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CHAPTER TWO

Cognitive Development

CHAPTER OUTLINE

LEARNING OUTCOMES

At the end of this chapter, you should be able to:

2.1 Describe Piaget's theory of human development and discuss how it can apply in the classroom

2.2 Describe the theories of development presented by Vygotsky and by Bronfenbrenner and discuss how they apply in the classroom

2.3 Describe the distinct stages of language and literacy and explain how you can set up your classroom to promote literacy development

2.4 Describe how knowledge of social, moral, and emotional development informs intentional teaching

Patricia Wing is very proud of her third-grade class. Her students have done very well on state tests, and they are succeeding in all of their subjects, especially science, Patricia's own favorite. So she decides to give her students a challenge they'll really enjoy. "Class," she says, "I'm so excited to see the good work you've all done in science. Today, I'm going to give you a problem to solve in your teams that will stretch your minds, but I know you can solve it.

"At each of your tables you have a pendulum, several weights, and a stopwatch. You can change the weights on the pendulum, the length of the string, the push you give the weight to start it swinging, or anything you like. My question to you is this: What determines how many times the pendulum goes back and forth in a minute?"

The students get right to work with excitement. They try more weight and less weight, more push and less push, longer strings and shorter strings. Each team appoints a time keeper who writes down how many swings there are in a minute. The students argue with each other: "It's the weight!" "It's the push!" "It's the string!" The groups are working hard but haphazardly. None of them gets the right answer (which is that only the length of the string matters).

Patricia is astonished. The students know a lot about science, try hard, and work well together, yet they cannot solve the problem.

USING YOUR EXPERIENCE

CRITICAL THINKING Why do you think Patricia Wing's class cannot solve the pendulum problem? What does her experience suggest to you about why teachers should consider children's stages of development in their teaching?

Over the course of their first 18 years of life, children go through astounding changes. Most of these changes are obvious—children get bigger, smarter, and more socially adept, for example. However, many aspects of development are not so obvious. Individual children develop in different ways and at different rates, and development is influenced by biology, culture, parenting, education, and other factors. Every teacher needs to understand how children grow and develop to be able to understand how children learn and how best to teach them (Comer, 2005).

HOW DO CHILDREN DEVELOP COGNITIVELY?

The term **development** refers to how people grow, adapt, and change over the course of their lifetimes, through personality development, socioemotional development, cognitive development (thinking), and language development. This chapter begins with two major theorists of cognitive development whose ideas are widely accepted: Jean Piaget and Lev Vygotsky (see Bee & Boyd, 2010; Berk, 2013; Mahn & John-Steiner, 2013; McDevitt & Ormrod, 2016; Woolfolk & Perry, 2015).

Aspects of Development

Children are not miniature adults. They think differently and see the world differently. One of the first requirements of effective teaching is that you understand how students think and how they view the world. Effective teaching strategies must take into account students' ages and stages of development. A bright third-grader might appear to be able to learn any kind of mathematics but in fact may not have the cognitive maturity to do the abstract thinking required for algebra. In the opening vignette, Ms. Wing's class is smart and motivated, yet the pendulum task is a classic example of a kind of thinking that usually does not appear until adolescence, when most children gain the ability to think logically about problems of this kind and to proceed in a methodical way toward a solution.

InTASC 1
Learner Development

Issues of Development

Two central issues have been debated for decades among developmental psychologists: the degree to which development is affected by experience and whether development proceeds in stages.

NATURE–NURTURE CONTROVERSY Is development predetermined at birth, by heredity and biological factors, or is it affected by experience and other environmental factors? Today, most

developmental psychologists (e.g., Bee & Boyd, 2010; Berk, 2013; Feldman, 2012; Woolfolk & Perry, 2015) believe that nature and nurture combine to influence development, with biological factors playing a stronger role in some aspects, such as physical development.

The argument about nature vs. nurture, heredity vs. environment, goes back to the Greeks (at least). The environmentalist philosopher John Watson (1930, p. 82) put his position this way:

> I'll guarantee to take any (child) at random and train him to become . . . a doctor, lawyer, artist, merchant-chief, and yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors. I admit that I am going beyond my facts . . . but so have the advocates of the contrary . . . for thousands of years.
>
> *Source:* From *Behaviorism* by John Broadus Watson. Published by W. W. Norton & Company, © 1930.

While few scientists today would go as far as Watson, there remains much debate about the relative influences of genes and environment. One problem is that the two interact. For example, if a child is a little better at sports than other children at a young age, he or she may receive a lot more practice, encouragement, and training in sports and therefore become an outstanding athlete. So was that outcome due to nature or nurture? Similarly, a child who shows promise in science at a young age may receive a lot of encouragement, leading him or her to develop motivation to learn science and seek science-related experiences. Nature or nurture? Obviously, nature and nurture are mixed up in any particular person or population. For educators, the key point is that while nothing can be done about a child's genes, a great deal can be done about his or her environment to build skill, motivation, and self-confidence. There is no question that teachers and parents make a huge difference in children's learning, over and above whatever the children's genetic predispositions may be.

CONTINUOUS AND DISCONTINUOUS THEORIES A second issue revolves around the notion of how change occurs. **Continuous theories of development**, such as information-processing models (Halford, Baker, McCredden, & Baine, 2005; Munakata, 2006), assume that development occurs in a smooth progression as skills develop and experiences are provided by caregivers and the environment. Continuous theories emphasize the importance of environment rather than heredity in determining development.

A second perspective assumes that children progress through a set of predictable and invariant stages of development. From this perspective, major changes happen when children advance to a new stage of development. All children are believed to acquire skills in the same sequence, although rates of progress differ from child to child. The abilities children gain in each subsequent stage are not simply "more of the same"; at each stage, children develop qualitatively different understandings, abilities, and beliefs. Skipping stages is rare or impossible, although at any given point the same child may exhibit behaviors characteristic of more than one stage (DeVries, 2008). In contrast to continuous theories, these **discontinuous theories of development** focus on inborn factors rather than environmental influences to explain change over time. Environmental conditions may have some influence on the pace of development, but the sequence of developmental steps is essentially fixed. According to this perspective, the 9-year-olds in Patricia Wing's class could not have solved the pendulum problem no matter how much they had been taught, because they had not reached a developmental stage that enables people to solve problems involving many factors at the same time.

Stage theorists, such as Piaget and Vygotsky, share the belief that distinct stages of development can be identified and described. However, their theories differ significantly in the number of stages and in their details (see DeVries, 2008).

HOW DID PIAGET VIEW COGNITIVE DEVELOPMENT?

Jean Piaget, born in Switzerland in 1896, is the most influential developmental psychologist in the history of psychology (see Wadsworth, 2004). After receiving his doctorate in biology, he became more interested in psychology, basing his earliest theories on careful observation of his own three children. Piaget thought of himself as applying biological principles and methods to the study of human development, and many of the terms he introduced to psychology were drawn directly from biology.

Piaget explored both why and how mental abilities change over time. For Piaget, development depends in large part on the child's manipulation of and active interaction with the environment. In Piaget's view, knowledge comes from action (see DeVries, 2008; Wadsworth, 2004). Piaget's theory of **cognitive development** proposes that a child's intellect, or cognitive ability, progresses through four distinct stages. Each stage is characterized by the emergence of new abilities and ways of processing information. Many of the specifics of Piaget's theories have been challenged in later research. In particular, many of the changes in cognitive functioning that he described are now known to take place earlier than he stated, at least under certain circumstances. Nevertheless, Piaget's work forms an essential basis for understanding child development.

How Development Occurs

SCHEMES Piaget believed that all children are born with an innate tendency to interact with and make sense of their environments. Young children demonstrate patterns of behavior or thinking, called **schemes**, that older children and adults also use in dealing with objects in the world. We use schemes to find out about and act in the world; each scheme treats all objects and events in the same way. When babies encounter a new object, how are they to know what this object is all about? According to Piaget, they will use the schemes they have developed and will find out whether the object makes a loud or a soft sound when banged, what it tastes like, whether it gives milk, and whether it goes thud when dropped (see Figure 2.1).

Connections 2.1
For information on schema theory (a topic related to schemes) in connection with information processing and memory, see Chapter 6.

ASSIMILATION AND ACCOMMODATION According to Piaget, **adaptation** is the process of adjusting schemes in response to the environment by means of assimilation and accommodation. **Assimilation** is the process of understanding a new object or event in terms of an existing scheme. If you give young infants small objects that they have never seen before but that resemble familiar objects, they are likely to grasp them, bite them, and bang them. In other words, they will try to use existing schemes to learn about these unknown things (see Figure 2.1b). Similarly, a high school student may have a studying scheme that involves putting information on cards and memorizing the cards' contents. She may have had success with this in one subject and then applied the same scheme to many subjects.

a. Banging is a favorite **scheme** used by babies to explore their world.

b. **Assimilation** occurs when they incorporate new objects into the scheme.

c. **Accommodation** occurs when a new object does not fit the existing scheme.

FIGURE 2.1 • Schemes
Babies use patterns of behavior called *schemes* to learn about their world.

ON THE WEB

For more on Piaget's life and work, go to www.simplypsychology.org and enter Piaget into the search engine. For information on Piaget's theory applied to the classroom, visit piaget.weebly.com. The Jean Piaget Society's website can be found at piaget.org.

Certification Pointer
Most teacher certification tests will require you to know that a constructivist approach to learning emphasizes the active role that learners play in building their own understandings.

Sometimes, when old ways of dealing with the world simply don't work, a child might modify an existing scheme in light of new information or a new experience, a process called **accommodation**. For example, if you give an egg to a baby who has a banging scheme for small objects, what will happen to the egg is obvious (Figure 2.1c). Less obvious, however, is what will happen to the baby's banging scheme. Because of the unexpected consequences of banging the egg, the baby may change the scheme. In the future the baby might bang some objects hard and others softly. The high school student who studies only by means of memorization might learn to use a different strategy, such as discussing difficult concepts with a friend, to study subjects or topics in which memorization does not work very well.

The baby who banged the egg and the student who tried to memorize rather than comprehend had to deal with situations that could not be fully handled by existing schemes. This, in Piaget's theory, creates a state of disequilibrium, or an imbalance between what is understood and what is encountered. People naturally try to reduce such imbalances by focusing on the stimuli that cause the disequilibrium and developing new schemes, or adapting old ones, until equilibrium is restored. This process of restoring balance is called **equilibration**. According to Piaget, learning depends on this process. When equilibrium is upset, children have the opportunity to grow and develop. Eventually, qualitatively new ways of thinking about the world emerge, and children advance to a new stage of development. Piaget believed that physical experiences and manipulation of the environment are critical for developmental change to occur. However, he also believed that social interaction with peers, especially arguments and discussions, helps to clarify thinking and, eventually, to make it more logical. Research has stressed the importance of confronting students with experiences or data that do not fit into their current theories of how the world works as a means of advancing their cognitive development. Having students resolve disequilibrium working with peers is particularly effective (Slavin, 2014).

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Video Example 2.1
The children in this classroom, while studying tadpoles, are learning something new about growth. They can assimilate the idea that the tadpole grows legs, but they need to accommodate their concept of growth to understand why the tadpole's tail gets smaller.

Piaget's theory of development represents **constructivism**, a view of cognitive development as a process in which children actively build systems of meaning and understandings of reality through their experiences and interactions (Berk, 2013; Schunk, 2016). In this view, children actively construct knowledge by continuously assimilating and accommodating new information.

Piaget's Stages of Development

Piaget divided the cognitive development of children and adolescents into four stages: sensorimotor, preoperational, concrete operational, and formal operational. He believed that all children pass through these stages in this order and that no child can skip a stage, although different children pass through the stages at somewhat different rates. The same individuals may perform tasks associated with different stages at the same time, particularly at points of transition into a new stage. Table 2.1 summarizes the approximate ages at which children and adolescents pass through Piaget's four stages. It also shows the major accomplishments of each stage.

Certification Pointer
When responding to the case studies in certification tests, you may be asked to identify appropriateness of instruction according to the students' Piagetian stage of development.

SENSORIMOTOR STAGE (BIRTH TO AGE 2) The earliest stage is called **sensorimotor** because during this stage, babies and young children explore the world by using their senses and motor skills. Dramatic changes occur as infants progress through the sensorimotor period. Initially, all infants have inborn behaviors called **reflexes**. Touch a newborn's lips, and the baby will begin to suck; place your finger in the palm of an infant's hand, and the infant will grasp it. These and other innate behaviors are the building blocks from which the infant's first schemes form.

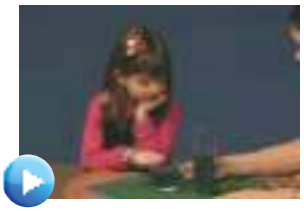
TABLE 2.1 • Piaget's Stages of Cognitive Development

People progress through four stages of cognitive development between birth and adulthood, according to Jean Piaget. Each stage is marked by the emergence of new intellectual abilities that enable people to understand the world in increasingly complex ways.

STAGE	APPROXIMATE AGES	MAJOR ACCOMPLISHMENTS
Sensorimotor	Birth to 2 years	Formation of concept of "object permanence" and gradual progression from reflexive behavior to goal-directed behavior.
Preoperational	2 to 7 years	Development of the ability to use symbols to represent objects in the world. Thinking remains egocentric and centered.
Concrete operational	7 to 11 years	Improvement in ability to think logically. New abilities include the use of operations that are reversible. Thinking is decentered, and problem solving is less restricted by egocentrism. Abstract thinking is not yet possible.
Formal operational	11 years to adulthood	Abstract and purely symbolic thinking is possible. Problems can be solved through the use of systematic experimentation.

Infants soon learn to use these reflexes to produce more interesting and intentional patterns of behavior. This learning occurs initially through accident and then through more intentional trial-and-error efforts. According to Piaget, by the end of the sensorimotor stage, children have progressed from their earlier trial-and-error approach to a more planned approach to problem solving. For the first time they can mentally represent objects and events. What most of us would call "thinking" appears now. This is a major advance because it means that the child can think through and plan behavior. For example, suppose a 2-year-old is in the kitchen watching his mother prepare dinner. If the child knows where the step stool is kept, he may ask to have it set up to afford a better view of the counter and a better chance for a nibble. The child did not stumble on this solution accidentally. Instead, he thought about the problem, figured out a possible solution that used the step stool, tried out the solution mentally, and only then tried the solution in practice (Trawick-Smith, 2014).

Another hallmark development of the sensorimotor period is the ability to grasp **object permanence**. Piaget argued that children must learn that objects are physically stable and exist even when the objects are not in the child's physical presence. For example, if you cover an infant's bottle with a towel, the child may not remove it, believing that the bottle is gone. By 2 years of age, children understand that objects exist even when they cannot be seen. Once they realize that things exist out of sight, children can start using symbols to represent these things in their minds so that they can think about them (Cohen & Cashon, 2003).



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Video Example 2.2

In this video, children participate in tasks that show their understanding of conservation of volume and conservation of number. Compare the responses, and identify each child's stage of cognitive development, according to Piaget's theory.

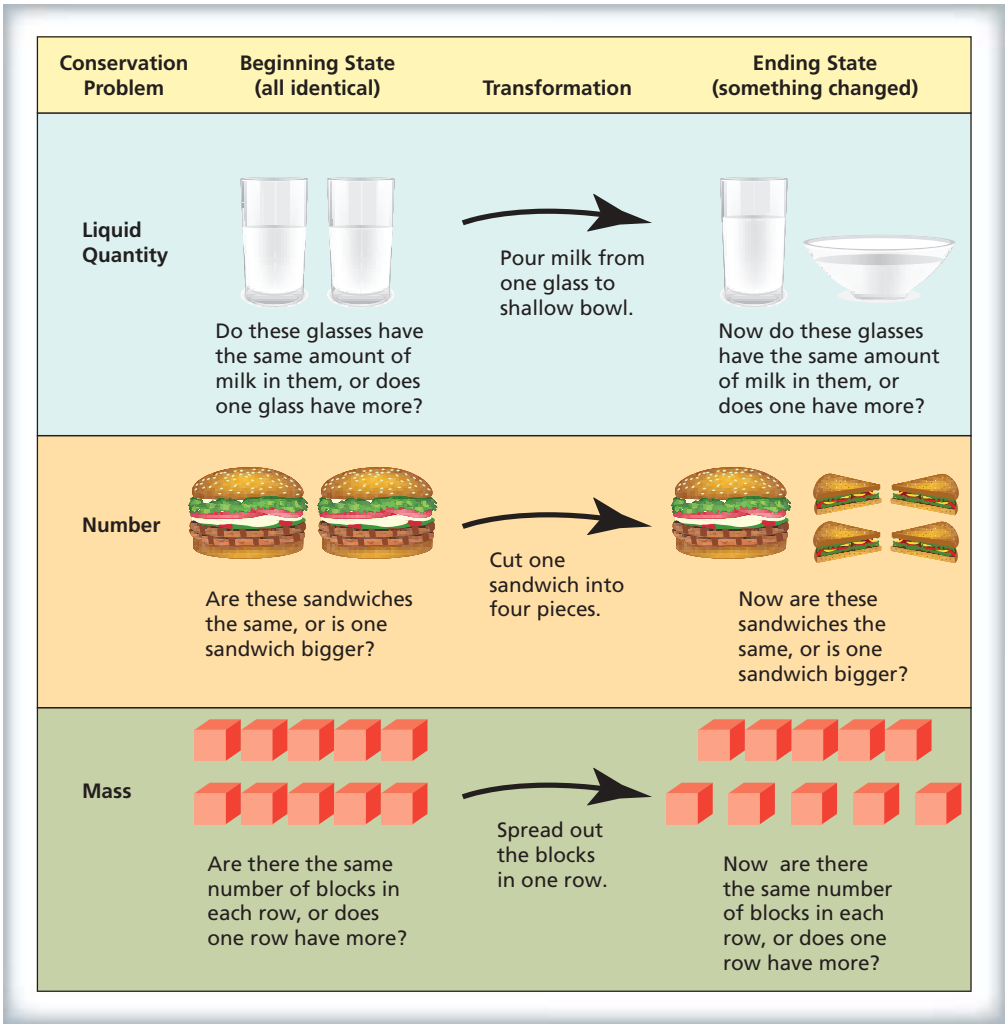
PREOPERATIONAL STAGE (AGES 2 TO 7) During the **preoperational stage**, children have greater ability to think about things and can use symbols to mentally represent objects (Massey, 2008; Ostroff, 2012). Their language and concepts develop at an incredible rate. Yet much of their thinking remains surprisingly primitive. One of Piaget's earliest and most important discoveries was that young children lack an understanding of the principle of **conservation**. For example, if you pour milk from a tall, narrow container into a shallow, wide one, and back again, in the presence of a preoperational child, the child will firmly believe that the tall glass has more milk (see Figure 2.2). Similarly, a preoperational child is likely to believe that a sandwich cut in four pieces is more sandwich or that a line of blocks that is spread out contains more blocks than a line that is compressed, even after being shown that the number of blocks is identical.

Several aspects of preoperational thinking help to explain the error on conservation tasks. One characteristic is **centration**: paying attention to only one aspect of a situation. In the example illustrated in Figure 2.2, children might have claimed that there was less milk after it was poured into the wide container because they centered on the height of the milk, ignoring its width. At the bottom of Figure 2.2, children focused on the length of the line of blocks and ignored its density (or the actual number of blocks).

Reversibility, the ability to change direction in one's thinking to return to a starting point, is another facet of thinking that is not yet developed in preoperational children. As adults, for

FIGURE 2.2 • Some Piagetian Conservation Tasks

Children at the preoperational stage cannot yet conserve. These tasks are mastered gradually over the concrete operational stage. Most children acquire conservation of number, mass, and liquid sometime between 6 and 7 years and of weight between 8 and 10 years.



example, we know that if $7 + 5 = 12$, then $12 - 5 = 7$. If we add 5 items to 7 items and then take the 5 items away (reverse what we've done), we are left with 7 items again. If preoperational children could think this way, then they could mentally reverse the process of pouring the milk and realize that if the milk were poured back into the tall beaker, its quantity would not change.

Another characteristic of the preoperational child's thinking is a focus on states. In the milk problem the milk is poured from one container to another. Preschoolers ignore this pouring process and focus only on the beginning state (milk in a tall glass) and the end state (milk in a shallow dish). Unlike adults, the young preschooler forms concepts that vary in definition from situation to situation and are not always logical. How else can we explain the 2-year-old's ability to treat a stuffed animal as an inanimate object one minute and as an animate object the next? Eventually, though, the child's concepts become more consistent and less private. Children become increasingly concerned that their definitions match other people's. But they still lack the ability to coordinate one concept with another.

Finally, preoperational children are **egocentric** in their thinking. Children at this stage believe that everyone sees the world exactly as they do. For example, Piaget and Inhelder (1956) seated children on one side of a display of three mountains and asked them to describe how the scene looked to a doll seated on the other side. Children below the age of 6 or 7 described the doll's view as identical to their own, even though it was apparent to adults that this could not be so. Because preoperational children are unable to take the perspective of others, they often interpret events entirely in reference to themselves.

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Video Example 2.3

Bob Slavin provides an example of developmental changes in children's egocentric thinking. How will your understanding of egocentrism help you as a teacher?

CONCRETE OPERATIONAL STAGE (AGES 7 TO 11) Although the differences between the mental abilities of preoperational preschoolers and concrete operational elementary school students are dramatic, concrete operational children still do not think like adults (Davis, 2008). They are very much rooted in the world as it is and have difficulty with abstract thought. Flavell describes the concrete operational child as taking "an earthbound, concrete, practical-minded sort of problem-solving approach, one that persistently fixates on the perceptible and inferable reality right there in front of him. A theorist the elementary-school child is not" (1986, p. 103). The term **concrete operational stage** reflects this earthbound approach. Children at this stage can form concepts, see relationships, and solve problems, but only as long as they involve objects and situations that are familiar.

During the elementary school years, children's cognitive abilities undergo dramatic changes. Elementary school children no longer have difficulties with conservation problems because they have acquired the concept of reversibility. For example, they can now see that the amount of milk in the short, wide container must be the same as that in the tall, narrow container, because if the milk were poured back into the tall container, it would be at the same level as before. Another fundamental difference between preoperational and concrete operational children is that the preoperational child responds to perceived appearances, whereas the older, concrete operational child responds to inferred reality. Flavell (1986) demonstrated this concept by showing children a red car and then, while they were still watching, covering it with a filter that made it appear black. When asked what color the car was, 3-year-olds responded "black," and 6-year-olds responded "red." The older, concrete operational child is able to respond to **inferred reality**, seeing things in the context of other meanings; preschoolers see what they see, with little ability to infer the meaning behind what they see.

One important task that children learn during the concrete operational stage is **seriation**, or arranging things in a logical progression—for example, lining up sticks from smallest to largest. To do this, they must be able to order or classify objects according to some criterion or dimension, in this case length. Once this ability is acquired, children can master a related skill known as **transitivity**, the ability to infer a relationship between two objects on the basis of knowledge of their respective relationships with a third object. For example, if you tell preoperational preschoolers that Tom is taller than Becky and that Becky is taller than Fred, they will not see that Tom is taller than Fred. Logical inferences such as this are not possible until the stage of concrete operations, during which school-age children develop the ability to make two mental transformations that require reversible thinking. The first of these is inversion (+A is reversed by −A), and the second is reciprocity (A < B is reciprocated by B > A). By the end of the concrete operational stage, children have the mental abilities to learn how to add, subtract, multiply, and divide; to place numbers in order by size; and to classify objects by any number of criteria. Children can think about what would happen if . . . , as long as the objects are in view—for example, "What would happen if I pulled this spring and then let it go?" Children can understand time and space well enough to draw a map from their home to school and are building an understanding of events in the past.

Children in the elementary grades also are moving from egocentric thought to decentered or objective thought. Decentered thought enables children to see that others can have different perceptions than they do. For example, children with decentered thought will be able to understand that different children may see different patterns in clouds. Children whose thought processes are decentered are able to learn that events can be governed by physical laws, such as the laws of gravity. These changes do not all happen at the same time. Rather, they occur gradually during the concrete operational stage.

InTASC 1
Learner Development

FORMAL OPERATIONAL STAGE (AGE 11 TO ADULTHOOD) Sometime around the onset of puberty, children's thinking begins to develop into the form that is characteristic of adults (Horn, Drill, Hochberg, Heinze, & Frank, 2008; Packard & Babineau, 2008). The preadolescent begins to be able to think abstractly and to see possibilities beyond the here and now. These abilities continue to develop into adulthood. With the **formal operational stage** comes the ability to deal with potential or hypothetical situations; the form is now separate from the content.

Inhelder and Piaget (1958) described one task that is approached differently by elementary school students in the concrete operational stage than by adolescents in the formal operational

FIGURE 2.3 • A Test of Problem-Solving Abilities

The pendulum problem uses a string, which can be shortened or lengthened, and a set of weights. When children in the concrete operational stage are asked what determines frequency (the number of times per minute that the pendulum swings back and forth), they will tackle the problem less systematically than will adolescents who have entered the stage of formal operations. (The answer is that only the string's length affects the frequency.)

stage—the pendulum problem that Patricia Wing gave to her third-graders. The children and adolescents were given a pendulum consisting of a string with a weight at the end. They could change the length of the string, the amount of weight, the height from which the pendulum was released, and the force with which the pendulum was pushed. They were asked which of these factors influenced the frequency (the number of swings per minute). Only the length of the string makes any difference in the frequency of the pendulum: The shorter the string, the more swings per minute. This experiment is illustrated in Figure 2.3. The adolescent who has reached the stage of formal operations is likely to proceed quite systematically, varying one factor at a time (e.g., leaving the string the same length and trying different weights). For example, in Inhelder and Piaget's (1958) experiment, one 15-year-old selected 100 grams with a long string and a medium-length string, then 20 grams with a long and a short string, and finally 200 grams with a long and a short string and concluded, "It's the length of the string that makes it go faster and slower; the weight doesn't play any role" (p. 75). In contrast, 10-year-olds (who can be assumed to be in the concrete operational stage) proceeded in a chaotic fashion, varying many factors at the same time and hanging on to preconceptions. One boy varied simultaneously the weight and the push; then the weight, the push, and the length; then the push, the weight, and the elevation; and so on. He first concluded, "It's by changing the weight and the push, certainly not the string."

The transitivity problem also illustrates the advances brought about by formal thought. Recall the concrete operational child who, when told that Tom was taller than Becky and that Becky was taller than Fred, understood that Tom was taller than Fred. However, if the problem had been phrased in the following way, only an older child who had entered the formal operational stage would have solved it: "Becky is shorter than Tom, and Becky is taller than Fred. Who is the tallest of the three?" Here the younger, concrete operational child might get lost in the combinations of greater-than and less-than relationships. Adolescents in the formal operational stage can imagine several different relationships among the heights of Becky, Tom, and Fred and can figure out the accuracy of each until they hit on the correct one. This example illustrates another ability of preadolescents and adolescents who have reached the formal operational stage: They can monitor, or think about, their own thinking.

Connections 2.2

For more on thinking about one's own thinking, or metacognition, see Chapter 6.

Generating abstract relationships from available information and then comparing those abstract relationships to each other is a broadly applicable skill underlying many tasks in which adolescents' competence leaps forward. Piaget (1952a) described a task in which students in the concrete operational stage were given a set of 10 proverbs and a set of statements with the same meanings as the proverbs. They were asked to match each proverb to the equivalent statement. Again, concrete operational children can understand the task and choose answers. However, their answers are often incorrect because they often do not understand that a proverb describes a general

principle. For example, asked to explain the proverb "Don't cry over spilled milk," a child might explain that once milk is spilled, there's nothing to cry about but might not see that the proverb has a broader meaning. The child is likely to respond to the concrete situation of spilled milk rather than understanding that the proverb means "Don't dwell on past events that can't be changed." Adolescents and adults have little difficulty with this type of task.

HYPOTHETICAL CONDITIONS Another ability that Piaget and others recognized in the young adolescent is an aptitude to reason about situations and conditions that have not been experienced. The adolescent can accept, for the sake of argument or discussion, conditions that are arbitrary, that are not known to exist, or even that are known to be contrary to fact. Adolescents are not bound to their own experiences of reality, so they can apply logic to any given set of conditions. One illustration of the ability to reason about hypothetical situations is found in formal debate, in which participants must be prepared to defend either side of an issue, regardless of their personal feelings or experience, and their success is judged on the basis of their documentation and logical consistency. For a dramatic illustration of the difference between children and adolescents in the ability to suspend their own opinions, compare the reactions of fourth- and ninth-graders when you ask them to present an argument in favor of the proposition that schools should be in session 6 days a week, 48 weeks a year. The adolescent is far more likely to be able to set aside her or his own opinions and think of reasons why more days of school might be beneficial. The abilities that make up formal operational thought—thinking abstractly, testing hypotheses, and forming concepts that are independent of physical reality—are critical to acquiring higher-order skills. For example, learning algebra or abstract geometry requires the use of formal operational thought, as does understanding complex concepts in science, social studies, and other subjects.

The thinking characteristics of the formal operations stage usually appear between ages 11 and 15, but there are many individuals who never reach this stage (Niaz, 1997; Packard & Babineau, 2008). As many as two-thirds of U.S. high school students do not succeed on Piaget's formal operations tasks (Meece & Daniels, 2008). Most individuals tend to use formal operational thinking in some situations but not others, and this remains true into adulthood.

Certification Pointer
When responding to case studies in certification tests, you may be asked to design a lesson that would be considered developmentally appropriate for a group of adolescents.

HOW IS PIAGET'S WORK VIEWED TODAY?

Piaget's theory revolutionized, and in many ways still dominates, the study of human development. However, some of his central principles have been questioned in more recent research, and modern descriptions of development have revised many of his views (see Feldman, 2012; Schunk, 2016).

Criticisms and Revisions of Piaget's Theory

One important Piagetian principle is that development precedes learning. Piaget held that developmental stages were largely fixed and that such concepts as conservation could not be taught. However, research has established many cases in which Piagetian tasks can be taught to children at earlier developmental stages (Feldman, 2012). Several researchers have found that young children can be taught to succeed on simpler forms of Piaget's tasks before they reach the stage at which that task is usually achieved (Gelman, 2000; Kuhn, 2006; Siegler & Svetina, 2006). Piaget understood that children do not move, for example, from being nonconservers to being conservers all at once. Instead, they typically master conservation of number (blocks rearranged are still the same number of blocks) a year or two before they master conservation of weight (the weight of a ball of clay does not change when you flatten it). This observation makes the concept of set stages of development more difficult to justify (Miller, 2011). Similarly, in simple, practical contexts, children have been found to demonstrate their ability to consider the point of view of others (Siegler, 2006), and infants have been shown to demonstrate aspects of object permanence much earlier than Piaget predicted (Baillargeon, 2002).

The result of this research has been a recognition that children are more competent than Piaget originally thought, especially when their practical knowledge is being assessed, and that experience and direct teaching affect the pace of development (Feldman, 2012). Piaget (1964) responded to demonstrations of this kind by arguing that the children must have been on the verge of the next developmental stage already—but the fact remains that some of the Piagetian tasks can be taught to children well below the age at which they usually appear without instruction.

Another point of criticism goes to the heart of Piaget's "stage" theory. Many researchers now doubt that there are broad stages of development affecting all types of cognitive tasks; instead, they argue that children's skills develop in different ways on different tasks and that their experience (including direct teaching in school or elsewhere) can have a strong influence on the pace of development (see Miller, 2011; Siegler, 2006; Trawick-Smith, 2014). The evidence is particularly strong that children can be taught to perform well on the Piagetian tasks assessing formal operations, such as the pendulum problem illustrated in Figure 2.3. Clearly, experience matters. Watch an intelligent adult learning to sail. Initially, he or she is likely to engage in a lot of concrete operational behavior, trying everything in a chaotic order, before systematically beginning to learn how to adjust the tiller and the sail to the wind and direction (as in formal operational thought).

Neo-Piagetian Views of Development

Connections 2.3
For more on information processing, see Chapter 6.

Neo-Piagetian theories are modifications of Piaget's theory that attempt to overcome its limitations and address problems that critics have identified. In particular, neo-Piagetians have demonstrated that children's abilities to operate at a particular stage depend a great deal on the specific tasks involved (Massey, 2008); that training and experience, including social interactions, can accelerate children's development (Birney, Citron-Pousiy, Lutz, & Sternberg, 2005; Flavell, 2004; Siegler, 2006); and that culture has an important impact on development (Gelman, 2000; Greenfield, 2004).

Neo-Piagetians see cognitive development in terms of specific types of tasks instead of overall stages. For example, different tasks described as indicators of concrete operational thinking appear at very different ages (Cohen & Cashon, 2003; Halford & Andrews, 2006). Neo-Piagetians refer to "dialectical thinking," the ability to see that real-life problems do not necessarily have a single solution (Sternberg, 2008). Influenced by Vygotsky (see the next section), Neo-Piagetians place a far greater emphasis than Piaget himself did on the impact of culture, social context, and education on the development process (Crisp & Turner, 2011; Maynard, 2008).

InTASC 1
Learner Development

InTASC 2
Learning Differences

THEORY INTO PRACTICE

Educational Implications of Piaget's Theory

Piaget's theories have had a major impact on the theory and practice of education (DeVries, 2008; Hustedt, Epstein, & Barnett, 2013; Ostroff, 2012; Schunk, 2016; Seifert, 2013). The theories focused attention on the idea of **developmentally appropriate education**—an education with environments, curriculum, materials, and instruction that are suitable for students in terms of their physical and cognitive abilities and their social and emotional needs. Piagetian theory has been influential in constructivist models of learning, which will be described in Chapter 8. Berk (2013) summarizes the main teaching implications drawn from Piaget as follows:

1. ***A focus on the process of children's thinking, not only its products.*** In addition to checking the correctness of children's answers, teachers must understand the processes children use to get to the answer. Appropriate learning experiences build on children's current level of cognitive functioning, and only when teachers appreciate children's methods of arriving at particular conclusions are they in a position to provide such experiences.
2. ***Recognition of the crucial role of children's self-initiated, active involvement in learning activities.*** In a Piagetian classroom the presentation of ready-made knowledge is deemphasized, and children are encouraged to discover for themselves through spontaneous interaction with the environment. Therefore, instead of teaching didactically, teachers provide a rich variety of activities that permit children to act directly on the physical world.

3. ***A deemphasis on practices aimed at making children adultlike in their thinking.*** Piaget referred to the question "How can we speed up development?" as "the American question." Among the many countries he visited, psychologists and educators in the United States seemed most interested in what techniques could be used to accelerate children's progress through the stages. Piagetian-based educational programs accept his firm belief that premature teaching could be worse than no teaching at all because it leads to superficial acceptance of adult formulas rather than to true cognitive understanding.
4. ***Acceptance of individual differences in developmental progress.*** Piaget's theory assumes that all children go through the same developmental sequence but that they do so at different rates. Therefore, teachers must make a special effort to arrange classroom activities for individuals and small groups of children rather than for the total class group. In addition, because individual differences are expected, children's educational progress should be assessed in terms of each child's own previous course of development rather than in terms of the performances of same-age peers.

MyEdLab **Self-Check 2.1**

HOW DID VYGOTSKY VIEW COGNITIVE DEVELOPMENT?

Lev Semionovich Vygotsky was a Russian psychologist who died in 1934. Although Piaget and Vygotsky never met, they were contemporaries who were aware of each other's early work (DeVries, 2008). Vygotsky's work was not widely read in English until the 1970s, however, and only since then have his theories become influential in North America. Vygotskian theory is now a powerful force in developmental psychology, and many of the critiques he made of the Piagetian perspective more than 70 years ago have come to the fore today (see Daniels, Cole, & Wertsch, 2007; Gredler & Shields, 2008; John-Steiner & Mahn, 2003; Winsler, 2003).

Vygotsky's work is based on two key ideas. First, he proposed that intellectual development can be understood only in terms of the historical and cultural contexts children experience. Second, he believed that development depends on the **sign systems** that individuals grow up with: the symbols that cultures create to help people think, communicate, and solve problems. Examples include a culture's language, its writing system, and its counting system. Focusing only on Western symbol systems, he argued, greatly underestimates cognitive development in diverse cultures (Mahn & John-Steiner, 2013; Trawick-Smith, 2014). In contrast to Piaget, Vygotsky proposed that cognitive development is strongly linked to input from others.

How Development Occurs

Recall that Piaget's theory suggests that development precedes learning. In other words, specific cognitive structures need to develop before certain types of learning can take place. Vygotsky's theory suggests that learning precedes development. For Vygotsky, learning involves the acquisition of signs by means of information from others and deliberate teaching. Development occurs as the child internalizes these signs so as to be able to think and solve problems without the help of others, an ability called **self-regulation**.

The first step in the development of self-regulation and independent thinking is learning that actions and sounds have a meaning. For example, a baby learns that the process of reaching toward an object is interpreted by others as a signal that the infant wants the object, and then reaches toward objects out of reach as a sign that he or she wants help getting the object. In the case of language acquisition, children learn to associate certain sounds with meaning. The second step in developing internal structures and self-regulation involves practice. The infant practices gestures that will get attention. The preschooler enters into conversations with others to master language.

Connections 2.4
For more on self-regulated learning, see Chapter 8.

MyEdLab

Video Example 2.4

Is organizing blocks in a pattern based on color a skill that is in the boy's zone of proximal development, or is it still too advanced for a child at his developmental level?

The final step is the use of signs to think and solve problems without the help of others. At this point, children become self-regulating, and the sign system has become internalized.

PRIVATE SPEECH Vygotsky proposed that children incorporate the speech of others and then use that speech to help themselves solve problems. **Private speech** is easy to see in young children, who frequently talk to themselves, especially when faced with difficult tasks (Corkum, Humphries, Mullane, & Theriault, 2008; Flavell, 2004). Later, private speech becomes silent but is still very important. Studies have found that children who make extensive use of private speech learn complex tasks more effectively than do other children (Al-Namlah, Fernyhough, & Meins, 2006; Emerson & Miyake, 2003; Schneider, 2002).

THE ZONE OF PROXIMAL DEVELOPMENT Vygotsky (1978) believed that learning takes place most effectively when children are working within their **zone of proximal development**. Tasks within the zone of proximal development are those that a child cannot yet accomplish alone but could accomplish with the assistance of more competent peers or adults. That is, the zone of proximal development describes tasks that a child has not yet learned but is capable of learning at a given time. Some educators refer to a "teachable moment" when a child or group of children is exactly at the point of readiness for a given concept (Berger, 2012). Vygotsky further believed that higher mental functioning usually exists in conversation and collaboration among individuals before it exists within the individual.

"I'm sorry, Miss Scott, but this is outside of my zone of proximal development."

MEDIATION Vygotsky believed that complex skills, such as reasoning and problem solving, are developed via **mediation** with adults and higher-performing peers (Vygotsky, 1978; Wertsch, 2007). That is, older children and adults help learners by explaining, modeling, or breaking down complex skills, knowledge, or concepts. In this way they help learners obtain psychological tools, as when children are giving each other pointers on a computer game or modeling the use of debate strategies. The more knowledgeable peers or adults help the learner take the next learning step, but also add to the learner's "cultural tool kit." For example, imagine that two young friends are driving together and the driver (unintentionally) screeches around a corner. The passenger notes, "I always slow waaay down when I'm turning to keep that from happening." This advice, from a peer in the exact moment when it is likely to be meaningful, will not only help the driver corner better, but will add to the driver's "cultural tool kit" of solutions for driving problems and sense of mastery of a task of enormous cultural importance in Western societies. In a traditional culture, where young adolescents go through puberty rites, peers might share ideas about ways to prepare for a rite of passage, such as surviving alone in the jungle. Just as in the driving example, this sharing adds to the learner's "cultural tool kit"; it's just a different kit, designed for a different culture. Vygotsky's point is that each culture outfits each of its members with such a kit through a process of mediation, passing on knowledge, skills, and experience from older to younger members of the society.

SCAFFOLDING A key idea derived from Vygotsky's notion of social learning is that of **scaffolding** (John-Steiner & Mahn, 2003; Rogoff, 2003): the assistance provided by more competent peers or adults. Typically, scaffolding means providing a child with a great deal of support during the early stages of learning and then diminishing that support and having the child take on increasing responsibility as soon as she or he is able. Scaffolding can be thought of as mediation on purpose, planfully helping a learner move from a current level of skill to independent capability to use a new skill. Parents use scaffolding when they teach their children to play a new game or to tie their shoes. A related concept is **cognitive apprenticeship**, which describes the entire process of modeling, coaching, scaffolding, and evaluation that is typically seen whenever one-to-one instruction takes place (John-Steiner & Mahn, 2003; Rogoff, 2003). For example, in *Life on the Mississippi,* Mark Twain describes how he was taught to be a steamboat pilot. At first the experienced pilot talked him through every bend in the river, but gradually he was left to figure things out for himself, with the pilot there to intervene only if the boat was about to run aground.

Connections 2.5

For more on scaffolding and cooperative learning, see Chapter 8.

COOPERATIVE LEARNING Vygotsky's theories support the use of cooperative learning strategies in which children work together to help one another learn (Slavin, 2014; Webb, 2008). Because peers are usually operating within each other's zones of proximal development, they often provide models for each other of slightly more advanced thinking (Gredler, 2009). In addition, cooperative learning makes children's inner speech available to others, so they can gain insight into one

another's reasoning process. That is, children benefit from hearing each other "thinking out loud," especially when their groupmates talk themselves or each other through a problem.

ON THE WEB

To learn more about applications of Vygotsky's theories to education practice, visit mathforum.org. To learn more about Vygotsky and to compare his theories with Piaget's, visit www.simplypsychology.org and type Vygotsky into the search engine.

THEORY INTO PRACTICE

Classroom Applications of Vygotsky's Theory

Vygotsky's theories of education have major practical implications in the classroom (see Hustedt et al., 2013; Schunk, 2016; Seifert, 2013). The concept of a zone of proximal development implies that only instruction and activities that fall within this zone can be learned. Teaching content that is too easy or too difficult does not add to learning (see Figure 2.4). Also, according to a Vygotskian approach to instruction, teaching must emphasize scaffolding, with students taking more and more responsibility for their own learning (Berger, 2012; Daniels et al., 2007; Ostroff, 2012). Finally, students can benefit from cooperative learning arrangements among groups of learners with differing levels of ability. Tutoring by more competent peers can be effective in promoting growth within the zone of proximal development, as can interactions around complex tasks (Roth & Lee, 2007).

You can use information about Vygotsky's zone of proximal development in organizing classroom activities in the following ways:

- Instruction can be planned to provide practice within the zone of proximal development for individual children or for groups of children. For example, hints and prompts that helped children during a preassessment could form the basis of instructional activities.
- Scaffolding (John-Steiner & Mahn, 2003) provides hints and prompts at different levels. In scaffolding, the adult does not simplify the task, but the role of the learner is simplified "through the graduated intervention of the teacher."
- Cooperative learning activities can be planned with groups of children at different levels who can help each other learn (Slavin, 2014; Webb, 2008).

Scaffolding is directly related to the concept of a zone of proximal development. For example, a child might be shown pennies to represent each sound in a word (e.g., three pennies for the three sounds in "man"). To master this word, the child might be asked to place a penny on the table to show each sound in a word, and finally the child might identify the sounds without the pennies. The pennies provide a scaffold to help the child move from assisted to unassisted success at the task (Rogoff, 2003). In a high school laboratory science class, a teacher might provide scaffolding by first giving students detailed guides to carrying out experiments, then providing brief outlines that they might use to structure experiments, and finally asking them to set up experiments entirely on their own.

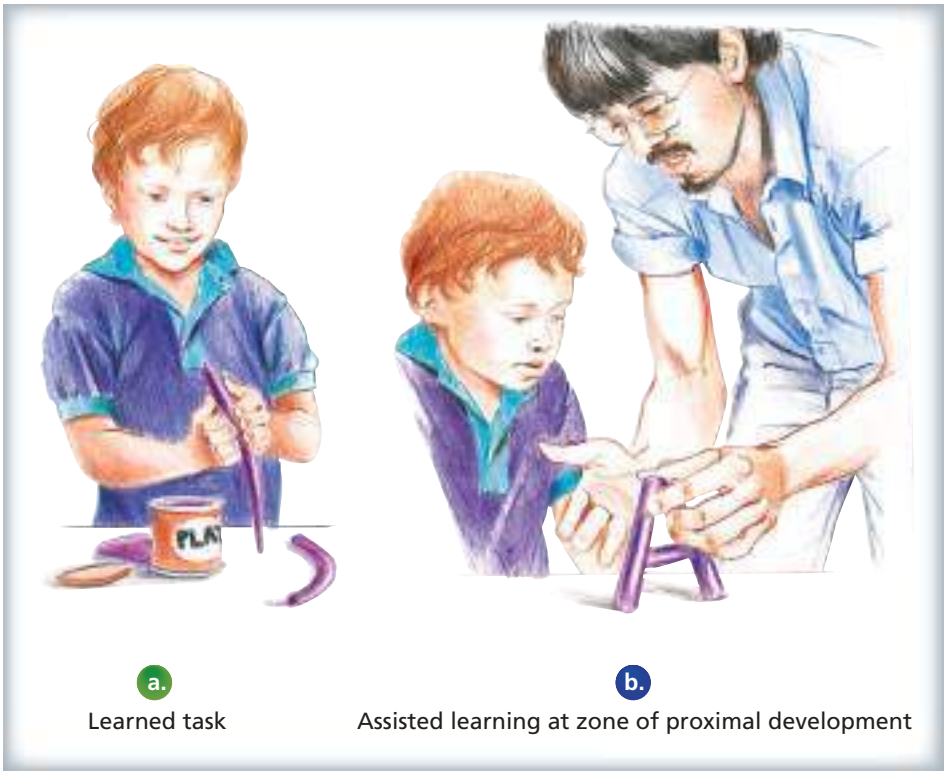
InTASC 1
Learner Development

InTASC 8
Instructional Strategies

Certification Pointer
Lev Vygotsky's work will probably be on your teacher certification test. You may be required to know that the zone of proximal development is the level of development just above where a student is presently functioning and why this is important for both teachers and students.

FIGURE 2.4 • Teaching Model Based on Vygotsky's Theory

In (a), the child performs a learned task; in (b), the child is assisted by a teacher or peer who interacts with the child to help him move into a new zone of proximal development (unlearned tasks at the limits of a learner's abilities) with a new learned task.



HOW DID BRONFENBRENNER VIEW DEVELOPMENT?

Urie Bronfenbrenner, a psychologist who was born in Russia but came as a child to the United States, described a "bioecological" model of human development (Bronfenbrenner & Morris, 2006). His model is summarized in Figure 2.5. The focus of his model is on the social and institutional influences on a child's development, from family, schools, places of worship, and neighborhoods, to broader social and political influences, such as mass media and government.

Bronfenbrenner's main contribution was in showing how development is influenced at each of the levels. Bronfenbrenner critiques the Piagetian view for its limited focus beyond the child (the microsystem). He notes the enormous influence of the home and family and the mutual influences between the child and the family. This *mesosystem* also binds children to parents, students to teachers, and friends to friends. The *exosystem* (e.g., community, local government, church) affects development directly and through its influence on families, and the *macrosystem*, including cultural and religious values as well as mass media, sets an important context for all of development. Finally, the *chronosystem* consists of the passage of time and those immediate historical events that change all of the factors surrounding the child. Bronfenbrenner emphasizes that all of these factors are constantly changing, and that the child him- or herself has an influence on many of them, especially the family.

The importance of the **bioecological approach** is in emphasizing the interconnectedness of the many factors that influence a child's development. A change in the family, such as a divorce or loss of a job, not only influences the child directly, but may also cause changes in the child's neighborhood, school, place of worship, and friends.

The bioecological approach is descriptive and philosophical, and does not have the extensive research support devoted to Piaget's or Vygotsky's perspectives. However, it builds out from Vygotsky's emphasis on sociocultural factors a more complete model of influences beyond biology on child development (see Bronfenbrenner & Evans, 2000).

MyEdLab **Self-Check 2.2**

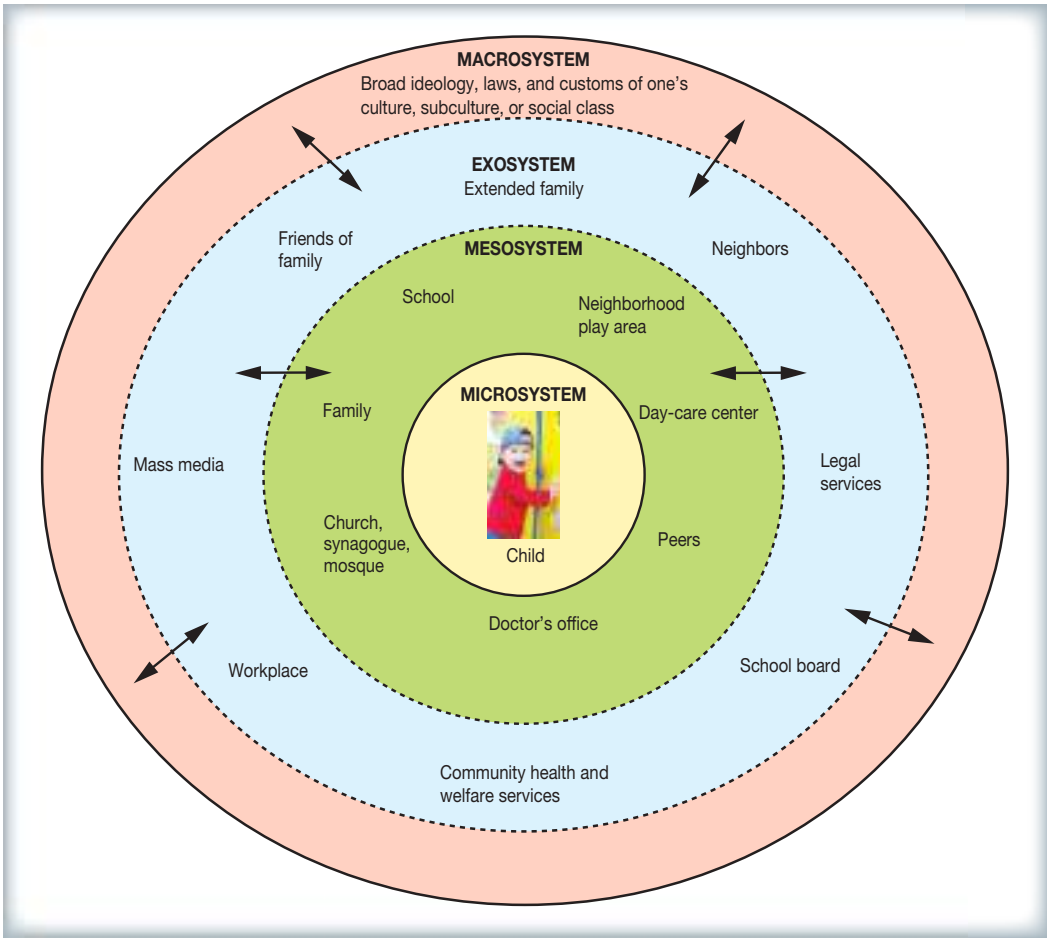


FIGURE 2.5 • Bronfenbrenner's Bioecological Theory

Urie Bronfenbrenner believed that a child's development is affected by social and institutional influences.

Based on Bronfenbrenner, U. (1999). Environments in developmental perspective: Theoretical and operational models. In *Measuring environment across the lifespan: Emerging models and concepts* (1st ed., pp. 3–28). Washington, DC: American Psychological Association.

HOW DO LANGUAGE AND LITERACY DEVELOP?

The aspects of development arguably of greatest concern to educators are language and literacy. Children who develop large vocabularies and become effective speakers, readers, and writers are likely to be successful in school and beyond (Owens, 2016). Development of language and literacy is a key objective of teaching, but there are also characteristic patterns of development over time seen in all cultures that are not the direct results of teaching.

Language and Literacy Development during the Preschool Years

Although there are individual differences in the rates at which children acquire language abilities, the sequence of accomplishments is similar for all children, no matter which language they are learning. Around age 1, children produce one-word utterances such as "bye-bye" and "Mommy." These words typically represent objects and events that are important to the child. Over the course of the second year of life, children begin to combine words into two-word sentences (e.g., "More milk"). During the preschool years, children's vocabulary increases, along with their knowledge of the rules of spoken language. By the time they start school, children have mastered most of the grammatical rules of language, and their vocabulary consists of thousands of words.

ORAL LANGUAGE Development of oral language, or spoken language, requires not only learning words but also learning the rules of word and sentence construction (Gleason & Ratner, 2009; Owens, 2016). For example, children learn the rules for forming plurals before they enter kindergarten. In a

classic study, Berko (1985) showed preschoolers a picture of a made-up bird called a "Wug." She then showed them two such pictures and said, "Now there is another one. There are two of them. There are two _____." The children readily answered "Wugs," showing that they could apply general rules for forming plurals to a new situation. In a similar fashion, children learn to add *-ed* and *-ing* to verbs.

Interestingly, children often learn the correct forms of irregular verbs (such as "He broke the chair") and later replace them with incorrect but more rule-based constructions ("He breaked [or broked] the chair"). One 4-year-old said, "I flew my kite." He then thought for a moment and emphatically corrected himself, saying, "I *flewed* my kite!" These errors are a normal part of language development and should not be corrected.

Just as they learn rules for forming words, children learn rules for sentences. Their first sentences usually contain only two words ("Want milk," "See birdie," "Jessie outside"), but they soon learn to form more complex sentences and to vary their tone of voice to indicate questions ("Where doggie go?") or to indicate emphasis ("Want cookie!"). Three-year-olds can usually express rather complex thoughts, even though their sentences may still lack such words as *a, the,* and *did*.

Certification Pointer
For teacher certification tests, you may be expected to know that children's overgeneralizations of the rules of grammar are normal for young children and should not be corrected.

Preschoolers often play with language or experiment with its patterns and rules. This experimentation frequently involves changing sounds, patterns, and meanings. One 3-year-old was told by his exasperated parent, "You're impossible!" He replied, "No, I'm impopsicle!" The same child said that his baby brother, Benjamin, was a man because he was a "Benja-man." Children often rearrange word sounds to create new words, rhymes, and funny sentences. The popularity of finger plays, nonsense rhymes, and Dr. Seuss storybooks shows how much young children enjoy playing with language.

Oral language development is heavily influenced by the amount and quality of the talking parents do with their children. A classic study by Hart and Risley (1995) found that middle-class parents talked far more to their children than did working-class parents, and that their children had substantially different numbers of words in their vocabularies. The amount of parent speech was as important as socioeconomic status; children of low-income parents who spoke to their children a great deal also had large vocabularies. Numerous studies have also shown that school programs directed at building vocabulary can be very effective (Hindman & Wasik, 2012; Marulis & Neuman, 2013).

While language development is similar for children who are speakers of all languages, children who speak languages other than English in U.S. schools have additional challenges. Teaching strategies to assist second language development are discussed in Chapter 4.

InTASC 2
Learning Differences

READING Learning to read in the early elementary grades is one of the most important of all developmental tasks, both because other subjects depend on reading and because in our society school success is so often equated with reading success. Children who do not learn to read well by third grade are at great risk for long-term problems (Lesnick, George, Smithgall, & Gwynne, 2010). Children often have complex language skills that are critical in reading, and the process of learning to read can begin quite early if children are read to (Giorgis & Glazer, 2009). Research on **emergent literacy**, or preschoolers' knowledge and skills related to reading (Morrow, Roskos, & Gambrell, 2015; National Institute for Literacy, 2008), has shown that children may enter school with a great deal of knowledge about reading and that this knowledge contributes to success in formal reading instruction. For example, young children have often learned concepts of print, such as that print is arranged from left to right, that spaces between words have meaning, and that books are read from front to back. Many preschoolers can "read" books from beginning to end by interpreting the pictures on each page. They understand about story plots and can often predict what will happen next in a simple story. They can recognize logos on familiar stores and products; for example, very young children often know that *M* is for *McDonald's.* Children who are read to and taught letters at home start off with an advantage in reading (Hood, Conlon, & Andrews, 2008), but all children can learn concepts of print, plot, and other prereading concepts if they attend preschools or kindergartens that emphasize reading and discussing books in class (Chambers, Cheung, & Slavin, in press; Diamond, Justice, Siegler, & Snyder, 2013; Hindman & Wasik, 2012; National Institute for Literacy, 2008). Similarly, young children can be taught to hear specific sounds within words (a skill called *phonemic awareness*), which contributes to later success in reading (Anthony & Lonigan, 2004; National Institute for Literacy, 2008). It is also important to take every possible opportunity to build children's vocabulary (Neuman, 2014) by pointing out new words in many contexts.

WRITING Children's writing also follows a developmental sequence (MacArthur, Graham, & Fitzgerald, 2015; Morrow et al., 2015; Tolchinsky, 2015). It emerges out of early scribbles and at

THEORY INTO PRACTICE

Promoting Literacy Development in Young Children

Many of the educational implications derived from research on children's literacy development transfer findings from two sources: parental and teacher behaviors that encourage oral language development and studies of young children who learn to read without formal classroom instruction. The most frequent recommendations include reading to children; surrounding them with books and other printed materials; making various writing materials available; encouraging reading and writing; and being responsive to children's questions about letters, words, and spellings (Casbergue & Strickland, 2015; Florez, 2008; Morrow, et al., 2015; National Institute for Literacy, 2008; Pianta et al., 2015).

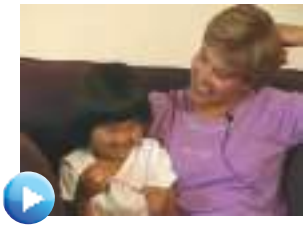
You can use numerous props in the classroom, such as office space in a dramatic play area. Classrooms can have writing centers that make available computers with writing programs, magnetic letters, chalkboards, pencils, crayons, markers, and paper.

You can encourage children's involvement with print by reading in small groups, having volunteers read to children individually, and allowing children to choose books to read. Intimate reading experiences allow children to turn pages, pause to look at pictures or ask questions, and read along with an adult.

Predictable books such as *The Three Little Pigs* and *There Was an Old Lady Who Swallowed a Fly* allow beginning readers to rely on what they already know about literacy while learning sound–letter relationships. Stories are predictable if a child can remember what the author is going to say and how it will be stated. Repetitive structures, rhyme and rhythm, and a match between pictures and text increase predictability.

Children's understanding of literacy is enhanced when adults point out the important features of print. Statements such as "We start at the front, not at the back of the book"; "Move your finger; you're covering the words and I can't see to read them"; and "Point to each word as you say it, not to each letter, like this" help to clarify the reading process. You can indicate features in print that are significant and draw attention to patterns of letters, sounds, or phrases.

Programs that encourage parents to read with their preschoolers have shown that children benefit. One prominent example is Raising a Reader (Anthony et al., 2014), which helps parents read with young children.



MyEdLab

Video Example 2.5

The preschool child in this video has very clear ideas about literacy already. What types of activities would you expect that she and her family engage in regularly?

first is spread randomly across a page. This characteristic reflects an incomplete understanding of word boundaries, as well as an inability to mentally create a line for placing letters. Children invent spellings by making judgments about sounds and by relating the sounds they hear to the letters they know. In trying to represent what they hear, they typically use letter names rather than letter sounds; short vowels are frequently left out because they are not directly associated with letter names (Morrow, 2009). For example, one kindergartner labeled a picture of a dinosaur "DNSR."

Language and Literacy Development during the Elementary and Secondary Years

Language and literacy develop at a rapid rate for children in the elementary and secondary grades. For example, Graves (2007) estimates that the average student adds 3,000 words each year to his or her vocabulary. However, these words will vary, as a student's motivations, interest, culture, and peer group come to have a huge impact. For example, a girl who talks sports with her friends and family, plays sports, reads about sports, and watches sports on television builds up an enormous sports vocabulary. A girl who loves science and is in a family and peer group who talk

about science builds up an equally enormous science vocabulary. But which of these—sports or science—will be on the SAT? Obviously, the girl immersed in science is at a great advantage in school because of her interests and social context.

Literacy also develops rapidly in the elementary and middle grades. Whereas the emphasis in the early elementary grades is primarily on decoding and fluency, students from second grade onward are increasingly focused on building comprehension, vocabulary, and study skills (Deshler, Palincsar, Biancarosa, & Nair, 2007; Kamil, Borman, Dole, Kral, & Salinger, 2008). Good readers use strategies such as predicting, reviewing, summarizing, and generating their own questions, and if these strategies are directly taught to elementary and secondary students, their comprehension improves (Biancarosa & Snow, 2006; Block & Duffy, 2008; Gersten, Chard, Jayanthi, & Baker, 2006).

THEORY INTO PRACTICE

Teaching Children to Read

There once was a saying in elementary education: "Math is taught, but reading is caught." Yet research over the past 20 years has shown that reading can and must be taught, explicitly, planfully, and systematically. Some students do "catch" reading no matter how it is taught, but for a very large number, perhaps the majority, it matters a great deal how reading is taught (Allington, 2011; Hunter, 2012; Schwanenflugel & Knapp, 2015).

An influential report by the National Reading Panel (2000) concluded that there were five key components to reading instruction, each of which must be successfully taught. These are as follows.

1. Phonemic awareness (or phonological awareness) is the ability to recognize sounds within words. For example, preschool and kindergarten children may learn to put the spoken words "tower," "tag," and "time" in the same category because they all start with the sound /t/. They might learn that without the /d/ sound, "dog" becomes "og." They might recognize that there are three sounds in the words "cat" and "pack," but four in "milk" and "child" (see, for example, Blachman et al, 1999; Center, 2005; Temple, Ogle, Crawford, & Freppon, 2016).
2. Phonics involves the ability to take letter sounds and form them into words, a process often called "decoding" (Blevins, 2011). This requires knowing the sounds letters make (sound–symbol correspondence) and then blending them into words. For example, children in kindergarten or first grade might learn the sounds made by the letters m, a, n. But can they put them together to make the word "man"? Sound blending can be taught and practiced so that students can quickly sound out words. This enables them to focus on meaning (see Center, 2005; Hunter, 2012; Rasinski & Zutell, 2010; Temple et al., 2016).
3. Comprehension, the meaning of text, is ultimately the whole purpose of reading. Students must be able to recognize words smoothly and quickly before comprehension can reach a high level. However, even students who are very good at decoding may struggle with comprehension. Beyond building decoding and fluency, students can become effective comprehenders by having many books read to them, by reading many books themselves, and by discussing books with peers and others (Duke & Carlisle, 2011). They may be taught to use "metacognitive strategies" such as predicting how a story will end, summarizing or stating the main idea of paragraphs, and learning strategies for dealing with unknown words or difficult content (Gambrell, Morrow, & Pressley, 2007; Guthrie, 2008). While decoding instruction is typically completed in the early grades, students need to grow in comprehension throughout their lives, especially

by reading books on many topics and in many genres. Students moving into upper elementary and secondary grades especially need to learn to read in content areas, such as science and social studies; to grow increasingly able to read and comprehend factual as well as narrative texts; to read critically, and to enjoy reading (Guthrie, 2008).

4. Our vocabulary consists of words for which we know the meanings. Much of one's vocabulary is built by daily life, exposure to media, and discussions with friends and family. However, there is a great deal of vocabulary that is unlikely to come up in daily life. Words specific to science, to math, to social studies, to art, to music, or to literature are all unlikely to be heard on the playground, but they are still extremely important. Vocabulary is built by giving students many opportunities to read about various topics and to discuss what they have read, especially in cooperative groups (Scott, Skobel, & Wells, 2008). In particular, giving students many opportunities to read about a wide variety of topics that greatly interest them builds vocabulary (Rasinski & Zutell, 2010). Teaching word meanings in context, ideally with pictures or actions to demonstrate meanings, can be very effective (Beck, McKeown, & Kucan, 2002; Blachowicz & Fisher, 2006; Graves, August, & Carlo, 2011; Hiebert & Reutzel, 2010).

   For English learners, learning English vocabulary imposes some added difficulties, but the basic strategies are not so different. English learners need a lot of opportunities to use their English in cooperative learning groups and other peer settings, to see words explained in context and with pictures, and to read in many genres (August & Shanahan, 2006a; Calderón & Minaya-Rowe, 2011). This is discussed further in Chapter 4.

5. Fluency is the speed at which students can decode and comprehend text. Reading fluency is important because slow readers lose comprehension and motivation (Temple et al., 2016). Reading fluency can be built by giving students many opportunities to read aloud, and by having students time each other's reading and try to improve their speeds. Fluency should never become more important than comprehension; students should not be asked to read fast while ignoring meaning. But rapid reading is a skill that can and should be taught (Center 2005; Temple et al., 2016).

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THE INTENTIONAL TEACHER

Teaching in Light of Principles of Cognitive, Language, and Literacy Development

Intentional teachers use what they know about predictable patterns of cognitive, literacy, and language development to make instructional decisions.

- They are aware of what children of the age they teach are able to do now, and of the next steps in their development, and they help give their students opportunities to grow into new ways of thinking.
- They assess their children's thinking processes, using observation as well as formal measures, to understand their cognitive levels and barriers to their growth.
- They modify their instruction if they find that it is not challenging their students to make conceptual growth, or if they find that many students are struggling due to developmental unreadiness.

(continued)

- They give students many opportunities to work with diverse peers so that they can regularly experience how peers at slightly different cognitive levels proceed to solve problems.
- They give students many opportunities to solve complex, practical problems that force them to encounter cognitive issues appropriate to their developmental levels, such as puzzling science experiments and intriguing math problems.
- They take into account cultural, family, and community factors in their teaching without using these factors as excuses to demand less of certain students.
- They proactively invite parents and community members to be involved with their teaching, so that students can see a consistency of expectations among school, home, and community, and so that families and community members can better reinforce the school's goals for the children they share.

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Application Exercise 2.1

In the Pearson etext, watch a classroom video. Then use the guidelines in "The Intentional Teacher" to answer a set of questions that will help you reflect on and understand the teaching and learning presented in the video.

SUMMARY

How Do Children Develop Cognitively?

Most developmental psychologists believe that nature and nurture combine to influence cognitive development. Continuous theories of development focus on social experiences that a child goes through, whereas discontinuous theories emphasize inborn factors rather than environmental influence.

How Did Piaget View Cognitive Development?

Piaget postulated four stages of cognitive development through which people progress between birth and young adulthood. People adjust their schemes for dealing with the world through assimilation and accommodation. Piaget's developmental stages include the sensorimotor stage (birth to 2 years of age), the preoperational stage (2 to 7 years of age), and the concrete operational stage (ages 7 to 11). During the formal operational stage (age 11 to adulthood), young people develop the ability to deal with hypothetical situations and to monitor their own thinking.

How Is Piaget's Work Viewed Today?

Piaget's theory has been criticized for relying exclusively on broad, fixed, sequential stages through which all children progress, and for underestimating children's abilities. In contrast, neo-Piagetian theories place greater emphasis on social and environmental influences on cognitive development. Nevertheless, Piaget's theory has important implications for education. Piagetian principles are embedded in the curriculum and in effective teaching practices, and Piaget-influenced concepts such as cognitive constructivism and developmentally appropriate instruction have been important in education reform.

How Did Vygotsky View Cognitive Development?

Vygotsky viewed cognitive development as an outgrowth of social development through interaction with others and the environment. Mediated learning takes place in children's zones of proximal development, where they can do new tasks that are within their capabilities only with a teacher's or peer's assistance. Children internalize learning, develop self-regulation, and solve problems through vocal or silent private speech. Teachers provide interactional contexts, such as cooperative learning, mediation, and scaffolding, to help children build understanding of developmentally appropriate skills.

How Did Bronfenbrenner View Development?

Bronfenbrenner created a bioecological model to describe how family, school, community, and cultural factors impact a child's development.

How Do Language and Literacy Develop?

During the Preschool Years

Young children's language develops in predictable patterns as children use and play with language. Early literacy developments depend on children's experiences at home and on their learning about books and letters.

During the Elementary and Secondary Years

Students make rapid progress in vocabulary and reading comprehension. Motivation is a key to both, as are opportunities to use new words and reading skills with peers and in new forms.

KEY TERMS

Review the following key terms from the chapter.

accommodation 26
adaptation 25
assimilation 25
bioecological approach 36
centration 27
cognitive apprenticeship 33
cognitive development 25
concrete operational stage 29
conservation 27
constructivism 26
continuous theories of development 24
development 23
developmentally appropriate education 32
discontinuous theories of development 24
egocentric 28
emergent literacy 38
equilibration 26
formal operational stage 29
inferred reality 29
mediation 33
object permanence 27
preoperational stage 27
private speech 33
reflexes 26
reversibility 27
scaffolding 33
schemes 25
self-regulation 33
sensorimotor stage 26
seriation 29
sign systems 33
transitivity 29
zone of proximal development 33

SELF-ASSESSMENT: PRACTICING FOR LICENSURE

Directions: This chapter addresses indicators that are often assessed in state licensure exams. Respond to the following questions.

1. According to Piaget, why do preoperational children think a cut-up sandwich is more sandwich than a whole one?
2. According to Vygotsky, why does cooperative work help children to learn?
3. According to Bronfenbrenner, how might a parents' divorce change a child's cognitive development?
4. Write a brief description of a typical student at one of the following grade levels: K–1, 2–5, 6–8, 9–12. Use the ideas of each theorist from this chapter to guide your description.
5. Make a list of developmentally appropriate teaching strategies for one of the following grade levels: K–1, 2–5, 6–8, 9–12.

MyEdLab **Licensure Exam 2.1** Answer questions and receive instant feedback in your Pearson eText in MyEdLab.