CHAPTER

9 Classroom Contexts for Cognitive Growth

The evolution of cognitive psychology away from "purely cognitive" variables of memory and thinking to include learners' motivational and belief systems that we described in earlier chapters also has led to another important understanding—the role of social interaction and discourse in fostering cognitive development, motivation, and learning.

It seems obvious to anyone who has ever been a student or a teacher, a child or a parent, that teaching and learning are highly social activities. From the very earliest interactions between parent and child on up to a graduate student's relationship with a graduate advisor, much of our learning is influenced by the larger culture in which we live and takes place through interactions with adults or peers who have greater knowledge.

Despite this seemingly obvious importance of the social context in learning, cognitive development research did not begin to focus in earnest on social processes and their effect on cognition until the late 1970s. The translation and publication in 1962 of *Thought and Language* by the Russian psychologist Lev Vygotsky, and in 1978 of his book *Mind in Society: The Development of Higher Psychological Processes,* began this major shift of focus. Vygotsky's assertion that higher mental functions originate in our social life when children interact with adults or more capable peers (Vygotsky, 1978) resonated with researchers and educators who felt that the information processing approaches to cognitive development had a major weakness in lacking any account of the social context of learning.

Information processing approaches to theories of cognitive development, as described in Chapters 2–5, have focused on describing mechanisms such as encoding, retrieval and strategy choice that operate internally when a learner is participating in a task. These are excellent descriptions of the internal processes occurring during learning, but they fail to describe the social processes often involved—Vygotsky's interactions with adults or more capable peers—and internal processes such as tacit inner speech and reflection. There is now clear evidence that external processes such as scaffolding, peer tutoring, and student collaborations all exert an important influence on the development of internal processes such as self talk, memory and strategy use.

The social context of cognition and its applications to learning and instruction received increasing attention from theorists and researchers through the 1980s and 1990s (Lave, 1988; Moll & Whitmore, 1993; Newman, Griffin, & Cole, 1989; Pressley & Wharton-McDonald, 1997; Rogoff, 1990). The idea of children as active learners, who construct their own knowledge and reflect on their learning with the help of more experienced partners, expanded the way we think about classroom teaching and our ideas of the teacher's role. Teachers moved beyond their roles as information givers, serving in new ones as coaches and guides and facilitating students' knowledge building. This increasing emphasis on the social context and the effects of the wider culture on cognition and learning has led researchers to consider new teaching approaches, such as guided participation (Rogoff, 1990; Rogoff & Angelillo, 2002) and Schön's reflective practitioner model (1987), and to look beyond the classroom to the cognitive effects of the provision and regulation of children's everyday activities (Gauvain, 2001; Loyens, Rikers, & Schmidt, 2008). Our view of the centrality of these ideas to education is reflected in two of the cognitive themes that we outlined in Chapter 1: that learning is a constructive, not a receptive process, and that social interaction is fundamental to cognitive development. If anything, these ideas have continued to increase in relevance since the 1980s and are more viable today among researchers and educators than ever before (Kincheloe, 2005; McCaslin, 2004; O'Donnell, 2006; Wertsch, 2008).

Another of Vygotsky's important contributions to the thinking about cognitive development was the concept of language as one of the most important social and cognitive tools. As researchers have recognized the importance of the social context of cognition, interest has also grown in the role of classroom discussion, or discourse, in building knowledge. A classroom discussion can be seen as the everyday expression of the idea that students are active agents in their own learning, enabling students to construct new conceptions and acquire new ways of thinking. Yet research suggests that classroom discussion often fails to achieve these goals (Chinn, Anderson, & Waggoner, 2001; O'Donnell, 2006). The ideas of Calfee (1994), Chinn and Waggoner (1992), Chinn et al. (2001), O'Flahavan and Stein (1992), and others help define ways that teachers can guide classroom discourse to create a more "reflective" classroom and foster cognitive growth.

The social contexts of cognition and learning have obvious applications to the classroom. As any teacher knows, the classroom is above all a social environment and teaching is a form of social interaction that affects group collaboration (Martin, 2006), motivation (Perry, Turner, & Meyer, 2006), learning (De Jong & Pieters, 2006) and even use of technology (Lajoie & Azevedo, 2006). The challenge to teachers is to provide classroom environments that support knowledge development in all its forms and that encourage students' self-awareness and self-direction. One of the most important perspectives directing how researchers and educators think about the social context of the classroom has its roots in Vygotsky's work: the perspective of *constructivism.*

Constructivism: The Learner's Role in Building and Transforming Knowledge

Constructivism is a broad term with philosophical, learning, and teaching dimensions, but it generally emphasizes the learner's contribution to meaning and learning through both individual and social activity (Fosnot, 2008: Kincheloe, 2005; Packer & Goicoechea, 2000). In the constructivist

view, learners arrive at meaning by selecting information and constructing what they know either individually or in collaboration with other learners. Scholars differ in the degree to which they ascribe knowledge construction solely to the learner (see, e.g., Prawat, 1996). Some constructivists view mental structures as reflective of external realities, while others see no independent reality outside the mental world of the individual (Martin, 2006).

Although there are many dimensions of constructivism, most constructivists share four main characteristics (Loyens, Rikers, & Schmidt, 2009). One is that learners are active in constructing their own knowledge by discovering and transforming existing knowledge and experiences into new understandings. A second is that social interactions are important to knowledge construction. In our discussion here, we concentrate most strongly on a form of constructivism—**dialectical constructivism** (Moshman, 1982)—that highlights the importance of social interactions in developing knowledge and thought. In our judgment, this view best helps us identify the elements most likely to create a reflective classroom—one in which teachers and students interact in ways that stimulate both knowledge construction and cognitive growth. A third characteristic is the crucial role of self-regulation and metacognition (Hiekkila & Lonka, 2006), which includes planning, goal setting, strategy selection and coordination, integration, and self-monitoring. A fourth characteristic is using authentic learning tasks in the classroom that reflect how knowledge and skills will be used outside the classroom.

Many key concepts of cognitive psychology, such as *schema theory* and *levels of processing,* represent constructivist thinking. Constructivist perspectives are also shaping significant changes in curriculum and instructional practices in the United States. A constructivist view of learning has provided support for meaning-based approaches to reading instruction, such as those advocated in the *Standards for the English Language Arts* (NCTE, 1996), developed by the International Reading Association and the National Council of Teachers of English. The *Principles and Standards for School Mathematics* (NCTM, 2000) of the National Council of Teachers of Mathematics, though not explicitly constructivist, have a strongly constructivist flavor, as do the *Benchmarks for Science Literacy* (AAAS, 1993) of the American Association for the Advancement of Science and the *National Science Education Standards* (NRC, 1996) of the National Research Council.

The aim of teaching, from a constructivist perspective, is not so much to transmit information as to encourage *knowledge formation* and *metacognitive processes for judging, organizing, and acquiring new information that is student-driven.* The primary reason that constructivist learning is assumed to be superior to other approaches is that the student is active and responsible for meaning-making in the knowledge-construction process. A constructivist approach will manifest itself in the classroom in numerous ways, including the following:

- *Selection of instructional materials:* Employing materials that children can manipulate or use to interact with their environments
- *Choice of activities:* Encouraging students to observe, gather data, test hypotheses, and participate in field trips
- *Nature of classroom processes:* Using cooperative learning and guided discussions
- *Integration of curricula:* Using, for example, long-term thematic projects combining mathematics, science, reading, and writing

In constructivist classrooms, students typically are taught to plan and direct their own learning to some extent. Students are encouraged to take an active role in their learning and teachers adopt new roles as coaches and facilitators rather than serving only as primary sources of information. Typical activities include establishing a safe classroom environment for exploration, fostering an inquiry-based classroom milieu, promoting individual reflection, providing a great deal of opportunity for collaborative discussion, and valuing the importance of the "big picture" as the end result of the knowledge construction process (Kroll, 2004).

Types of Constructivism: A Closer Look

Although some discuss constructivism as if it were a unified philosophical, psychological, and educational perspective, a more differentiated understanding is useful for considering its implications for instruction (Fosnot, 2008: Kincheloe, 2005). Moshman (1982; see also Pressley, Harris, & Marks, 1992; Pressley & Wharton-McDonald, 1997) has distinguished among three types of constructivism: exogenous constructivism, endogenous constructivism, and dialectical constructivism. All involve knowledge construction but reflect different views of how knowledge construction occurs (Ernest, 1995).

In **exogenous constructivism,** knowledge formation is basically a reconstruction of structures, such as cause–effect relationships, presented information, and observed behavior patterns, that already exist in external reality. In this view, our mental structures reflect the organization of the world outside—or *exogenous* to—ourselves. Although they cannot be classified exclusively as examples of exogenous constructivism, important concepts in cognitive psychology such as schemata, network models, and production systems (see Chapter 3), clearly fit within this perspective. Exogenous constructivism emphasizes the strong external influence of physical reality, presented information, and social models on knowledge construction. Knowledge is "true" from this perspective to the extent that it accurately copies the external structures that it ideally represents (Moshman, 1982). A common instructional example of exogenous constructivism is the reciprocal teaching method (see Chapter 4) in which an expert or teacher scaffolds instruction for a novice until the novice can construct sufficient knowledge and regulate her own performance (Webb & Palincsar, 1996).

Contrasted with exogenous constructivism is **endogenous constructivism,** where cognitive structures are created from earlier structures, not directly from information provided by the environment. In endogenous constructivism, according to Moshman, the key process is coordination of cognitive actions; knowledge exists at a more abstract level and develops through cognitive activity within—*endogenous* to—ourselves. Cognitive structures are created from other, earlier structures and follow one another in predictable sequences. Piaget's stages of cognitive development are a prominent example of endogenous constructivism. An intuitively appealing but often-criticized instructional method tied to an endogenous constructivist view is **discovery learning.** Among the criticisms leveled at discovery learning (e.g., see Ericsson, 2003; Kirschner, Sweller, & Clark, 2006) is that studies typically have shown it to be less effective than more structured approaches and that students may lack the knowledge and motivation to construct deep understanding autonomously.

The third category of constructivism represents a point between the extremes of exogenous and endogenous constructivism. Dialectical constructivism places the source of knowledge in the *interactions* between learners and their environments. Knowledge is a "constructed

synthesis" that grows out of contradictions that individuals experience during these interactions (Moshman, 1982, p. 375). Dialectical constructivism is linked with yet another philosophical point of view that has become increasingly influential in American psychology—*contextualism*—which holds that thought and experience are inextricably intertwined with the context in which they occur. A common instructional example of dialectical constructivism is the collaborative peer teaching method in which students work together to scaffold instruction for one another (O'Donnell, 2006).

Although these types of constructivism represent divergent views, Moshman argues that each can be useful for understanding different ways in which individuals might construct knowledge. If, for instance, our primary interest is how accurately children perceive the organization of some body of information, such as concepts in biology, we likely would find an exogenous view of constructivism inviting. If our interest is children's cognitive growth from naive to sophisticated mathematical or scientific concepts (see Chapters 14 and 15), an endogenous constructivism is more likely to be useful. In addition, it is important to understand that any individual likely will engage in all three types of constructivism during the development of expertise in a specific discipline. For example, a novice is likely to engage in exogenous constructivism when entering a new domain of learning (e.g., introductory statistics) because she has little prior knowledge. This means that she will depend to some extent on textbooks, teachers, and experts to develop a core knowledge base and basic skills. Similarly, the same individual likely will collaborate with peers at all stages of learning to master material and concepts, and to revise and hone her statistical reasoning skills. Most likely, only after acquiring some degree of expertise will she engage in endogenous constructivism to restructure knowledge in novel ways.

Of the three, dialectical constructivism provides the most general perspective and has become increasingly important in cognitive psychology. A dialectical perspective incorporates both internal and external factors and focuses our attention on the *interaction* between them. For instance, if we are considering instruction aimed at children's *interpretations* of literature or at challenging children's naive conceptions in mathematics or science, we enter the realm of the dialectic. To better understand dialectical constructivism we need to examine the views of its most distinguished proponent, Vygotsky. Although Vygotsky did his pivotal research in the 1920s and died at the young age of 37 in 1934, it wasn't until translation and publication of his monograph *Thought and Language* that his work began to be known in the West. The publication of *Mind in Society* and subsequent translations of his work (e.g., Rieber & Carton, 1987) fueled further interest in Vygotsky's thinking and marked the beginning of an era in which his ideas have had great influence on psychology and education.

Vygotsky's Dialectical Constructivism

The core of Vygotsky's theory is that higher mental functions have their origin in social life as children interact with more experienced members of their community, such as parents, other adults, and more capable peers. Vygotsky emphasizes the integration of internal and external aspects of learning and the social environment for learning (Newman et al., 1989; Wertsch, 2008). In Vygotsky's view, cultures externalize individual cognition in their tools, by which he means not only the shared physical objects of a culture (e.g., a toothbrush, an automobile, and artwork) but also more abstract social-psychological tools, such as written language and social

institutions. Physical tools are directed toward the external world, but social-psychological tools are "symbol systems used by individuals engaged in thinking" (John-Steiner, 1997). Cognitive change occurs as children use these mental tools in social interactions and internalize and transform these interactions; that is, they progress from other-regulation to self-regulation (del Rio, 2007; Wertsch, 2008). Contemporary theorists believe that **socially mediated co-regulation** affects a variety of cognitive and social skills and provides the basis for values and expectations that support motivation for learning (Corno & Mandinach, 2004: Hickey & Grenade, 2004; McCaslin, 2004).

Perhaps Vygotsky's most influential concept has been the **zone of proximal development.** The zone of proximal development can be defined as the difference between the difficulty level of a problem that a child can cope with independently and the level that can be accomplished with adult help. In the zone of proximal development, a child and an adult (or novice and expert) work together on problems that the child (or novice) alone could not work on successfully. Both external and internal factors can affect the individual's zone of proximal development (del Rio, 2007).

Cognitive change takes place in the zone of proximal development or, in the phrase of Newman et al. (1989), in the "construction zone." Children bring a developmental history to the zone of proximal development; adults bring a support structure. As children and adults interact, they share values, beliefs, and cultural tools. This culturally mediated interaction, in Vygotsky's view, is what yields cognitive change. The interaction is internalized and becomes a new function of the individual, including cognitive, social, and motivational aspects of one's development.

Vygotsky's colleague Leont'ev (1981) suggested the term *appropriation* to describe how learners internalize cultural knowledge from this process of interaction. Children, Leont'ev suggested, need not, and in fact should not, reinvent the artifacts of a culture. The culture has built up these artifacts over thousands of years, and children can *appropriate* them to their own circumstances as they learn how to use them.

Internalization of knowledge in the zone of proximal development is not an automatic reflection of external events (Wertsch, 2008). Children bring their own understanding to social interactions and make whatever sense they can of exchanges with adults. They can participate in activities beyond their understanding, but still be affected by them; think of a 2-year-old "reading" a book with his or her parent. Likewise, adults may not fully understand children's perspectives but still play an important role in their cognitive change. As children and adults interact, children are exposed to adults' advanced systems of understanding, and cognitive change—learning—becomes possible.

Wertsch (2008) proposed that internalization of external knowledge occurs in four continuous stages, three of which occur in the child's zone of proximal development. The first takes place when a child fails to understand an adult and requires explicit explanation and modeling from the adult. The second occurs when a child understands an adult with limited understanding, which promotes further discussion and explicit other-regulation from the adult to enhance the child's understanding. The third level is characterized by a situation in which the child understands an adult well enough that the child and adult share "co-regulation" of the child's internal thoughts and understanding. The fourth level occurs when the child engages in internalized, self-regulated problem solving and construction of understanding.

Part of the attractiveness of Vygotsky's thinking for cognitive and educational theorists has been his stress on the social influences in cognitive change. Cognitive development, in Vygotsky's view, is not simply a matter of individual change, but results also from social interactions in cultural contexts.

Many educators find the emphasis on adult–child interactions in cognitive growth especially appealing. The concept of **instructional scaffolding,** for example, is closely aligned with Vygotsky's theory of the zone of proximal development. As we see in more detail later in our discussion of classroom discourse, in instructional scaffolding a teacher provides students with selective help, such as asking questions, directing attention, or giving hints about possible strategies, to enable them to do things they could not do on their own. Then, as students become more competent, the support is withdrawn gradually (for a discussion of scaffolding see Beed, Hawkins, & Roller, 1991; Perry et al., 2006).

Some researchers feel that this view of scaffolding tends to focus too much on the adult's contribution to the process and reduces the child to being only a recipient of adult help (Gauvain, 2001). A perspective that focuses more on the learner's contribution is that of *social cognitive theory*.

Social Cognition: Social Factors in Knowledge Construction

Early cognitive research and theory focused on individual memory and thought, with relatively little emphasis on the context in which individuals were functioning. The information processing model we presented in this book's early chapters largely follows this approach. Under the influence of theorists such as Vygotsky, however, cognitive theory now includes a much greater recognition of social influences on cognition. As a consequence, researchers increasingly are turning their attention to children's interactions with parents, peers, and teachers in their homes, neighborhoods, and schools.

The perspective guiding these investigations is *social cognitive theory*. Closely related to dialectical constructivism, social cognitive theory stresses how human skill, activity, and thought develop in the context of specific historical and cultural activities of the community (Fosnot, 2008; Mercer, 2007; Sternberg & Wagner, 1994). Social exchanges between individuals are seen as the primary source of cognitive growth, especially to the extent that they promote talk that enables learners to internalize self-regulation skills via **inner speech** (Jones, 2009). In the next sections, we examine two influential social cognitive models: Rogoff's apprenticeships in thinking model (1990, 1995) and Schön's reflective practitioner model (1983, 1987).

Rogoff's Apprenticeships in Thinking Model

Barbara Rogoff and colleagues (Rogoff, 1990; Rogoff & Angelillo, 2002; Rogoff, Paradise, Arauz, Correa-Chavez, & Angelillo, 2003), following the lead of Vygotsky, have argued that cognitive development occurs when children are guided by adults in social activities that stretch their understanding of, and skill in using, the tools of the prevailing culture. When children are with their peers and adults, they are *apprentices in thinking*. In an apprenticeship, a novice works closely with an expert in joint problem-solving activity. The apprentice also typically participates

in skills beyond those that he or she is capable of handling independently. In the manner of an apprenticeship, Rogoff states, development builds on "the internalization by the novice of the shared cognitive processes, appropriating what was carried out in collaboration to extend existing knowledge and skills" (1990, p. 141). Rogoff argues that cognitive development is inherently social in nature, requiring mutual engagement with one or more partners of greater skill.

Other children form one important pool of "skilled partners." For instance, children's play and their dialogues with each other help them think collaboratively and offer a host of possibilities for considering others' perspectives. Play also involves imagination and creativity and so helps children extend themselves into new roles, interactions, and settings. Peers are highly available and active, Rogoff (1990) points out, providing each other with "motivation, imagination, and opportunities for creative elaboration of the activities of their community." Indeed, Kelly (2007) reported higher levels of student engagement in classroom contexts where there was an open dialogue in which student ideas were taken seriously and incorporated into classroom discourse.

For most children, however, adults are the most reliable and important skilled partners, helping them acquire skills through talk and external collaboration and translate these into internal speech and knowledge structures. Parents, relatives, and teachers routinely play many roles with important implications for cognitive development. These include (1) stimulating children's interest in cognitive tasks, (2) simplifying tasks so that children can manage them, (3) motivating children and providing direction to their activities, (4) giving feedback, (5) controlling their frustration and risk, and (6) demonstrating idealized versions of the acts to be performed (Rogoff, 1990).

Adults often engage in **guided participation** (Rogoff, 1995) with children, a process by which children's efforts are structured in a social context and the responsibility for problem solving is gradually transferred. In guided participation, children learn to solve problems in the context of social interactions. Guided participation always involves interpersonal communication and stage setting to build bridges between what children already know and the new information they encounter.

Rogoff argues that mental processes are enriched in guided participation because they occur in the context of *accomplishing something;* that is, cognitive processes direct intelligent, purposeful actions. Participants develop a sense of common purpose through extended dialogue and a shared focus of attention. Children are intrinsically motivated to come to a better understanding of their world and often initiate and guide interactions in which cognitive growth takes place.

Guided participation is not always formal or explicit, however (Kelly, 2007; Leinhardt & Steele, 2005). Events often are shared without participants being aware of efforts at guided participation or intending them to be instructional. A parent may help a child order at a restaurant or trim a tree branch, without thinking of it as teaching. Similarly, a preschool child may learn about what teachers and students do by playing school with an older brother or sister. In addition, participation is guided in part by students' beliefs about their participation. Jansen (2008) found that students with positive attitudes about participation as a means to acquire and internalize knowledge and learning skills were more likely to participate, and in turn, more likely to solicit future opportunities to participate from the teacher. O'Donnell (2006) provides a comprehensive review of classroom contextual factors affecting student participation in collaborative groups.

In summary, Rogoff views cognitive development as a process growing out of interactions with other children and adults. Individual cognition is constructed from the intellectual tools that a particular society has available. Although children's interactions with their peers provide support for building new knowledge, adults play a unique role in helping children move to new cognitive levels. Parents and teachers are reliable expert partners with children in guided participation. These interactions help children build bridges between what they know and what they don't and support children's efforts at acquiring new knowledge.

Schools provide a unique resource for cognitive development, especially for acquiring the more formal tools of language and thought. Schools offer structured opportunities for guided participation with adults and for appropriating adults' knowledge and strategies for problem solving—activities such as acquiring a technical vocabulary for understanding perspective in painting, learning ways to search for information, using cause–effect frameworks for understanding historical events, using algebraic procedures to solve mathematics problems, or applying formal research methods for gathering and categorizing data. Among the most basic challenges for teachers is learning how best to help students acquire effective mental tools. As we discuss later in the chapter, classroom dialogue guided by the teacher can provide important conditions to meet these challenges.

Schön's Reflective Practitioner Model

Like Rogoff, Schön (1983, 1987) also put forward a dialectic constructivist perspective on cognitive development. Schön drew less explicitly from Vygotsky, and his interests were centered mainly on teaching and learning in the professions rather than with children. His perspective on cognitive development nonetheless shares several key elements with Vygotsky's theory and with Rogoff's approach: guided discovery, learning by doing, and the importance of social interactions in building knowledge and understanding. Schön developed his system around three key concepts: knowing-in-action, reflection-in-action, and reflection on reflection-in-action.

Knowing-in-Action **Knowing-in-action** is tacit knowledge, the sort of knowledge that is unarticulated but revealed in our intelligent actions (Polanyi, 1967; see also our discussion of implicit memory in Chapter 3). We show our tacit knowledge whenever we act in reasonable ways, such as driving a car, greeting a friend, or typing a letter, but are not explicitly aware of the thinking underlying our actions. These actions may be implicit in part because the beliefs they are based on also are implicit (Bendixen & Rule, 2004; Hedberg, 2009; Pirttila-Backman & Kajanne, 2001).

Much of what we know is knowing-in-action and is revealed only as we go about our daily lives. Although it is possible to describe the implicit knowing that underlies your actions, these descriptions will always be *constructions,* "attempts to put into explicit, symbolic form a kind of intelligence that begins by being tacit and spontaneous" (Schön, 1987, p. 25). By describing knowing-in-action, we convert it to **knowledge-in-action,** making it a part of our semantic memory.

Ordinarily, however, knowing-in-action is not verbalized; our actions consist largely of spontaneous, routinized responses. As long as the situation is normal and there are no surprises to our knowledge-in-action categories, our scripts flow smoothly into action. *Surprises*—outcomes that do not fit our scripts—are not necessarily negative events, however.

In fact, they are the key to triggering reflection-in-action, a mechanism Schön argues is crucial for change and cognitive growth.

Reflection-in-Action **Reflection-in-action** is conscious thought about our actions and about the thinking that accompanies them. Reflection-in-action is a form of metacognition in which we question both the unexpected event and the knowledge-in-action that brought it on. A child entering a new class may tug and pull at the teacher's clothing, an action that brought positive attention from a former teacher but brings a reprimand from the new teacher. A formerly successful routine now is not working, and the surprise forces the child to reflect both on his or her actions and on the reasons for the changed circumstances.

Schön's concept of *reflection-in-action* has a great deal in common with both dimensions of metacognition discussed in Chapter 4: *knowledge of cognition* and *regulation of cognition.* Reflection-in-action stimulates a kind of on-the-spot thought experiment. Depending on the extent of prior knowledge, unexpected failures and successes may lead in various directions: to *exploration,* in which the learner makes no predictions; to *testing moves,* in which different paths are tested for their feasibility; or to *hypothesis testing,* in which competing hypotheses are tested to determine which is valid.

Under a skilled teacher's guidance, a similar process can lead to student learning. The potential for learning lies in the constructive nature of reflection-in-action (Cole & Knowles, 2000; Jay, 2003; Larrivee, 2006). When students are placed in situations that are uncertain and where they are motivated to change, Schön contends, they begin a process of exploration, movement, and hypothesis testing. Research indicates that teacher reflection, especially during preservice training and the early years of teaching, enables them to construct models and theories of their teaching in a manner that improves instruction and student learning (Dinkelman, 2000; Lyons, 2006).

Reflection on Reflection-in-Action All of us construct and reconstruct our cognitive worlds as we experience the events of our lives and reflect on them. By assisting students in constructing new knowledge, skilled teachers can help learners do much more than they could do alone. Schön (1987) refers to this process as **reflection on reflection-in-action.** Skilled teachers can help learners to develop reflection-in-action, that is, to articulate the thoughts guiding their actions and to judge their adequacy. Consistent with Vygotsky's views of the zone of proximal development, the teacher's goal is to be literally "thought-provoking" (Schön, 1987, p. 92). Ideally, the teacher creates an interactive setting in which both the teacher and the students are co-learners, but students' self-discovery has the highest priority.

According to Schön, students cannot be taught what they need to know, *but they can be coached toward self-understanding*—a form of dialectical, social constructivism. Schön advocates creating *practice situations*—relatively low-risk events in which students can learn by doing and receive rich feedback—that motivate learners toward understanding and contain at least some elements that the students themselves have created.

Because of its unfamiliarity, students may initially strongly resist this kind of coaching approach and become unsettled, even angry, when there seem to be "no right answers." They may become frustrated and demand to be told what is "correct." The teacher–coach must keep in mind that he or she is managing a transaction between learners and environment, not offering information. Uncertainty and conflict about values are inevitable. In Schön's view, this uncertainty is among the most powerful motivating forces teachers have available.

In summary, Schön reflects social-cognitive and constructivist points of view by portraying learning as a social-interactive process in which students are helped to create new understandings. The key goal is students' reflection-in-action—metacognitive reflection on unexpected events or variations in phenomena and the thinking that led to them. In Schön's view, students learn when they act and are helped to think about their actions. Learning by doing forces them to make judgments; reflection helps them recognize their assumptions and see what is important. Although students initially may perceive this kind of instruction as threatening, ambiguous, or confusing, clarification comes when students stay with problems and dialogue continues between the teacher–coach and the students.

Schön's reflective judgment model has been investigated in detail in domains such as business management and education and used to develop a model of reflective professional development. Roglio and Light (2009) summarized five key components in high-level reflective practice, including having a repertoire of critical learning skills, reflective instructors who serve as models, well-integrated instructional scaffolding, an interdisciplinary curriculum, and many opportunities for collaboration among students. These five components seem essential to the developmental of reflective practice in any domain (Hedberg, 2009). Not surprisingly, content knowledge seems to be a particularly important requirement for effective reflection (Lee, 2005).

Together, Rogoff's and Schön's models reflect a social-cognitive viewpoint consistent with Vygotsky's. The exchanges between teachers and students create a zone of proximal development in which students construct new knowledge and acquire habits of reflection and increased metacognitive knowledge. These exchanges with teachers and advanced peers are essential to cognitive change and growth and are vital to creating useful situated knowledge and thought. Dialogue between teachers and students is not the only mechanism for building students' understanding and revealing their misunderstandings, but it is among the most potent tools that teachers have available. In the next section, we extend our examination of social cognitive theory by exploring the nature of the discussions that take place in the classroom. We consider the potential of different kinds of classroom dialogue for building knowledge and fostering reflection.

Role of Classroom Discourse in Knowledge Construction

Most people's prototypical classroom images involve language use: teachers asking questions and students answering, class members discussing works of literature or poring over textbooks, and students struggling to write satisfactory answers to test questions. Language is the medium by which concepts are presented and clarified and through which students' knowledge typically is expressed and judged.

Language, as we learned from Vygotsky (1978, 1986), also is one of the most important social and cognitive tools, yet it often is not used effectively as it could be in the classroom. Classroom talk can play a critical role in learning and cognitive growth when it is used effectively. One theoretical perspective on how students can learn from discourse is based on Vygotsky's view that higher mental functions develop through a process by which the learner internalizes and transforms the content of social interaction (Fall, Webb, & Chudowsky, 2000; Wertsch, 2008).

Discourse is a general term referring to structured, coherent sequences of language. In discourse, propositions (see Chapter 3) take on meaning in relationship to one another. Meaning is

drawn from the context. Discourse has **coherence,** and references forward or backward give meaning to individual elements (Brophy, 2006; O'Donnell, 2006). A conversation is an example of discourse: as two people discuss an event, the structure builds, each new idea taking meaning from the ones that came before. Essays, short stories, novels, and classroom discussions also are examples of discourse. Here we are interested in **classroom discourse,** which refers to the verbal exchanges in the classroom.

Researchers increasingly consider the quality of classroom discourse to be one of the most critical elements in effective schooling and teacher education (e.g., Calfee, Dunlap, & Wat, 1994; Chinn et al., 2001; Kuhn, Shaw, & Felton, 1997; Nystrand & Gamoran, 1991; Orland-Barack & Yinon, 2007; Wiencek & O'Flahavan, 1994). Classroom discourse, they argue, is a primary vehicle by which teachers guide, organize, and direct their students' activities. Like Rogoff and Schön, these researchers view learning as a constructive process in which social exchanges with others are fundamental to students' construction of meaning. As Hull and her associates (Hull, Rose, Fraser, & Castellano, 1991) have stated, "In the classroom, it is through talk that learning gets done, that knowledge gets made" (p. 318). This view is being translated into research aimed at finding the discourse structures and uses of classroom discourse that best promote learning (e.g., Calfee et al., 1994; Chinn & Waggoner, 1992; Jansen, 2008; Kuhn et al., 1997; Leinhardt & Steele, 2005; Wiencek & O'Flahavan, 1994).

Traditional classroom discourse has not been particularly supportive of student expression and reflection, however. Classroom discourse at all levels, from primary grades through college, tends almost always to be dominated by teacher talk. Students typically say little, and questions are rare. Most classroom talk centers on a single dominant discourse pattern: A teacher asks a question, a student responds, and the teacher gives feedback (Alvermann, O'Brien, & Dillon, 1990; Cazden, 2001; Mehan, 1979). Often simply called the **IRE pattern** (initiate, respond, evaluate), the sequence in slightly more elaborated form is as follows:

1. *Teacher initiates.* The teacher informs, directs, or asks students for information. For example:

   TEACHER: Jen, can you tell me the name of the town where they were going?

2. *A student responds.* Student responses to the teacher's prompt or question can be verbal or nonverbal.

   JEN: Uh . . . I think it was Peatwick.

3. *The teacher evaluates.* The teacher comments on the student's reply or reacts to it nonverbally.

   TEACHER: Right. Peatwick. Good. And what were they . . .

As Cazden and others have pointed out, the IRE is the "default pattern" for classroom exchanges between teacher and student; that is, IRE is what happens unless deliberate intervention is made to achieve some alternative. Although this pattern can support a discussion of sorts, it most often is used for *recitation* in which a teacher quizzes students about content they have just studied. It often is accompanied by mini-lectures—periods of teacher talk that the teacher uses to elaborate on information already being discussed or to present new information. Chinn and Waggoner (1992) and others (e.g., Alvermann & Hayes, 1989; Cazden, 2001) have pointed out that it is extraordinarily difficult for teachers to move away from these patterns and their variations.

It may be, as Chinn and Waggoner speculate, that teacher control and authority are at stake, or it simply may be that teachers stick to this pattern because it is useful for probing student attention and comprehension.

Toward a More Reflective Classroom

We have been building the case in this chapter that cognitive growth is best fostered in a social environment in which students are active participants and where they are helped to reflect on their learning. For teachers to create a reflective classroom in which students build new knowledge and learn to manage their own learning, they almost certainly need to extend classroom discourse beyond the IRE recitations and the IRE-type discussions in which turn-taking rotates between teacher and students.

Calfee et al. (1994) have proposed the idea of **disciplined discussion** as an alternative to the IRE. Disciplined discussion draws on the best features of both *conversation,* which ordinarily is structured informally and student generated, and *instruction,* which typically refers to a more formal and teacher-directed interaction organized around a lesson. In disciplined discussion, a classroom discussion group approaches a text or other information source strategically, with a particular goal in mind. The roles and responsibilities of the participants are defined: Students solve problems by using interactive processes they have learned through modeling, practice, and feedback; a teacher plays several important but not dominating roles, acting as an organizer and participant or simply as an observer.

But what kinds of interactions are most likely to help students build knowledge and reflect on their learning? Chinn and Waggoner (1992) suggest that teachers first need to ensure that students have sufficient knowledge to support the discussion topic, knowledge that may come from personal experience, reading, or other sources. Beyond this are two fundamental criteria, both reflecting a social-cognitive viewpoint: (1) that students share alternative perspectives and (2) that the discourse has an open participation structure.

When students share *alternative perspectives,* they give their personal reactions and interpretations and consider the viewpoints of other participants. Students reading a short story, for instance, are likely to interpret parts of it in different ways. A good discussion provides a forum for determining things they agree on and for building metacognitive awareness. Similarly, children examining a picture of a snail may disagree about whether particular protrusions on its head are antennae or eyes. Discussion can stimulate further inquiry, such as closer observation or consulting other text sources, which will lead to an answer or resolution of the disagreement.

Open participation structure, which refers to the ability of students to talk freely with each other as they would in ordinary conversations, also is vital to building knowledge and reflection. In an open participation structure, both students and the teacher can initiate topics and ask questions (Chinn & Waggoner, 1992), which helps involve students in the discussion. When classroom discourse incorporates both of these functions, it can become *authentic* (Calfee et al., 1994; Graesser, Long, & Horgan, 1988; Nystrand & Gamoran, 1991); that is, organized around genuine questions of interest to the students and eliciting their perspectives.

The CORE Model What are some ways that discussions can affect the development of knowledge and reflective thought in participating students? Calfee et al. (1994) suggest four possibilities in their CORE (**c**onnecting, **o**rganizing, **r**eflecting, and **e**xtending) model of instruction (Calfee, Chambliss, & Beretz, 1991). First, discussions provide *connections* for learning. Useful knowledge is contextual, grounded in what students already know. Good discussions draw on students' prior domain and general knowledge and allow them to share what they know with their discourse partners. To take part effectively in discussions, students must recall information and use their metacognitive knowledge to link and sequence their ideas. Students learn that good discussions have coherence. By staying on topic and building on the ideas brought up by the participants, together they create a new body of shared information.

Second, discussions help *organize* knowledge. Knowledge construction is not simply a matter of accumulating particular facts or even of creating new units of information. It also involves organizing old information into new forms. Discussions are uniquely suited for these purposes. As participants strive to understand and contribute to discussions, they are forced to relate and organize what they know.

Third, good discussions can *foster reflective thought.* Discussions offer many opportunities for students to become aware of their thinking and to learn skills for regulating their thoughts and actions. Like all forms of discourse, discussions require participants to externalize thought. Presenting, organizing, clarifying, and defending ideas push students' cognitive processes into the open. Reactions of others in the discussion provide feedback on whether they have been persuasive and coherent. The act of explaining their reasoning promotes students' learning, particularly when reasons are elaborated with further evidence (Chinn, O'Donnell, & Jinks, 2000). Teachers, by coaching before and after discussions and adopting roles that allow them to scaffold student thought during discussions, can significantly influence students' abilities to reflect on their interactions and on the substance of their thinking (O'Flahavan & Stein, 1992).

Guthrie (1993) has provided an example of how discussion can stimulate reflection, describing how fifth graders in one of his project classrooms were engaged in a debate about whether life might exist on Mars. One student, John, insisted he had read that life did exist on Mars. He was challenged immediately by other students to identify the book that supported this belief. One student, Patty, proposed that the book in question most likely discussed what it *might be like* to live on Mars but that it did not say life *actually* existed on Mars. After further discussion, she volunteered to go to the school library to try to find more information that would resolve the question. This information did lead to more discussion and finally to resolution of the question (Patty was correct). Discussions like these, involving debate and reaching a conclusion, have a strong reflective component and stimulate students' use of strategic skills (Guthrie, McRae, & Klauda, 2007).

Finally, discussions help *extend* knowledge among students and teachers (Lee, 2005). As students work on long-term projects, their discourse can lead quite naturally into new domains. Guthrie (1993) observed that student discourse on one topic (the moon and its phases) quickly extended into several related topics. Students' declarative and procedural knowledge expanded rapidly as they searched for answers to questions they had posed; metacognitive knowledge increased as they discussed strategies for acquiring information with their peers and with the teacher and as they tried to explain their findings to their classmates.

Using Classroom Discourse to Build Knowledge

It is one thing to assert that high-quality discourse is at the heart of the reflective classroom; it is another to create classrooms in which knowledge construction and reflective thinking are the norm. On the one hand, when the teacher retains too much involvement in discussion, the result often is the IRE pattern, in which classroom discourse more nearly resembles recitation sequences than authentic exchanges. On the other hand, a laissez-faire approach to discussion that totally gives up social and interpretive authority to student groups is an invitation to chaos and deprives students of essential contributions by the teacher (Brown, 2006; Jansen, 2008; Kelly, 2007).

So what is the best way to engage students in authentic, extended discourse with each other and with their teacher? O'Flahavan (O'Flahavan & Stein, 1992; Wiencek & O'Flahavan, 1994) suggests that because discussions are highly complex, it is useful to consider them from a variety of perspectives, each involving a somewhat different form of knowledge construction. In O'Flahavan's view, the most effective classroom discussions are likely to be created when teacher and students work together from the outset to (1) develop the norms for participating in the discussions, (2) determine the interpretive agenda for a group's discussion, and (3) reflect after each discussion about the group's success in achieving both its social and interpretive goals.

O'Flahavan argues that teachers can play two especially important roles in these discussions: *coaching* and *scaffolding*. Although O'Flahavan favors decentralized, student-centered discussions, he considers teacher involvement essential for developing students' cognitive strategies, motivation, and expertise over the long term. In addition to managing some of the discussion, teachers are responsible for other features important to their success: creating the physical context for discussions, including determining group size and composition; devising seating arrangements; and making texts and other materials available.

In general, this work and a variety of recent reviews point toward five general strategies for improving effective learning in classroom discussion (Brophy, 2006; O'Donnell, 2006). The most basic strategy for creating productive discussion groups is to help students construct **group participation norms** (Gureckis & Goldstone, 2006). Most students understand basic social norms for interacting in classroom groups, such as raising their hands and not interrupting. But they may not know how to work well with other students or to listen to them, particularly in decentralized groups in which the teacher is not directing the interactions. One approach is to teach interactive skills directly (e.g., "These will be our rules. We should . . . "). A more effective approach is to allow students to help create their own rules for interaction. O'Flahavan and Stein (1992), for instance, had their students keep running lists of their group's participation norms, which typically included such rules as paying attention, not interrupting, and taking turns. Because these were the students' own norms, they were highly valued, probably more so than if the teacher had devised them. At the same time, the teacher plays an important role in helping the students reflect on whether their participation norms are effective. By serving as a *group process monitor* (O'Flahavan & Stein, 1992), the teacher can help the students periodically evaluate how well their group processes are working.

A second strategy is to help students develop **interpretive norms** for judging their progress (Brown, 2006). Students need to assume considerable responsibility for decentralized discussions to be effective. Assume, for instance, that a high school biology class is preparing a

detailed report for local officials on the environmental threats to a nearby wetland. To meet this challenge, the class must make decisions on how it will proceed, such as what data it will gather, how they will be gathered, and the format of the document it eventually will produce. An effective teacher is likely to adopt a stance somewhere between authoritarian determination of the group's intellectual agenda (e.g., "OK, first I want you to study these maps of eastern Douglas County . . . ") and laissez-faire inattention to students' attempts to grapple with this complex and metacognitively demanding task.

A third strategy in helping students develop a reflective stance is **coaching.** In O'Flahavan and Stein's (1992) judgment, students will be most productive when they are allowed to work together in their groups for significant blocks of time—say, 15 to 20 minutes—with the teacher coaching at the boundaries of discussion, before and after discussion blocks. Many recent studies suggest that coaching is an essential component in the acquisition of reflection and is especially effective when used with authentic activities that are relevant to the student (Brophy, 2006).

For O'Flahavan and Stein (1992), coaching takes two major forms: (1) providing students with guidance and direction and (2) helping students reflect on their interactions and achievements. For instance, think of a long-term science project for middle school students in describing the status of a wetlands habitat. Most students would need coaching in basic strategies for gathering information, such as making inferences from texts, determining what is important, and monitoring their understanding while reading about birds, plants, and insects. They also likely would need coaching in such procedural strategies as keeping reflective logs, identifying variables for observation, recording their observations, and planning simple experiments. The teacher also might want to remind students of supplies and resources they are likely to need to complete tasks and to discuss ways these might be obtained. Students who need information about marsh plants and water beetles could be coached in using indexes and tables of contents to search books in the library for relevant information. These kinds of guidance all are effective forms of coaching.

A fourth strategy for creating effective discourse is **scaffolding** (Gijlers, Saab, Van Joolingen, De Jong, & Van Hout-Walters, 2009; Perry et al., 2006; Roglio & Light, 2009), where the teacher enables students to do things they cannot do on their own by helping them articulate what they are thinking, reminding them of assumptions they are making, drawing their attention to information, and providing new perspectives. Scaffolding makes use of Vygotsky's idea of the zone of proximal development, described earlier in this chapter (Gnadinger, 2008). The teacher, as the more expert person, provides frames of reference and modes of interpretation that students are capable of acquiring but do not yet have. In a discussion relating to sources of information about wetlands, for instance, one teacher became aware that her students did not know how to get information about land use and so posed an indirect question about where it might be found, suggesting "Maybe we should think about where we might find information about land use." Students, given this hint and occasional suggestions, soon began to debate the merits of such sources as surveying, aerial photography, satellite images, and landowner reports. Without the teacher's direction, the students likely would have been unable to continue their inquiry. With the scaffolding, they soon began to search library resources and initiated a series of productive contacts with landowners, agencies, and governmental units. The teacher's comment helped move them toward considering new information and frames of reference.

O'Flahavan defines several distinct roles that can be useful for scaffolding student thought. Among these are the role of the *framer,* in which the teacher draws attention to relevant background knowledge or helps students in interpretation; the *elicitor,* in which the teacher focuses the group's thinking on a point by bringing forth elaboration and extension from students; and the *interpretive peer,* in which the teacher is a participant in the group's inquiry.

Finally, *positive motivation* is critical to successful classroom discourse (Perry et al., 2006). Perhaps the most fundamental motivational requirement is that discussions be authentic, accessing the real culture of the students (Calfee et al., 1994; Kelly, 2007). This can be ensured if the group communicates about goals and issues that are meaningful to them. For instance, upper-level elementary students would find activities such as developing a class book about their neighborhoods, writing and directing a play for presentation at "Parents' Night," or creating a mural promoting school safety for younger students meaningful and motivating. In addition to rich topics, other factors important to motivation include the extent of teacher participation (not too much or too little), the teacher's ability to value and take up students' ideas and incorporate them into the ongoing discussion (Nystrand & Gamoran, 1991), and giving students greater control over interpretation, turn taking, and topic selection (Chinn et al., 2001).

Collaboration as a Tool for Learning

It should be clear that all of the strategies previously described involve some degree of collaboration, often between two or more peers, or between an expert and novice. Collaboration in the classroom now is viewed as an essential part of education. Increasingly, sociocultural models of learning such as situated learning theory (Lave & Wenger, 1991), cognitive apprenticeships (Collins, Brown, & Newman, 1989), and the work of Vygotsky (1978, 1986) have played a prominent role in educational research and practice. In the context of the instructional strategies presented here, collaboration can be viewed as a tool much like technology that can encourage an inquiry orientation, utilization of strategies, development and sharing of mental models, and making personal beliefs explicit.

Collaboration in the form of interactions with teachers and students facilitates learning for a variety of reasons. First, teacher and student modeling provide explicit examples of how to perform a task and often provide explicit feedback (Webb & Palincsar, 1996). Second, collaborative supports such as tutors, peer models, or small groups provide an opportunity for explicit discussion and reflection that promotes metacognition and self-regulation. For example, discussion promotes planning and evaluation of whether students met learning goals (Davis, 2001). Students of similar achievement levels may be more effective than teacher-student pairs because the former are able to discuss strategies in the novice's zone of proximal development (Feldman, Campbell, & Lai, 1999). Third, communities of learners have greater knowledge resources than individuals. Fourth, social interactions that cut across gender, economic, and ethnic lines promote social equity in the classroom, which enhances motivation and epistemological awareness (Hogan, 1999).

Collaboration in the classroom may occur among students, teachers, and between students and teachers (Hogan, 1999, 2000, 2002). Student collaboration typically involves tutors or small collaborative work groups. Research suggests that peer tutors who are judged to be of similar ability to their tutees increase the declarative and procedural knowledge and self-efficacy of

those students (Pajares, 1996). Sometimes students are paired with expert mentors in what are referred to as **cognitive apprenticeships.** These relationships can help novice students develop expertise quickly and provide many opportunities for reflection that builds metacognitive understanding. Research suggests that tutors and cognitive apprenticeships can help novices achieve a higher degree of in-depth learning in a particular domain (Ramaswamy, Harris, & Tschirner, 2001).

Cooperative learning groups are one of the most common forms of collaboration. For instance, Hogan (1999) developed the Thinking Aloud Together (TAT) program as a means to promote metacognition and self-regulation in a small group collaborative setting. Students in the TAT programs demonstrated greater metacognitive awareness of their learning than students in the control group. Small group collaboration appears to be especially effective when students are engaged in inquiry-based discussion of problems (Meyer & Woodruff, 1998) and when students are given explicit training in how to work effectively in small groups (Bianchini, 1998). One potential problem is that student-centered cooperative groups can be difficult to initiate and manage. Guidelines for managing such groups have been provided by Webb and Palincsar (1996) and O'Donnell (2006).

Collaborations among teachers are necessary as well (Brophy, 2006); two ways to promote them are through cross-level mentoring and co-teaching. Cross-level mentoring refers to an experienced teacher mentoring a less-experienced teacher, usually as part of in-service training (Feldman et al., 1999). Training is typically one-on-one or in a small group and focuses on curricular choices and specific pedagogical strategies for improving student learning. In contrast, co-teaching involves two teachers of similar experience teaching in collaboration (Roth & Tobin, 2001). One advantage to co-teaching is that two teachers are able to make better use of their individual expertise. A second advantage is that one of the teachers can allocate more time to student small-group work while the other teacher directs the ongoing lesson. Co-teaching also helps promote the use of cognitive strategies and better metacognitive monitoring and evaluation, which support higher levels of student self-regulation.

Assessing Reflective Practice

Much of the research cited in this chapter emphasizes the importance of reflection and reflective practice, despite the fact that little work has been done on the assessment of reflection. Larrivee (2008), however, has recently developed such an assessment, which is focused on reflective practice in the classroom. The goal of this 53-item self-report instrument, called the *Survey of Reflective Practice* (SRP), is to identify which level of reflective practice a teacher currently demonstrates in the classroom.

The SRP is based on the work of a number of authors with strong conceptual links to the pioneering work of Donald Schön (Cole & Knowles, 2000; Jay, 2003; Larrivee, 2006). The psychological construct of **reflective practice** was defined as "on the job performance resulting using a reflective process for daily decision making and problem solving" (Larrivee, 2008, p. 342). Larrivee's review of more than 200 research articles suggested a four-level development framework for understanding reflective practice, which included pre-reflection, surface reflection, pedagogical reflection, and critical reflection. Pre-reflection was defined as a situation in which a teacher interprets classroom events without thoughtful analysis. This scale included 14

items such as *Does not see beyond the immediate demands of a teaching episode.* Surface reflection was defined as a situation in which a teacher focuses on tactical issues concerning how to best accomplish classroom teaching standards and objectives. This scale included 11 items such as *fails to connect specific methods to underlying theory.* Pedagogical reflection was defined as a reflective approach in which classroom teaching strategies are guided by an underlying pedagogical theory and the teacher's view of learning transcends the immediate classroom. This scale included 14 items such as *Engages in constructive criticism of one's own teaching.* Finally, critical reflection—the highest level of reflection measured—was defined as a context in which teachers are engaged in ongoing reflection and inquiry about their own teaching and thinking processes. This scale included 14 items such as *Acknowledges the social and political consequences of one's teaching.* Preliminary findings indicate that many teachers are at the surface or pedagogical levels of reflective practice, with relatively few at a critical reflection level.

Although early work on the SRP is promising, there still is much about the relationships among teachers' reflective practices, curricular decisions, and pedagogical choices that remains to be understood. Larrivee (2008), however, has proposed an agenda for future research with the SRP, including examining the developmental timeline of reflective practice in the classroom and across a teacher's career, investigating relationships between teacher effectiveness and reflective practice, and determining how school and professional development programs affect reflective practice. As researchers as well as textbook authors, we look forward to the future development of assessments like the SRP and its use in conjunction with interview methods (Larrivee, 2006; Lee, 2005; Lyons, 2006).

Implications for Instruction: A Portrait of the Reflective Classroom

We return now to our starting point—the goals of building student knowledge and habits of reflection. Building knowledge is not a simple matter. As we know from earlier chapters, there are several kinds of knowledge, each important in its own right. Expertise in any domain requires large networks of declarative knowledge, as well as readily available arrays of procedural skills. It requires metacognitive awareness and the regulatory knowledge of knowing how and when to apply what is known. Because the amount of knowledge we need is very large and the relationships among the knowledge elements so complex, the process of acquiring significant domain knowledge requires motivated, long-term student effort. The challenge to teachers is considerable.

If we succeed in building an ideal reflective classroom, what might it look like? We could begin by imagining a classroom in which the teacher has placed student knowledge construction at its center. To help accomplish this goal, the teacher has organized class activities around long-term, thematic projects in which students can make choices and use knowledge in ways that help them achieve their goals (Calfee & Miller, 2005b, 2007; Corno & Mandinach, 2004; Guthrie et al., 2007). We see a hands-on teacher who makes little use of the IRE pattern and who lectures infrequently. Further, in our reflective classroom, we see a teacher working as a partner with the students and organizing classroom activities around student information seeking and information exchange. One of this teacher's primary roles is guiding and supporting students in becoming self-directed, strategic learners.

A strong sense of purpose is evident in our ideal classroom. As teacher and students work together to reach project goals, activities alternate among whole-class instruction, in which students are coached on how to find and organize information; student reading and writing, in which students search for, find, and organize information and reflect on how they found it; and small-group discussions and collaboration, in which students report what they have learned, discuss their differing points of view, and judge their progress. We see our teacher helping students pick meaningful goals, coaching them on possible strategies for reaching their goals, and scaffolding their thinking as needed. Indeed, three of the 12 core effective teaching guidelines described by Brophy (2006) (i.e., thoughtful discourse, scaffolding student learning and engagement, and cooperative learning) pertain directly to sociocultural support mechanisms in the classroom.

Over time, we see the students in our ideal classroom becoming more and more expert and self-directed. Their growing knowledge is not isolated facts memorized from texts, but is organized and meaningful because it grows from authentic projects in which they have been allowed to choose topics and decide about ways to gather, organize, and present information. Students have learned not only "what" but also "how" and "why." As a consequence, they can readily explain why that information is useful, the strategies they used to find information, and how it is organized. Although our existing classrooms may fall short of this ideal, we still can draw on the basic principles presented that follow to help us move toward a reflective classroom.

1. *Take a broad perspective on knowledge.* Declarative knowledge is a good starting point, as is procedural knowledge—knowing how. Both, however, need to be made useful by being tied to metacognitive awareness and self-regulation. In the long run, these metacognitive dimensions may be the most critical aspects of knowledge acquisition. Because what is known changes rapidly and the amount of information available far exceeds anyone's ability to acquire it, students must develop the capacity to direct their own learning and the motivation to continue to acquire new information and skills.

2. *Develop students' information-seeking skills.* Modern communication technologies provide access to a wealth of information but also require that students learn to search for information, organize it, and judge its reliability. Teaching these skills in the context of long-term projects can be especially effective. Guthrie and his colleagues, for instance (e.g., Guthrie, Bennett, & McGough, 1994; Guthrie et al., 2007; Wigfield et al., 2008), have helped students not only to learn multiple strategies for acquiring information from texts but also to judge the utility of the information they found.

3. *Organize instruction in ways that favor knowledge construction.* One of cognitive psychology's most valuable contributions has been to remind us that learners' activities affect what is learned and how functional it will be. We therefore must help students engage all of their learning capabilities. Rote rehearsal, in which meaning is ignored, tends to generate rote, list-like, fragile learning. In contrast, approaches aimed at student comprehension of the meaning of what is to be learned are much more likely to help students understand, organize, retain, and use the information they encounter (Roglio & Light, 2009). Scaffolded instruction and peer tutoring are particularly effective instructional strategies (O'Donnell, 2006).

4. *Create a "thinking classroom."* Effective knowledge construction and good thinking flourish in classroom cultures organized to support them (Tishman, Perkins, & Jay, 1995). Early cognitive theory tended to portray intellectual growth as a solitary pursuit, but social

cognitive theory and research now emphasize family, school, community, and cultural influences on cognitive development (e.g., see Gauvain, 2001; Rogoff & Chavajay, 1995). Rogoff's ideas of guided participation and the child as cognitive apprentice and Schön's concept of reflection on reflection-in-action both emphasize the social nature of cognitive growth.

5. *Use discourse structures that promote reflection and knowledge construction.* Among the most important resources for knowledge construction and reflection are classroom discussions in which students interact freely and grapple with authentic questions. As Rosenblatt argued many years ago in her classic book *Literature as Exploration* (1938), we need to encourage students to express what texts mean to them and then to use discussion to negotiate what they mean. In any subject area, students' initial understandings, though often immature and incomplete, are the only legitimate starting point for learning. As students continue their exchanges with each other and with the teacher about what they are learning, their understanding will deepen.

6. *Use coaching and scaffolding to build student understanding.* Like the guidance provided by the master craftsperson, teachers' coaching and scaffolding are vital to creating new levels of student understanding (Gijlers et al., 2009). As we saw earlier in the chapter, O'Flahavan and Stein (1992) argue for concentrating coaching at the boundaries of discussions. Before discussions, teachers can help students set the agenda for discussion; after discussions, teachers can assist students in reflecting on their successes and failures. Within discussions, scaffolding works effectively as teachers help students clarify their ideas and judge whether they're reaching their goals (Brophy, 2006; McCaslin, 2004).

7. *Consider decentralizing discussions.* Although large-group discussions can be productive (Calfee et al., 1994), the opportunity for individual students to participate always will be limited by group size. Also, some students are reluctant to take part in a full-class setting because of perceived lack of knowledge or shyness. O'Flahavan and his colleagues (e.g., O'Flahavan & Stein, 1992) and Guthrie and his associates (e.g., Guthrie et al., 2007) have shown that groups of four to six upper-level elementary students can carry on long-term inquiry relatively independent of the teacher if they are supported periodically by teacher coaching and scaffolding. Students in such groups can learn both to reflect on their interactions and monitor progress toward their goals.

8. *Make tolerance a basic rule for classroom interaction.* Classroom interaction is a social process and students do not necessarily come to our classrooms with highly refined social skills. They often need to learn rules for classroom and small-group discussion. For instance, the prevailing norms governing whole-class discussions may specify what kinds of replies to questions are considered appropriate, points at which it is acceptable to interrupt, and preferred ways to get others' attention. For a variety of reasons, such as family history or ethnic background, some students' communication styles will not match those of others in the class. Students who interrupt frequently, for example, may have developed this style of communication in their families, have had success with it in other classes, or simply may be extraordinarily eager to do well (see Hull et al., 1991).

Variations in style and skill levels demand that both students and teachers practice basic principles of respect for others' ideas. For the long term, it will be useful for most discussion groups to develop their own participation norms (see O'Flahavan & Stein, 1992; Wiencek & O'Flahavan, 1994). The rules that students themselves generate (e.g., "Take turns," "No putdowns," and "Don't hog the discussion") typically are more effective and will be viewed as less coercive than any the teacher might impose. Also, students can be asked to reflect periodically on whether their rules are creating effective working groups or need to be modified.

Summary

This chapter has described processes for fostering cognitive growth in the classroom. Knowledge acquisition is viewed as a constructive process in which learners build and organize knowledge. Three types of constructivism were outlined: exogenous constructivism, endogenous constructivism, and dialectical constructivism. Of these, dialectical constructivism is the most generally applicable to effective learning, although all three are important components of student learning.

Stimulated by the work of the Russian psychologist Vygotsky and his concept of zone of proximal development, cognitive scientists and many educators now emphasize social processes in knowledge formation. Social interactions between a child and a peer or an adult providing guided participation help build bridges between what children already know and new information they encounter. In effect, children are "apprentices in thinking" whose knowledge and ways of knowing grow out of interactions with others (Rogoff, 1990; Schön, 1983). The child's cognitive development is embedded in their social and cultural contexts.

Classroom discourse is a significant factor in building knowledge and shaping cognitive growth. If discourse is authentic, honors the students' points of view, and has continuity, it will engage students and become a basis for knowledge construction and reflective thinking. The tenor of classroom discourse also shapes students' perceptions of self and learning; it can be supportive or threatening, uplifting or demeaning.

The best discussions allow alternative perspectives and have open participation structures. By providing a forum for expression and feedback, they create opportunities to extend knowledge and to develop reflective thought. Strategies for creating productive discussion groups include having the groups develop and modify their own social and interpretive norms, teacher coaching before and after discussions, and teacher scaffolding during discussions. Such approaches enhance the possibility of knowledge construction and development of self-directed, strategic, reflective approaches to learning.

Collaboration is involved in all of the instructional strategies described in this chapter and is viewed as an essential part of education. In the classroom it may occur among students, teachers and between students and teachers and is a tool that encourages an inquiry orientation, the use of strategies, the development and sharing of mental models, and making explicit personal beliefs.

Because expertise requires organized, flexible knowledge, teachers should help students learn ways to seek and judge information. Ideally, classrooms provide authentic contexts for developing expertise by providing learning that students find meaningful, that builds on prior knowledge, and that allows self-expression. The ideal outcome is for students not only to acquire knowledge but also become independent, self-regulated learners.

SUGGESTED READINGS

Gauvain, M. (2001). *The social context of cognitive development*. New York, NY: Guilford Press.
This scholarly but readable book examines cognitive development from a social vantage point, arguing that understanding children's learning requires that we not only understand cognitive principles but also the social and cultural contexts for learning.

O'Donnell, A. (2006). The role of peer and group learning. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology* (2nd ed., pp. 781–802). Mahwah, NJ: Erlbaum.
This chapter from the *Handbook of educational psychology* compares several conceptual frameworks for understanding how social processes and classroom contexts affect student learning and development. It also contains a detailed discussion of peer learning strategies such as reciprocal teaching, peer tutoring, and collaborative group work.

Perry, N. E., Turner, J. C., & Meyer, D. K. (2006). Classrooms as social contexts for motivating learning. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology* (2nd ed., pp. 327–348). Mahwah, NJ: Erlbaum.
This chapter, also from the *Handbook of educational psychology*, provides a comprehensive and detailed description of the effect of classroom context on the development of cognition, self-regulation, and student engagement and motivation.

Vygotsky, L. (1986). *Thought and language*. Cambridge, MA: The MIT Press.
This revised and enlarged edition of Lev Vygotsky's classic work includes an excellent overview of Vygotsky's thinking by Alex Kozulin that explains Vygotsky's influential ideas in easily understandable terms.

CHAPTER

10 Technological Contexts for Cognitive Growth

How Can Students Use Technologies? ■ Cognitive Load Theory and Multimedia Design ■ The Four-Component Instructional Design (4C/ID) Model and Complex Skill Development ■ Technology Supports for Metacognitive Development ■ Computer-Supported Collaborative Learning ■ Technology and Assessment ■ Implications for Instruction ■ Summary ■ Suggested Readings ■

This chapter is about technologies for learning and teaching. Simply put, a technology is any device or system that we humans use to accomplish our goals. The wheel, an oar, an abacus, a hammer, a toothpick, and a TV set are various examples. In education, some technologies have been with us for hundreds and even thousands of years—items to write with (e.g., a stylus, pen, pencil, and chalk), record ideas (e.g., papyrus, paper, and chalkboards), and preserve and share information in an organized way (e.g., scrolls and books).

When educators refer to technology, however, they almost always are referring to a cluster of continuously evolving electronic hardware (e.g., computers, laptops, handheld devices, MP3 and DVD players), communication networks linking these devices (e.g., wireless networks, cable TV, the Internet), and associated software (e.g., word processing, presentation programs, apps, simulations, games, Web browsers). In this chapter, we focus on these electronic technologies and examine the implications of cognitive psychology for their design and use.

Educators increasingly are aware of technology's potential for changing how learning and teaching take place. Even though education continues to lag behind other segments of society in using technology, having a relatively low level of classroom use compared to its integral part of our daily lives as we bank, shop, search for information and use our cell phones in a growing number of ways, there is hope that technology can improve, and even revolutionize, how students learn and teachers teach.

Our modern era is not the first in which there have been hopes about technology's promise. When movies and television first appeared predictions were made that they would replace most, if not all, classroom instruction. That has not happened. But today's versatile technologies do seem to warrant optimism. With technology an obvious feature in all of our lives and playing an increasing role in schools, where students have access to course-related e-mail communication and Web-based resources such as course syllabi, assignments, reading