combining these ideas we can arrive at a fairly traditional definition of **intelligence** *as problem-solving skills and the ability to adapt to and learn from life's everyday experiences.* But even this broad definition doesn't satisfy everyone. As you will see shortly, some theorists propose that musical skills should be considered part of intelligence. And a definition of intelligence based on a theory like Vygotsky's would have to include the ability to use the tools of the culture with help from more-skilled individuals. Because intelligence is such an abstract, broad concept, it is not surprising that there are so many different possible definitions of it.

intelligence
Mental ability related to problem-solving skills, and the ability to adapt to and learn from life's everyday experiences; not everyone agrees on what constitutes intelligence.

Intelligence Tests

Robert J. Sternberg recalls being terrified of taking IQ tests as a child. He says that he literally froze when the time came to take such tests. Even as an adult, Sternberg feels stung by humiliation when he recalls being in the sixth grade and taking an IQ test with fifth-graders. Sternberg eventually overcame his anxieties about IQ tests. Not only did he begin to perform better on them, but at age 13 he devised his own IQ test and began using it to assess classmates—that is, until the school principal found out and scolded him. Sternberg became so fascinated by intelligence that he made its study one of his lifelong pursuits. Later in this chapter we will discuss his theory of intelligence. To begin, though, let's go back in time to examine the first valid intelligence test.

The Binet Tests   In 1904 the French Ministry of Education asked psychologist Alfred Binet to devise a method of identifying children who were unable to learn in school. School officials wanted to reduce crowding by placing in special schools students who did not benefit from regular classroom teaching. Binet and his student Theophile Simon developed an intelligence test to meet this request. The test is called the 1905 Scale. It consisted of 30 questions, ranging from the ability to touch one's ear to the ability to draw designs from memory and define abstract concepts.

Binet developed the concept of **mental age (MA),** *an individual's level of mental development relative to others.* Not much later, in 1912, William Stern created the concept of **intelligent quotient (IQ),** *which refers to a person's mental age divided by chronological age (CA), multiplied by 100. That is, IQ = MA/CA × 100.*

If mental age is the same as chronological age, then the person's IQ is 100. If mental age is above chronological age, then IQ is more than 100. If mental age is below chronological age, then IQ is less than 100. Scores noticeably above 100 are considered above-average. Scores noticeably below 100 are labeled below-average. For example, a 16-year-old with a mental age of 20 would have an IQ of 125, while a 16-year-old child with a mental age of 12 would have an IQ of 75.

The Binet test has been revised many times to incorporate advances in the understanding of intelligence and intelligence testing (Naglieri, 2000). These revisions are called the Stanford-Binet tests (because the revisions were made at Stanford University). By administering the test to large numbers of people of different ages from different backgrounds, researchers have found that scores on a Stanford-Binet test approximate a normal distribution (see figure 4.9 on p. 130). A **normal distribution** *is symmetrical, with a majority of the scores falling in the middle of the possible range of scores and few scores appearing toward the extremes of the range.*

The current Stanford-Binet is administered individually to people from the age of 2 through the adult years. It includes a variety of items, some of which require verbal responses and others of which require nonverbal responses. For example, items that reflect a typical 6-year-old's level of performance on the test include the verbal ability to define at least six words, such as *orange* and *envelope,* as well as the nonverbal ability

mental age (MA)
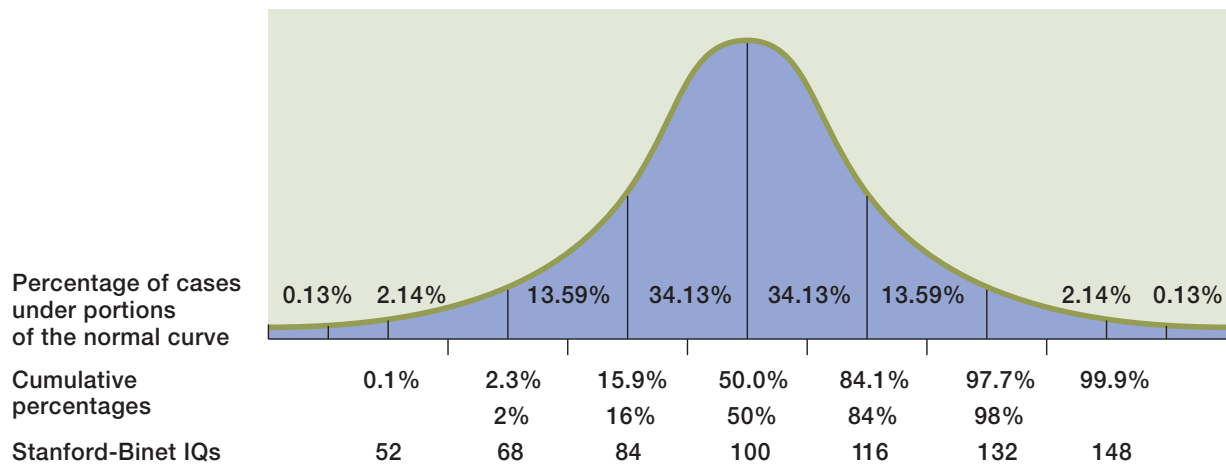An individual's level of mental development relative to others; a concept developed by Binet.

intelligent quotient (IQ)
A person's tested mental age divided by chronological age, multiplied by 100.

normal distribution
A symmetrical distribution of values or scores, with a majority of scores falling in the middle of the possible range of scores and few scores appearing toward the extremes of the range; a distribution that yields what is called a "bell-shaped curve."

Percentage of cases under portions of the normal curve	0.13%	2.14%	13.59%	34.13%	34.13%	13.59%	2.14%	0.13%
Cumulative percentages		0.1%	2.3% 2%	15.9% 16%	50.0% 50%	84.1% 84%	97.7% 98%	99.9%
Stanford-Binet IQs		52	68	84	100	116	132	148

■ FIGURE 4.9

The Normal Curve and Stanford-Binet IQ Scores

The distribution of IQ scores approximates a normal curve. Most of the population falls in the middle range of scores. Notice that extremely high and extremely low scores are very rare. Slightly more than two-thirds of the scores fall between 84 and 116. Only about 1 in 50 individuals has an IQ of more than 132 and only about 1 in 50 individuals has an IQ of less than 68.

to trace a path through a maze. Items that reflect an average adult's level of performance include defining such words as *disproportionate* and *regard,* explaining a proverb, and comparing idleness and laziness.

The fourth edition of the Stanford-Binet was published in 1985. One important addition in this version was the analysis of the individual's responses in terms of four functions: verbal reasoning, quantitative reasoning, abstract/visual reasoning, and short-term memory. A general composite score is still obtained to reflect overall intelligence. The Stanford-Binet continues to be one of the tests most widely used to assess a student's intelligence.
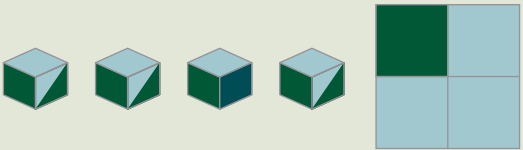
The Wechsler Scales   Another set of tests widely used to assess students' intelligence is the Wechsler scales, developed by David Wechsler (Kaufman, 2000b). They include the Wechsler Preschool and Primary Scale of Intelligence–Revised (WPPSI-R) to test children 4 to 6½ years of age; the Wechsler Intelligence Scale for Children–Revised (WISC-R) for children and adolescents 6 to 16 years of age; and the Wechsler Adult Intelligence Scale–Revised (WAIS-R).

In addition to an overall IQ, the Wechsler scales also yield verbal and performance IQs. Verbal IQ is based on six verbal subscales, performance IQ on five performance subscales (Naglieri, 2000). This allows the examiner to quickly see patterns of strengths and weaknesses in different areas of the student's intelligence. Samples of WAIS-R subscales are shown in Figure 4.10 on p. 131.

Theories of Multiple Intelligences

Is it more appropriate to think of an adolescent's intelligence as a general ability or as a number of specific abilities?

Early Views   Binet and Stern both focused on a concept of general intelligence, which Stern called IQ. Wechsler believed it was possible and important to describe both a person's general intelligence and more specific verbal and performance intelligences. He was building on the ideas of Charles Spearman (1927), who said that people have both a general intelligence, which he called *g,* and specific types of intelligence, which he called *s.* As early as the 1930s, L. L. Thurstone (1938) said people have seven of these specific abilities, which he called primary mental abilities: verbal comprehension, number ability, word fluency, spatial visualization, associative memory, reasoning,

VERBAL SUBSCALES

SIMILARITIES
An individual must think logically and abstractly to answer a number of questions about how things might be similar.

For example, "In what ways are boats and trains the same?"

PERFORMANCE SUBSCALES

BLOCK DESIGN
An individual must assemble a set of multicolored blocks to match designs that the examiner shows. Visual-motor coordination, perceptual organization, and the ability to visualize spatially are assessed.

For example, "Use the four blocks on the left to make the pattern at the right."

Remember that the Wechsler includes 11 subscales, 6 verbal and 5 nonverbal. Two of the subscales are shown here.

◼ **FIGURE 4.10**

Sample Subscales of the Wechsler Adult Intelligence Scale–Revised

Remember that the Wechsler includes 11 subscales, 6 verbal and 5 nonverbal. Two of the subscales are shown here.

Simulated items from the Wechsler Adult Intelligence Scale–Revised. Copyright © 1981, 1955 by The Psychological Corporation. All rights reserved.

and perceptual speed. More recently, the search for specific types of intelligence has heated up.

Sternberg's Triarchic Theory   Robert J. Sternberg (1986) developed the **triarchic theory of intelligence,** *which states that intelligence comes in three forms: analytical, creative, and practical.*

Analytical intelligence involves the ability to analyze, judge, evaluate, compare, and contrast. Creative intelligence consists of the ability to create, design, invent, originate, and imagine. Practical intelligence focuses on the ability to use, apply, implement, and put into practice (Wagner, 2000). Consider these three students:

- Ann scores high on traditional intelligence tests, such as the Stanford-Binet, and is a star analytical thinker.
- Todd does not have the best tests scores but has an insightful and creative mind.
- Art is street-smart and has learned to deal in practical ways with his world although his scores on traditional intelligence tests are low.

Some students are equally high in all three areas; others do well in one or two.

Sternberg (1997, 1999, 2000; Sternberg, Torff, & Grigorenko, 1998) says that students with different triarchic patterns "look different" in school. Students with high analytic ability tend to be favored in conventional schooling. They often do well in direct-instruction classes in which the teacher lectures and students are given objective tests. They often are considered to be "smart" students who get good grades, show up in high-level tracks, do well on traditional tests of intelligence and the SAT, and later get admitted to competitive colleges.

Students who are high in creative intelligence often are not on the top rung of their class. Sternberg says that many teachers have expectations about how assignments should be done, and that creatively intelligent students might not conform to these. Instead of giving conformist answers, they give unique answers, for which they sometimes are reprimanded or marked down. Most teachers do not want to discourage

triarchic theory of intelligence
Sternberg's view that intelligence comes in three main forms: analytical, creative, and practical.

Sternberg's Theory
http://www.mhhe.com/santrocka9

"You're wise, but you lack tree smarts."

creativity, but Sternberg believes that too often a teacher's desire to improve students' knowledge inhibits creative thinking.

Like students high in creative intelligence, students who are high in practical intelligence often do not relate well to the demands of school. However, these students often do well outside the classroom. They might have excellent social skills and good common sense. As adults, they sometimes become successful managers, entrepreneurs, or politicians, despite undistinguished school records.

Sternberg believes that few tasks are purely analytic, creative, or practical. Most require some combination of these skills. For example, when students write a book report, they might (1) analyze the book's main themes, (2) generate new ideas about how the book might have been written better, and (3) think about how the book's themes can be applied to people's lives.

He believes that in teaching it is important to balance instruction related to the three types of intelligence. That is, students should be given opportunities to learn through analytical, creative, and practical thinking, in addition to conventional strategies that focus on simply "learning" and remembering a body of information. You might be wondering whether there is a Sternberg triarchic intelligence test available. As yet, there isn't.

Gardner's Eight Frames of Mind   Howard Gardner (1983, 1993) believes there are eight types of intelligence. They are described here, along with examples of the types of individuals in which they are reflected as strengths (Campbell, Campbell, & Dickinson, 1999):

- *Verbal skills:* the ability to think in words and to use language to express meaning (authors, journalists, speakers)
- *Mathematical skills:* the ability to carry out mathematical operations (scientists, engineers, accountants)
- *Spatial skills:* the ability to think in three-dimensional ways (architects, artists, sailors)
- *Bodily-kinesthetic skills:* the ability to manipulate objects and be physically skilled (surgeons, craftspeople, dancers, athletes)
- *Musical skills:* Possessing a sensitivity to pitch, melody, rhythm, and tone (composers, musicians, and sensitive listeners)
- *Interpersonal skills:* Ability to understand and effectively interact with others (successful teachers, mental health professionals)
- *Intrapersonal skills:* Ability to understand oneself and effectively direct one's life (theologians, psychologists)
- *Naturalist skills:* ability to observe patterns in nature and understand natural and human-made systems (farmers, botanists, ecologists, landscapers)

Gardner says that the different forms of intelligence can be destroyed by brain damage, that each involves unique cognitive skills, and that each shows up in unique ways in both the gifted and idiot savants (individuals with mental retardation who have an exceptional talent in a particular domain, such as drawing, music, or computing).

An Interview with Howard Gardner
Multiple-Intelligences Links
http://www.mhhe.com/santrocka9

Evaluating the Multiple-Intelligences Approaches   Sternberg's and Gardner's approaches have much to offer. They have stimulated broader thinking about what makes up adolescents' competencies. And they have motivated educators to develop programs that instruct students in multiple domains (Torff, 2000). These approaches also have contributed to the interest in assessing intelligence in innovative ways that go beyond conventional standardized and paper-and-pencil memory tasks.

Some critics say that classifying musical skills as a main type of intelligence is off base. Why not also classify other skill domains as types of intelligence? For

example, there are outstanding chess players, prizefighters, writers, politicians, physicians, lawyers, ministers, and poets, yet we do not refer to chess intelligence, prizefighter intelligence, and so on. Other critics say that the research has not yet been conducted to support the thesis that the Sternberg's three intelligences and Gardner's eight intelligences are the best ways to categorize intelligence.

Emotional Intelligence

Both Sternberg's and Gardner's views include categories of social intelligence. In Sternberg's theory the category is called "practical intelligence" and in Gardner's theory the categories are "insights about self" and "insights about others." However, the greatest interest in recent years in the social aspects of intelligence has focused on the concept of emotional intelligence. **Emotional intelligence** *was proposed in 1990 as a form of social intelligence that involves the ability to monitor one's own and others' feelings and emotions, to discriminate among them, and to use this information to guide one's thinking and action* (Salovy & Mayer, 1990). However, the main interest in emotional intelligence was ushered in with the publication of Daniel Goleman's (1995) book, *Emotional Intelligence.* Goleman believes that when it comes to predicting an adolescent's competence, IQ as measured by standardized intelligence tests matters less than emotional intelligence. In Goleman's view, emotional intelligence involves these four main areas:

emotional intelligence
A form of social intelligence that involves the ability to monitor one's own and others' feelings and emotions, to discriminate among them, and to use this information to guide one's thinking and action.

- *Developing emotional self-awareness* (such as the ability to separate feelings from actions)
- *Managing emotions* (such as being able to control anger)
- *Reading emotions* (such as taking the perspectives of others)
- *Handling relationships* (such as the ability to solve relationship problems)

One private school in San Francisco, the Nueva School, has a class in self science that is closely related to the concept of emotional intelligence. The subject in self science is feelings—the adolescent's own and those involved in relationships. Teachers speak to such emotional issues as hurt over being left out, envy, and disagreements that can disrupt relationships. These are some of the topics in a fifth-grade self-science class at the Nueva School:

- Having self-awareness (in the sense of recognizing feelings and building a vocabulary for them; seeing links between thoughts, feelings, and reactions)
- Knowing if thoughts or feelings are governing a decision
- Seeing the consequences of alternative choices
- Applying these insights to decisions about such issues as drugs, smoking, and sex
- Managing emotions; learning to handle anxieties, anger, and sadness
- Taking responsibility for decisions and actions, such as following through on commitments
- Understanding that empathy, understanding others' feelings, and respecting differences in how people feel about things are key aspects of getting along in the social world
- Recognizing the importance of relationships and learning how to be a good listener and question asker; learning how to cooperate, resolve conflicts, and negotiate

Names for these classes range from "Social Development" to "Life Skills" to "Social and Emotional Learning." Their common goal is raise every child's and adolescent's emotional competence as part of regular education rather than focus on emotional skills as only something to be taught remedially to those who are faltering and identified as "troubled."

Measures of emotional intelligence have been and are being developed, but as yet none has reached the point of wide acceptance (Goleman, 1995; Rockhill & Greener, 1999; Salovy & Woolery, 2000). Especially lacking is research on the predictive validity of these measures (Mayer, Carsuso, & Salovy, 2000).
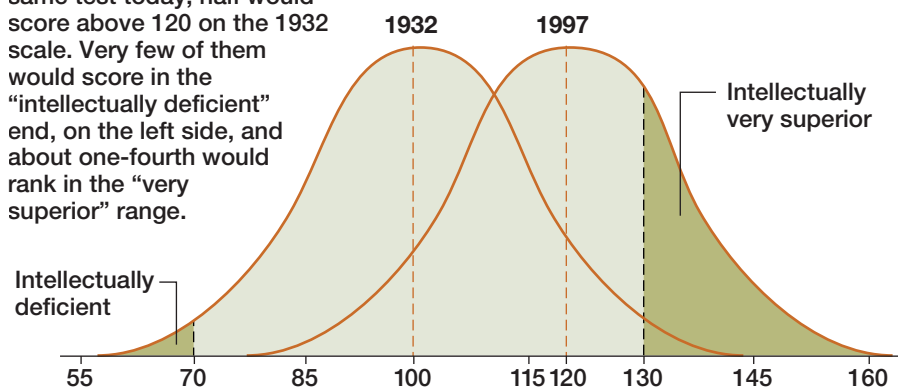
Controversies and Issues in Intelligence

The topic of intelligence is surrounded by controversy. Among those controversies are whether nature or nurture is more important in determining intelligence, how much intelligence tests are culturally biased, and appropriate and inappropriate uses of intelligence tests (Brody, 2000).

Nature and Nurture   In chapters 1 and 3, we introduced the question of how extensively nature (heredity) and nurture (environment) influence adolescents' development ◀▥ Pp. 22, 97. Some scientists proclaim that intelligence is primarily inherited and that environmental experiences play only a minimal role in its manifestation (Herrnstein & Murray, 1994; Jensen, 1969). Heredity is an important part of the intelligence equation (Grigorenko, 2000; Loehlin, 2000; Scarr, 1996). However, the emerging view on the nature-nurture controversy is that many complicated qualities, such as intelligence, probably have a genetic basis for a *propensity* for a particular developmental trajectory, such as low, average, or high intelligence. If such genes exist, they certainly are found both in adolescents whose families and environments appear to promote the development of adolescents' abilities and in adolescents whose families and environments do not appear as supportive. Regardless of one's genetic background, growing up with "all the advantages" does not guarantee eventual high intelligence and success, especially if those advantages are taken for granted. Nor does the absence of such advantages guarantee eventual low intelligence or failure, especially if the family and adolescent can make the most of whatever opportunities are available to them.

One argument for the importance of environment in intelligence involves the increasing scores of IQ tests around the world. Scores on these tests have been increasing so fast that a high percentage of people who would have been regarded as having average intelligence at the turn of the twentieth century would be considered below average in intelligence today (Hall, 1998) (see figure 4.11). If a representative sample of people today took the Stanford-Binet test used in 1932, about one-fourth would be defined as having very superior intelligence, a label usually accorded to fewer than 3 percent of the population. Because the increase in scores has taken place in a relatively short period of time, it can't be due to heredity, but rather might be due to such environmental factors as the explosion in information people are exposed to as well as a much greater percentage of the population experiencing more education.

Ethnicity and Culture   Are there ethnic differences in intelligence? Are conventional tests of intelligence biased, and if so, can we develop culture-fair tests?

On average in the United States, adolescents from African American and Latino families score below adolescents from non-Latino White families on standardized intelligence tests. Most comparisons have focused on African Americans and Whites. African American adolescents score 10 to 15 points lower than White American adolescents (Neisser & others, 1996). Keep in mind that this represents an average difference. Many African American adolescents score higher than most White adolescents. Estimates are that 15 to 25 percent of African American adolescents score higher than half of all White adolescents.

Are these differences based on heredity or environment? The consensus answer is environment (Brooks-Gunn, Klebanov, & Duncan, 1996). One reason to think so is that in recent decades, as African Americans have experienced improved social, economic, and educational

As measured by the Stanford-Binet intelligence test, American children seem to be getting smarter. Scores of a group tested in 1932 fell along a bell-shaped curve with half below 100 and half above. Studies show that if children took that same test today, half would score above 120 on the 1932 scale. Very few of them would score in the "intellectually deficient" end, on the left side, and about one-fourth would rank in the "very superior" range.

■ FIGURE 4.11
IQ Scores Increased from 1932 to 1997

opportunities, the gap between African American and White adolescents on conventional intelligence tests had declined (Jones, 1984). Between 1977 and 1996, as educational opportunities for African Americans increased, the gap between their SAT scores and those of their White counterparts also shrunk 23 percent (College Board, 1996). And when adolescents from low-income African American families are adopted by more-advantaged middle-socioeconomic-status families, their scores on intelligence tests are closer to the national average for middle-socioeconomic-status adolescents than to the national average for adolescents from low-income families (Scarr & Weinberg, 1983).

Many of the early tests of intelligence were culturally biased, favoring urban adolescents over rural adolescents, adolescents from middle-socioeconomic-status families over those from low-income families, and White adolescents over ethnic minority adolescents (Miller-Jones, 1989). The standards for the early tests were almost exclusively based on White middle-socioeconomic-status adolescents.

Another problem can arise: even if the content of test items is unbiased, the language in which the items appear might not be. Some adolescents from ethnic minority groups might have trouble understanding the test's written language. Consider Gregory Ochoa. When he was in high school, he and his classmates were given an IQ test. Gregory looked at the test questions and didn't understand many of the words. Spanish was spoken at his home, and his English was not very good. Several weeks later Gregory was placed in a "special" class in which many of the other students had names like Ramirez and Gonzales. The class was for students who were mentally retarded. Gregory lost interest in school and eventually dropped out. He joined the Navy, where he took high school courses and earned enough credits to attend college. He graduated from San Jose City College as an honor student, continued his education, and eventually became a professor of social work at the University of Washington in Seattle.

Culture-fair tests *are tests of intelligence that are intended to be free of cultural bias.* Two types of culture-fair tests have been devised. The first includes items that are believed to be familiar to children from all socioeconomic and ethnic backgrounds, or items that at least are familiar to the children taking the test. For example, a child might be asked how a bird and a dog are different, on the assumption that all children have been exposed to birds and dogs. The second type of culture-fair test has all of the verbal items removed. Figure 4.12 shows a sample item from the Raven Progressive Matrices Test, which exemplifies this approach. Even though such tests are designed to be culture-fair, students with more education score higher on them than their less-educated counterparts do.

These attempts to produce culture-fair tests remind us that conventional intelligence tests probably are culturally biased, yet the effort to create a truly culture-fair test has not yielded a successful alternative. It is important to consider also that what is viewed as intelligent in one culture might not be thought of as intelligent in another culture (Lonner, 1990; Poortinga, 2000). In most Western cultures, adolescents are considered intelligent if they are both smart (have considerable knowledge and can solve verbal problems) and fast (can process information quickly). By contrast, in the Buganda culture in Uganda, adolescents who are wise, slow in thought, and say the socially correct thing are considered intelligent. And in the widely dispersed Caroline Islands, one of the most important dimensions of intelligence is the ability to navigate by the stars.

The Use and Misuse of Intelligence Tests   Psychological tests are tools. Like all tools, their effectiveness depends on the knowledge, skill, and integrity of the user. A hammer can be used to build a beautiful kitchen cabinet or it can be used as a weapon of assault. Like a hammer, psychological tests can be used for positive purposes or they can be badly abused. Here are some cautions about IQ that can help us to avoid the pitfalls of using information about an adolescent's intelligence in negative ways.
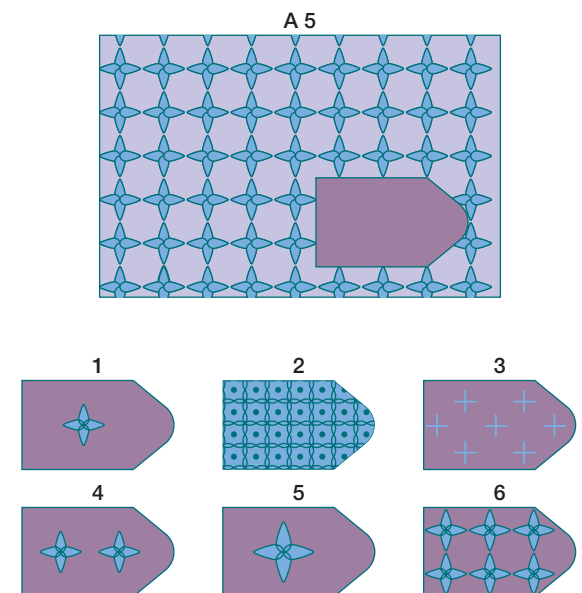

Cultural Bias and Testing
http://www.mhhe.com/santrocka9

culture-fair tests
Tests of intelligence that are intended to be free of cultural bias.

FIGURE 4.12
Sample Item from the Raven Progressive Matrices Test

Individuals are presented with a matrix arrangement of symbols, such as the one at the top of this figure, and must then complete the matrix by selecting the appropriate missing symbol from a group of symbols.

- *IQ test scores can easily lead to stereotypes and inappropriate expectations about adolescents.* Sweeping generalizations are too often made on the basis of an IQ score (Rosenthal, 2000). Imagine that you are in the teacher's lounge the day after school has started in the fall. You mention a student—Johnny Jones—and another teacher remarks that she had Johnny in class last year. She comments that he was a real dunce and scored 83 on an IQ test. How hard is it to ignore this information as you go about teaching your class? Probably difficult. But it is important that you not develop the expectation that, because Johnny scored low on an IQ test, it is useless to spend much time teaching him. An IQ test should always be considered a measure of current performance. It is not a measure of fixed potential. Maturational changes and enriched environmental experiences can advance a student's intelligence.
- *IQ test scores should not be used as the main or sole characteristic of competence.* As we have seen in this chapter, it is important to consider not only students' intellectual competence in areas such as verbal skills, but also their creative and practical skills.
- *Especially be cautious in interpreting the meaningfulness of an overall IQ score.* In evaluating an adolescent's intelligence, it is wiser to think of intelligence as being made up of a number of domains. Keep in mind the different types of intelligence described by Sternberg and Gardner. Remember that by considering different domains of intelligence, you can find that every adolescent has one or more strengths. Another important caution in interpreting intelligence tests is to recognize that they are an indicator of current performance, not fixed potential.

Since the last review, we have discussed many ideas about the psychometric/intelligence view. These questions should help you to reach your learning goals related to this topic.

■ FOR YOUR REVIEW

Learning Goal 4

Explain the psychometric/intelligence view

- This view emphasizes the importance of individual differences and assessment. Intelligence can be defined as verbal ability, problem-solving skills, and the ability to adapt from everyday experiences.
- Binet and Simon developed the first intelligence test. Binet created the concept of mental age and Stern crafted the concept of IQ as MA/CA × 100. The range of scores on the Stanford-Binet approximates a normal distribution. The Wechsler scales also are widely used to assess intelligence. They provide an overall IQ, as well as verbal and performance IQs.
- Spearman proposed many years ago that people have a general intelligence (*g*) and specific intelligences (*s*). Thurstone believed that people have seven specific abilities, which he called primary mental abilities. More recently, Sternberg has stated that intelligence comes in three main forms: analytical, creative, and practical. Gardner recently has described eight types of intelligence: verbal, math, spatial, bodily-kinesthetic, interpersonal, intrapersonal, musical, and naturalist.
- Emotional intelligence is a form of social intelligence that involves the ability to monitor one's own and others' feelings and emotions, to discriminate among them, and to use this information to guide one's own thinking and action. Goleman believes that emotional intelligence consists of four main areas: emotional self-awareness, managing emotions, reading emotions, and handling relationships.
- Among the controversies and issues in intelligence are those involving nature and nurture, ethnicity and culture, and the use and misuse of intelligence tests.

So far in this chapter we have explored three major perspectives on adolescent cognition: cognitive developmental, information processing, and psychometric/intelligence. Next, we will examine another topic that involves adolescent cognition: how adolescents think about social matters.

SOCIAL COGNITION

Social cognition refers to how individuals conceptualize and reason about their social world—the people they watch and interact with, relationships with those people, the groups in which they participate, and how they reason about themselves and others. Developmentalists have recently shown a flourish of interest in how children and adolescents reason about social matters. For many years, the study of cognitive development focused primarily on cognition about nonsocial phenomena, such as logic, numbers, words, time, and the like. Now there is a lively interest in how children and adolescents reason about their social world as well (Flavell & Miller, 1998). Our discussion of social cognition focuses on egocentrism, perspective taking, and implicit personality theory.

Adolescent Egocentrism

Adolescent egocentrism *refers to the heightened self-consciousness of adolescents, which is reflected in their belief that others are as interested in them as they themselves are, and in their sense of personal uniqueness.*
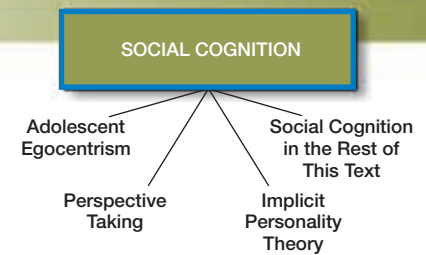
David Elkind (1976) believes that adolescent egocentrism can be dissected into two types of social thinking—imaginary audience and personal fable. The *imaginary audience* involves attention-getting behavior—the desire to be noticed, visible, and "on stage." Tracy's comments and behavior, discussed in the Images introduction to the chapter, reflect the imaginary audience. Another adolescent might think that others are as aware of a small spot on his trousers as he is, possibly knowing that he has masturbated. Another adolescent, an eighth-grade girl, walks into her classroom and thinks that all eyes are riveted on her complexion. Adolescents especially sense that they are "on stage" in early adolescence, believing that they are the main actors and all others are the audience.

According to Elkind, the *personal fable* is the part of adolescent egocentrism involving an adolescent's sense of uniqueness. Adolescents' sense of personal uniqueness makes them feel that no one can understand how they really feel. For example, an adolescent girl thinks that her mother cannot possibly sense the hurt that she feels because her boyfriend broke up with her. As part of their effort to retain a sense of personal uniqueness, adolescents might craft a story about the self that is filled with fantasy, immersing themselves in a world that is far removed from reality. Personal fables frequently show up in adolescent diaries.

Developmentalists have increasingly studied adolescent egocentrism in recent years. The research interest focuses on what the components of egocentrism really are, the nature of self-other relationships, why egocentric thought emerges in adolescence, and the role of egocentrism in adolescent problems. For example, David Elkind (1985) believes that adolescent egocentrism is brought about by formal operational thought. Others, however, argue that adolescent egocentrism is not entirely a cognitive phenomenon. Rather, they think that the imaginary audience is due both to the ability to think hypothetically (formal operational thought) and the ability to step outside one's self and anticipate the reactions of others in imaginative circumstances (perspective taking) (Lapsley & Murphy, 1985).

adolescent egocentrism
The heightened self-consciousness of adolescents, which is reflected in their belief that others are as interested in them as they themselves are and in their sense of personal uniqueness.

Many adolescent girls spend long hours in front of the mirror, depleting cans of hair spray, tubes of lipstick, and jars of cosmetics. *How might this behavior be related to changes in adolescent cognitive and physical development?*

Perspective Taking

Perspective taking is the ability to assume another person's perspective and understand his or her thoughts and feelings. Robert Selman (1980) proposed a developmental theory of perspective taking that has

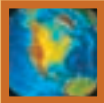*I check my look in the mirror. I wanna change my clothes, my hair, my face.*
—Bruce Springsteen
Contemporary American Rock Star

Social Cognition
http://www.mhhe.com/santrocka9

received considerable attention. He believes perspective taking involves a series of five stages, ranging from 3 years of age through adolescence (see figure 4.13 on p. 139). These stages begin with the egocentric viewpoint in early childhood and end with in-depth perspective taking in adolescence.

To study adolescents' perspective taking, Selman individually interviews the adolescents, asking them to comment on such dilemmas as the following:

Holly is an eight-year-old girl who likes to climb trees. She is the best tree climber in the neighborhood. One day while climbing down from a tall tree, she falls . . . but does not hurt herself. Her father sees her fall. He is upset and asks her to promise not to climb trees any more. Holly promises.

Later that day, Holly and her friends meet Shawn. Shawn's kitten is caught in a tree and can't get down. Something has to be done right away or the kitten may fall. Holly is the only one who climbs trees well enough to reach the kitten and get it down, but she remembers her promise to her father. (Selman, 1976, p. 302)

Subsequently, the interviewer asks the adolescents a series of questions about the dilemma, such as these:

Does Holly know how Shawn feels about the kitten?
How will Holly's father feel if he finds out she climbed the tree?
What does Holly think her father will do if he finds out she climbed the tree?
What would you do in this situation?

By analyzing children's and adolescents' responses to these dilemmas, Selman (1980) concluded that their perspective taking follows the developmental sequence described in figure 4.13. In this view, individuals move from the egocentric perspective of young children to the interdependent perspective of adolescents. Correspondingly, their interpersonal negotiation strategies change from the impulsiveness of young children to the more collaborative orientation of adolescents (Selman & Adalbjarnardottir, 2000; Selman & Schultz, 1999).

Selman's research has shown strong support for the sequential nature of perspective taking, although the ages at which children and adolescents reach the perspective-taking stages overlap considerably. Some researchers believe that the attainment of stage 3 perspective taking accounts for the imaginary audience and personal fable dimensions of adolescent egocentrism (Lapsley, 1993).

Although adolescents' perspective taking can increase their self-understanding, it also can improve their peer group status and the quality of their friendships. For example, in one investigation, the most popular children in the third and eighth grades had competent perspective-taking skills (Kurdek & Krile, 1982). Adolescents who are competent at perspective taking are better at understanding the needs of their companions so that they likely can communicate more effectively with them. And in one study, competence in social perspective coordination was an important influence on adolescent friendship formation following residential relocation (Vernberg & others, 1994).

The relation between the self and another individual is complex. Most major developmental theorists believe that development changes in self-other relationships are characterized by movement from egocentrism to perspectivism, but the considerable overlap in the age range at which various levels of perspective taking emerge make generalizations about clear-cut stages difficult. Next, we turn our attention to another aspect of social cognition that changes during adolescence—implicit personality theory.

■ THINKING CRITICALLY

Adolescent Egocentrism—Does It Ever Go Away?

In my course on adolescence, college students have occasionally commented that they know some people in their twenties who still show the characteristics we have associated with adolescent egocentrism. They want to know if it is maladaptive, when you are in your late teens and twenties, to act as if all eyes are riveted on you, to have a strong desire to be noticed, visible, and "on stage," and to feel like all others are as interested in you as you are.

What do you think? How maladaptive is it for individuals in their late teens and their twenties to show adolescent egocentrism? Isn't it adaptive to show at least some interest in oneself? How can you draw the line between self-interest that is adaptive, protective, and appropriate and self-interest that is maladaptive, selfish, and inappropriate? One good strategy for coming to grips with this issue is to consider the extent to which the egocentrism overwhelms and dominates the individual's life.

Stage	Perspective-taking stage	Ages	Description
0	Egocentric viewpoint	3–6	Child has a sense of differentiation of self and other but fails to distinguish between the social perspective (thoughts, feelings) of other and self. Child can label the other's overt feelings but does not see the cause-and-effect relation of reasons to social actions.
1	Social-informational perspective taking	6–8	Child is aware that other has a social perspective based on other's own reasoning, which may or may not be similar to child's. However, child tends to focus on one perspective rather than coordinating viewpoints.
2	Self-reflective perspective taking	8–10	Child is conscious that each individual is aware of the other's perspective and that this awareness influences self and other's view of each other. Putting self in other's place is a way of judging other's intentions, purposes, and actions. Child can form a coordinated chain of perspectives but cannot yet abstract from this process to the level of simultaneous mutuality.
3	Mutual perspective taking	10–12	Adolescent realizes that both self and other can view each other mutually and simultaneously as subjects. Adolescent can step outside the two-person dyad and view the interaction from a third-person perspective.
4	Social and conventional system perspective taking	12–15	Adolescent realizes mutual perspective taking does not always lead to complete understanding. Social conventions are seen as necessary because they are understood by all members of the group (the generalized other), regardless of their position, role, or experience.

■ FIGURE 4.13
Selman's Stages of Perspective Taking

THROUGH THE EYES OF PSYCHOLOGISTS

John Flavell
Stanford University

"Social cognition has as its objects humans and human affairs; it means cognition and knowledge about people and their doings."

implicit personality theory
The layperson's conception of personality.

Implicit Personality Theory

Implicit personality theory *is the layperson's conception of personality.* Do adolescents conceptualize an individual's personality differently than children do? Adolescents are more likely to interpret an individual's personality in the way that many personality theorists in psychology do than children are (Barenboim, 1981). Adolescents interpret personality differently than children in three ways. First, when adolescents are given information about another person, they are more likely to consider both previously acquired information and current information, rather than relying only on the concrete information at hand, like children do. Second, adolescents are more likely to detect the situational or contextual variability in personality, rather than thinking that personality is always stable. Third, rather than merely accepting surface traits as a valid description of someone's personality, adolescents are more likely than children to look for deeper, more complex, even hidden causes of personality.

In these comments obtained in one developmental investigation of how individuals perceive others, we can see how the development of an implicit personality theory proceeds (Livesley & Bromley, 1973):

> Max sits next to me, his eyes are hazel and he is tall. He hasn't got a very big head, he's got a big pointed nose. (p. 213; age 7 years, 6 months)

> He smells very much and is very nasty. He has no sense of humor and is very dull. He is always fighting and he is cruel. He does silly things and is very stupid. He has brown hair and cruel eyes. He is sulky and eleven years old and has lots of sisters. I think he is the most horrible boy in the class. He has a croaky voice and always chews his pencil and picks his teeth and I think he is disgusting. (p. 217; age 9 years, 11 months)

> Andy is very modest. He is even shyer than I am when near strangers and yet is very talkative with people he knows and likes. He always seems good tempered and I have never seen him in a bad temper. He tends to degrade other people's achievements, and yet never praises his own. He does not seem to voice his opinions to anyone. He easily gets nervous. (p. 221; age 15 years, 8 months)

> . . . she is curious about people but naive, and this leads her to ask too many questions so that people become irritated with her and withhold information, although she is not sensitive enough to notice it. (p. 225; young adult)

Social Cognition in the Rest of this Text

Interest in social cognition has blossomed, and the approach has infiltrated many aspects of the study of adolescent development. In the discussion of families in chapter 5, the emerging cognitive abilities of the adolescent are evaluated in concert with parent-adolescent conflict and parenting strategies. In the description of peer relations in chapter 6, the importance of social knowledge and social information processing in peer relations is highlighted. In the overview of the self and identity in chapter 9, social cognition's role in understanding the self and identity is explored. And in the evaluation of moral development in chapter 12, considerable time is devoted to discussing Kohlberg's theory, which is a prominent aspect of the study of social cognition in adolescence.

Since the last review we have explored many ideas about social cognition. These questions should help you to reach your learning goals related to this topic.
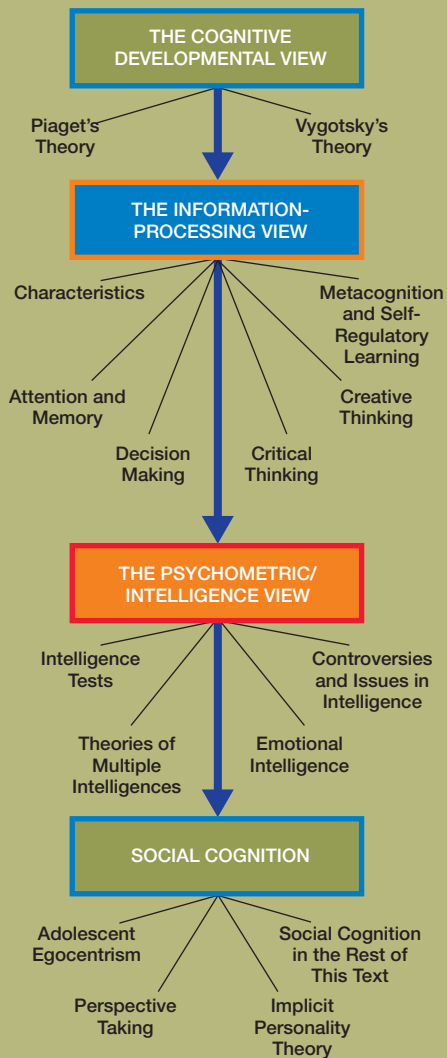
◾ F O R   Y O U R   R E V I E W

Learning Goal 5

Describe changes in social cognition

- Social cognition refers to how people conceptualize and reason about their social world, including the relation of the self to others.
- Elkind proposed that adolescents, especially young adolescents, develop an egocentrism that consists of an imaginary audience and a personal fable. Critics argue that perspective taking rather than formal operational thought is the main factor in the development of adolescent egocentrism.
- Perspective taking is the ability to take another person's perspective and understand his or her thoughts and feelings. Adolescents are better at perspective taking than children are, but there is considerable overlap in the ages at which the higher states of perspective taking occur. Selman proposed a model that has served as the basis for thinking about developmental changes in perspective taking.
- Implicit personality theory is the public's or layperson's conception of personality. Adolescents' implicit personality theory is closer to that of scientists who study personality than is the implicit personality of children. Compared to children, adolescents describe personality as having more past-present connections, as more contextual, and as more unconscious.
- We will study social cognition throughout this text, especially in chapters on families, peers, the self and identity, and moral development.

In this chapter, we have examined cognitive development in adolescence. In the next chapter, we will explore families and adolescents, the first chapter in the main section of the book titled, "The Contexts of Adolescent Development."

CHAPTER MAP

```
        THE COGNITIVE
    DEVELOPMENTAL VIEW

Piaget's              Vygotsky's
Theory                Theory

      THE INFORMATION-
      PROCESSING VIEW

Characteristics           Metacognition
                          and Self-
                          Regulatory
                          Learning
Attention and                 Creative
Memory                        Thinking
      Decision        Critical
      Making          Thinking

    THE PSYCHOMETRIC/
    INTELLIGENCE VIEW

Intelligence              Controversies
Tests                     and Issues in
                          Intelligence
Theories of           Emotional
Multiple              Intelligence
Intelligences

      SOCIAL COGNITION

Adolescent                Social Cognition
Egocentrism               in the Rest of
                          This Text
      Perspective     Implicit
      Taking          Personality
                      Theory
```

REACH YOUR LEARNING GOALS

At the beginning of the chapter, we stated five learning goals and encouraged you to review material related to these goals at four points in the chapter. This is a good time to return to these reviews and use them to guide your study and help you to reach your learning goals.

Page 118

Learning Goal 1   Discuss Piaget's theory
Learning Goal 2   Understand Vygotsky's theory

Page 128

Learning Goal 3   Evaluate the information-processing view

Page 136

Learning Goal 4   Explain the psychometric/intelligence view

Page 141

Learning Goal 5   Describe changes in social cognition

KEY TERMS

schema 106
assimilation 106
accommodation 106
equilibration 107
sensorimotor stage 107
preoperational stage 107
concrete operational stage 107
formal operational stage 108
hypothetical-deductive reasoning 109
neo-Piagetians 113
postformal thought 114
zone of proximal development (ZPD) 115
critical thinking 123
creativity 124

convergent thinking 124
divergent thinking 124
metacognition 126
self-regulatory learning 127
psychometric/intelligence view 128
intelligence 129
mental age (MA) 129
intelligent quotient (IQ) 129
normal distribution 129
triarchic theory of intelligence 131
emotional intelligence 133
culture-fair tests 135
adolescent egocentrism 137
implicit personality theory 140

KEY PEOPLE

Jean Piaget 106
Lev Vygotsky 106
Annamarie Palincsar and Ann Brown 000
Robbie Case 113
Barbara Rogoff 115
Robert Siegler 119
Daniel Keating 123
J. P. Guilford 124
Mihaly Csikszentmihalyi 125
Deanna Kuhn 126
Michael Pressley 126

Alfred Binet 129
William Stern 129
David Wechsler 130
Charles Spearman 130
L. L. Thurstone 130
Robert Sternberg 131
Howard Gardner 132
Daniel Goleman 133
David Elkind 137
Robert Selman 137
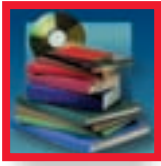
RESOURCES FOR IMPROVING THE LIVES OF ADOLESCENTS

Apprenticeship in Thinking

(1990) by Barbara Rogoff
New York: Oxford University Press

Rogoff believes that children's and adolescents' cognitive development is best served by participation in social activity, guided by companions who stretch and support their understanding and use of the culture's tools.

Children's Thinking

(1998, 3rd ed.) by Robert Siegler
Upper Saddle River, NJ: Prentice Hall

In-depth coverage of information processing by one of the field's leading experts.

Encyclopedia of Creativity

(1999, Vols. 1 & 2) by Mark Runco & Steven Pritzker (Eds.)
San Diego: Academic Press

A wealth of information about virtually every imaginable aspect of creativity, written by leading experts.

How People Learn

(1999) by the Committee on Developments
in the Science of Learning
Washington, DC: National Academy Press

A prestigious panel headed by John Bransford and Anne Brown describes the current state of knowledge about how children and youth think and learn.

The Jasper Project

(1997) by the Cognition and Technology Group at Vanderbilt
Mahwah, NJ: Erlbaum

An innovative, problem-based learning approach is discussed; includes a CD disc of one of the Jasper adventures.

Teaching and Learning Through Multiple Intelligences

(1999, 2nd ed.) by Linda Campbell, Bruce Campbell,
and Dee Dickinson
Boston: Allyn & Bacon

Provides applications of Gardner's eight intelligences to classrooms.

TAKING IT TO THE NET

http://www.mhhe.com/santrocka9

1. Your psychology instructor notes that in surfing the Web one can find a large number of sites with IQ tests, including tests for emotional IQ, sports IQ, trivia IQ, social IQ, musical IQ, as well as tests for IQs in a variety of other areas. As an extra credit assignment the instructor challenges the class to write a two-page paper indicating whose theoretical stance about intelligence could encompass such IQ concepts and how it would do so. *What would you write?*

2. Suppose your roommate complains that there is just too much material to learn in his or her classes and that he or she has a lot of trouble getting all the information into memory. You recognize this as a metamemory problem. *What means would you suggest your roommate use to improve getting information into memory?*

3. As a dual major in biology and psychology, you realize that fundamental psychological processes such as memory, problem solving, and information processing must ultimately be tied to components of biological development. You decide to write your term paper on the links between neuroscience and cognitive development. *What themes will you write about?*

Connect to *http://www.mhhe.com/santrocka9* to research the answers and complete these exercises. In some cases, you'll also find further instructions on this site.