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Chapter 4

Psychological Foundations of Instructional Design

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This chapter provides an overview of the major psychological concepts and principles of learning that are foundational to the field of instructional design (ID). The behavioral learning theory of B. F. Skinner, for example, contributed concepts such as reinforcement, feedback, behavioral objectives, and practice to the design of instruction. Cognitive theories such as information processing and schema theory shifted the focus of the ID field to attributes of learners and the role of prior knowledge in learning new knowledge and skills. Situated learning theory is also shifting the ID field toward consideration of sociocultural factors in learning. Finally, instructional theories such as Gagné's and constructivist approaches provide guidance for designing learning environments that facilitate the acquisition of desired skills, knowledge, and attitudes.

Regardless of the differences among psychological perspectives on learning, an underlying assumption of most is that instruction will bring about learning. This assumption is what is important to those in the ID field. As Gagné (1995/96) put it, "There are, after all, some useful human activities that are acquired without instruction, and others that result from self-instruction. But most practical and purposeful activities, such as the pursuits involved in vocational and technical training, are learned in settings that employ instruction" (p. 17).

Learning Defined

Most people have an intuitive notion of what it means to learn—they can do something that they could not do before or they know something that they did not know before. But learning must be distinguished from human development, or maturation, which also leads to abilities that were not present before. For example, young children are soon able to grasp objects in both hands simultaneously as they develop muscular control and coordination. Human development occurs as a natural process whereby "everyone, barring those with serious disorders, succeeds and succeeds well" (Gee, 2004, p. 11). Familiar examples of human development include learning to walk and learning one's native language.

Changes in ability that are only temporary must also be distinguished from learning, because learning implies a kind of permanence. Thus, the increased abilities of an athlete taking a performance-enhancing drug would not be thought of as learning.

Finally, some scholars make a further distinction between learning as an instructed process and learning as a cultural process (Gee, 2004). People learn many things by virtue of the cultural group to which they belong, such as social norms, rituals, and games. These are not typically the goals of instruction, whereas school subjects such as learning calculus or physics, are. As indicated earlier, overt instruction is what instructional designers care most about.

In most psychological theories, learning is defined as "a persisting change in human performance or performance potential" (Driscoll, 2005, p. 9), with performance potential referring to the fact that what is learned may not always be exhibited immediately. Indeed, you may remember many instances in which you were never asked to demonstrate what you had learned until a unit or final test was administered. It is important to note, however, that such demonstrations of learning are important for instructional designers to establish the effectiveness of instruction. How else can they determine the impact of instruction if they do not, in some way, ask the learners to perform what was to be learned in the first place?

Learning is defined further by how it is thought to occur. In most psychological theories, learning comes about as a consequence of "the learner's experience and interaction with the world" (Driscoll, 2005, p. 9), and this interaction is understood as an individual process. That is, the individual interacts with the world surrounding him or her, and this experience leads to an increased ability to perform in a particular way. A focus on the individual learner is why there has been such historical interest in differences among individuals and why the performance of individual learners is assessed after instruction. What differs among particular learning theories is how they describe the observed outcomes of learning and how they explain the learning process. Some of these differences are described in later sections of the chapter.

Recently, however, a perspective has emerged that calls into question the individuality of learning. Adherents of this view believe that "[psychological] individuality can only be properly identified and analyzed after the levels of community have been factored out" (Lemke, 1997, p. 49). In other words, learning is to be understood in terms of the activities of people living within a particular sociocultural setting. In this view, learning is more than a change in performance of a single individual; it can encompass the performance of a group of individuals sharing a common purpose or intent or engaged in a common practice. Furthermore, learning is characterized not just by the processes within an individual learner but also by the processes shared by and affecting the members of a defined group. It is in this perspective that learning as an instructed process begins to merge with learning as a cultural process.

In the sections that follow, major psychological concepts and principles of learning are explored and their implications for ID discussed. In some cases, such implications have already been observed as influences on the field. In others, implications are being imagined and proposed as potential and future influences on the field.

Behavioral Learning Theory

B. F. Skinner, throughout his life and career, advocated an approach to the study of psychology and learning that is focused on behavior (see, for example, Skinner, 1938, 1969, 1987). At the core of his radical behaviorism is Skinner's belief that learning can be understood, explained, and predicted entirely on the basis of observable events, namely, the behavior of the learner along with its environmental antecedents and consequences. Antecedents refer to the cues occurring in the environment that signal the appropriateness of a given behavior. A stop sign, for example, signals to the driver that the appropriate behavior is to apply the brakes. Likewise, a teacher's admonition to "listen up!" signals to learners that they should stop talking and pay attention. According to Skinner, the consequences of a behavior then determine whether it is repeated and thus considered to be learned. For instance, a learner who is rewarded with a teacher's smile for paying attention in class will be more likely to follow the teacher's direction at a later time than one whose behavior goes unnoticed. Similarly, a learner who tries a new strategy for finding information on the World Wide Web is more likely to keep using it if it proves to be successful (and is thus reinforced) than if the strategy does not yield the sought-for information.

The principles of behavior modification that Skinner and his disciples investigated in their research and tried out in instructional applications have had significant impact on the ID field. To begin with, behavioral learning theory is empirically based, which means that behavior is observed both before and after an intervention such as instruction has been implemented, and the observed changes in performance are related to what occurred during the intervention. If there is no change in behavior, then the intervention cannot be considered effective. In the ID field, these observations are part of formative evaluation, which is conducted to collect information about whether instruction resulted in learning and how it might be improved to result in even better learner performance.

The emphasis in this theory on the behavior of the learner also contributed to concepts such as behavioral objectives and the importance of practice in instruction. For example, prior to instruction, teachers and instructional designers can determine whether learners have already acquired a desired behavior by observing them. Desired behaviors that are not exhibited can be specified as objectives, or learning outcomes, to be addressed in the instruction that is being designed and developed. In a similar way, specifying desired behaviors as objectives points out the need to ensure that learners have sufficient opportunities to practice these behaviors as they learn.

Finally, behavioral theory influenced early conceptions of instructional feedback. That is, feedback was assumed to be essentially equivalent to reinforcement. When learners responded correctly during instruction, immediate feedback that the answer was correct was expected to reinforce the response. Likewise, feedback that an answer was wrong was expected to reduce the incidence of incorrect responding. Because of the anticipated reinforcing benefits of feedback, instructional designs (such as programmed instruction) resulted that broke instruction into small steps and required learners to respond frequently (see, for example, Holland & Skinner, 1961), thus virtually assuring errorless performance. Unfortunately, these designs were boring to learners, who could also "peek" ahead at answers before they responded, which meant that the presumed benefits of feedback were rarely realized (Kulhavy, 1977).

Cognitive Information Processing Theory

The informational value of feedback became apparent when researchers and practitioners began to adopt the perspective of information processing theory. This view rose to prominence among psychologists in the 1970s, and variations of it continue to be investigated and articulated today. Like behavioral theory, information processing theory regards the environment as playing an important role in learning. Where information processing theory differs from behavioral theory, however, is in its assumption of internal processes within the learner that explain learning. "The birth of computers after World War II provided a concrete way of thinking about learning and a consistent framework for interpreting early work on memory, perception, and learning. Stimuli became inputs; behavior became outputs. And what happened in between was conceived of as information processing" (Driscoll, 2005, p. 74).

Atkinson and Shriffin (1968) proposed a multistage, multistore theory of memory that is generally regarded as the basis for information processing theory. Three memory systems in the learner (sensory, short-term, and long-term memory) are assumed to receive information from the environment and transform it for storage and use in memory and performance. With sensory memory, learners perceive organized patterns in the environment and begin the process of recognizing and coding these patterns. Short-term or working memory permits the learner to hold information briefly in mind to make further sense of it and to connect it with other information that is already in long-term memory. Finally, long-term memory enables the learner to remember and apply information long after it was originally learned.

In addition to stages through which information passes, processes such as attention, encoding, and retrieval are hypothesized to act upon information as it is received, transformed, and stored for later recall and use. For instance, learners who fail to pay attention will never receive the information to be learned in the first place. To be most influential on learning, attention must often be directed so that learners heed specific aspects of the information they are being asked to learn. Similarly, the process of encoding provides a means for learners to make personally meaningful connections between new information and their prior knowledge. Finally, retrieval enables learners to recall information from memory so that it can be applied in an appropriate context.

Feedback from an information processing perspective, then, serves two functions during learning. First, it provides the learner with knowledge about the correctness of his or her response or the adequacy of his or her performance. While this knowledge is certainly important during learning, it is not sufficient for correcting misconceptions or other errors in performance. The second function of feedback, therefore, is to provide corrective information to the learner that can be used to modify performance. In essence, feedback completes a learning cycle where the feedback can be used to continually modify what is stored in memory and used to guide performance.

In addition to changing our conception of feedback in instructional design, information processing theory shifted our focus to various attributes of instruction and how they can facilitate or impede information processing and, thereby, learning. It also put increased emphasis on the role of prior knowledge in learning new knowledge and skills. For instance, a learner who already knows a good deal about the topic of instruction can call to mind many cues that will be helpful in processing whatever information is new. A learner with little prior knowledge, however, can make few connections between what is already known and what he or she is being asked to learn.

To assist learners in processing information, practitioners have incorporated strategies into their instructional designs that direct attention, facilitate encoding and retrieval, and provide practice in a variety of contexts. The use of boldface and italic print in text materials, for example, can draw learners' attention to important information just as the use of color in diagrams or slides can help learners distinguish important features of visual information. Graphical diagrams and imagery strategies can help learners make meaningful connections between their prior knowledge and the new information they are learning. Finally, providing many different kinds of examples or problems in different contexts can help learners apply the knowledge they are acquiring to situations where it is relevant.

Schema Theory and Cognitive Load

What distinguishes experts from novices in the way they structure knowledge and in their ability to solve problems? Questions like this have prompted developments in learning theory that, while still cognitive in orientation, diverge from information-processing perspectives. According to schema theory, knowledge is represented in long-term memory as packets of information called schemas. Schemas organize information in categories that are related in systematic and predictable ways. For instance, my knowledge or schema of "farm" may encompass categories of information such as kinds of animals raised there, types of crops grown, implements used, and so on. Learners use existing schemas to interpret events and solve problems, and they develop new and more complex schemas through experience and learning.

Automation is important in the construction of schemas, because learners have only so much processing capacity. "Indeed, knowledge about working memory limitations suggest[s] humans are particularly poor at complex reasoning unless most of the elements with which we reason have previously been stored in long-term memory" (Sweller, van Merriënboer, & Paas, 1998, p. 254). More sophisticated and automatic schemas free a learner's working memory capacity, allowing processes such as comprehension and reasoning to occur. However, a high cognitive load is put on learners when they do not have appropriate or automated schemas to access, or when the learning task imposes a heavy demand on working memory processes.

From their investigations of cognitive load theory, Sweller, van Merriënboer, and their colleagues have suggested instructional strategies designed to reduce extraneous cognitive load in instructional materials. These include providing worked examples and partially completed problems that learners review or finish solving. Worked examples appear to be effective not only in well-structured domains (such as algebra) but also in complex domains that are largely heuristic in nature (such as troubleshooting in engineering; Renkl, Hilbert, & Schworm, 2009). In multimedia instruction, Mayer and Moreno (2003) suggest that narration, rather than on-screen text, be used with animation or diagrams so that learners' attention is not split between two sources of visual input. The split-attention effect can also be reduced in text-based instruction by integrating explanations within diagrams instead of requiring learners to mentally integrate text and pictures (Sweller, van Merriënboer, & Paas, 1998).

Finally, the evolution of cognitive load theory has focused increasing attention in the instructional design field on learning of complex, cognitive skills. Van Merriënboer and his colleagues have proposed the 4C/ID model for complex learning, which calls for learning tasks to be sequenced in ways that reduce cognitive load (van Merriënboer, Kirschner, & Kester, 2003; van Merriënboer & Kirschner, 2007). That is, learners are gradually introduced to a series of task classes, each of which represents, on a simple to complex continuum, a version of the whole task. These are supplemented with just-in-time information and part-task practice, depending on the learner's growing expertise and the need for automaticity.

Situated Learning Theory

Whereas the context of learning is recognized as important in information processing theory, it takes on a more central and defining role in situated learning theory. As an emergent trend in the cognitive sciences (Robbins & Aydede, 2009), situated learning or situated cognition theory is regarded by its proponents as "a work in progress" (Kirshner & Whitson, 1997). There is growing consensus, however, about what it means to say that "learning is always situated" (Sawyer & Greeno, 2009) and what this could imply for instructional design.

Unlike behavioral and information processing theory, situated learning theory relies more on social and cultural determinants of learning than it does on individual psychology. Specifically, knowledge is presumed to accrue in "meaningful actions, actions that have relations of meaning to one another in terms of some cultural system" (Lemke, 1997, p. 43). For example, children selling candy on the streets of Brazil developed techniques for manipulating numbers that are related to currency exchanges, whereas their age-mates in school learned standard number orthography (Saxe, 1990). To understand why the candy sellers acquired the particular mathematical knowledge that they did and why it was so different from what their age-mates learned requires reference, at least in part, to the "mathematical and economic problems linked to the practice" of candy selling (Saxe, 1990, p. 99).

Thus, learning from a situated perspective occurs through the learner's participation in the practices of a community, practices that are mutually constituted by the members of the community. Consider, for example, the instructional design profession as a community of practice. As a student, you are a newcomer to the community, engaged in learning its models and practices and becoming ever more competent as you gain experience in these practices. With increasing participation, newcomers become old-timers in the community, individuals who control the resources and affect the practices of the community at large. Faculty members in programs, for example, change the practices of the field through their participation in research and development.

According to Wenger (1998), learning as participation can be defined:

- individually, i.e., as members engage in the practices of a community;
- community-wide, i.e., as members refine the practices of a community and recruit new members; and
- organizationally, i.e., as members sustain the interconnected communities of practice through which "an organization knows what it knows and thus becomes effective and valuable as an organization" (p. 8).

Organizations that hire instructional designers, for example, constitute their own communities of practice that embody the ways in which design is conducted in the context of their businesses. Yet their practices are influenced by the academic communities from which they recruit their instructional designers. It should also be obvious that the influence of interconnected communities of practice works in both directions; academic programs modify their practices from time to time based on what they learn from the organizations where they place their graduates.

Proponents of situated learning theory point to its strength as integrating knowing with doing. That is, one learns a subject matter by doing what experts in that subject matter do (Lave, 1990/1997). As an emergent view or "work in progress," the claims of situated learning theory are not without controversy, but evidence is growing that supports its validity and useful application to instruction.

For over fifteen years, Scardamalia and Bereiter (1994, 1996a) have researched a community-of-learners approach to instruction called CSILE, or Computer-Supported Intentional Learning Environment. CSILE—and its upgraded version, Knowledge Forum (Scardamalia, 2004; Zhang, et al., 2009)—is a computer tool that enables students to engage in the discourse of a subject matter discipline in a scholarly way. They focus on a problem and build a communal database, or "knowledge space," of information about the problem. With current Web technologies, CSILE/Knowledge Forum has the capability now of linking experts in the field with students in the classroom in mutually constituted knowledge-building efforts (Scardamalia & Bereiter, 1996b). Students continually improve their ideas as they consult others' work, and they collectively determine next steps based on gaps in their knowledge. Evidence from recent studies suggests that the tools embodied in Knowledge Forum can facilitate high-level collective cognitive responsibility and dynamic knowledge building among members of the learning community (Zhang, et al., 2009).

The influence of situated learning theory is also being felt in designs for anchored instruction. The Cognition and Technology Group at Vanderbilt (1990) proposed anchored instruction as a means of providing a situated context for problem solving. Specifically, they developed video adventure programs containing a series of embedded problems that engaged the viewers in attempting to solve the problems. The video adventure story provides a realistic, situated "anchor" for activities such as identifying problems, making hypotheses, proposing multiple solutions, and so on. The expectation is that students will engage in authentic practices of the discipline in which a given set of problems is anchored, whether mathematics, science, or history, for example.

Anchored instruction has been criticized for providing a simulation of a community of practice, casting the learners as observers rather than participants (Tripp, 1993). But the Vanderbilt group has evolved an approach where students begin with a video-based problem but then move through cycles of learning where they consult various knowledge resources, share ideas, and revise their understandings (Schwartz, Lin, Brophy, & Bransford, 1999). Web-based software provides a visual representation of the learning cycle and facilitates students' action and reflection, as well as their interaction with others. As with CSILE/Knowledge Forum, this affords an opportunity for learners to collaborate within a broader community and leave a legacy for others to use and build upon.

Gagné's Theory of Instruction

Although many learning theorists may be interested in what their work means for instruction, the explanation of learning is their primary concern. Robert M. Gagné, on the other hand, was primarily concerned with instruction and how what is known about learning can be systematically related to the design of instruction. He proposed an integrated and comprehensive theory of instruction that is based primarily on two foundations: cognitive information processing theory and Gagné's own observations of effective teachers in the classroom. A long-term collaborator of Gagné, Briggs (1980) wrote also that "I never asked Gagné about this, but I believe his early work in [designing training programs for] the Air Force must have been an important factor in his later derivation of his (a) taxonomy of learning outcomes, (b) concept of learning hierarchies, and (c) related concepts of instructional events and conditions of learning" (pp. 45–46).

As it evolved, then, Gagné's theory of instruction came to comprise three components:

- a taxonomy of learning outcomes that defined the types of capabilities humans can learn;

- internal and external learning conditions associated with the acquisition of each category of learning outcome; and
- nine events of instruction that each facilitate a specific cognitive process during learning.

Taxonomies of learning existed before and since Gagné's formulation of his, but none other besides his includes all three domains in which individuals are presumed to learn: cognitive, affective, and psychomotor. According to Gagné (1972, 1985; Gagné & Medsker, 1996; Gagné, et al., 2005), there are five major categories of learning:

- verbal information, i.e., knowing "that" or "what";
- intellectual skills, i.e., applying knowledge;
- cognitive strategies, i.e., employing effective ways of thinking and learning;
- attitudes, i.e., feelings and beliefs that govern choices of personal action; and
- motor skills, i.e., executing precise, smooth and accurately timed movements.

The reason for defining different categories of learning outcomes stems from the assumption that they must all require different conditions for learning. For example, learning to ride a bicycle (a motor skill) is different in fundamental ways from learning the multiplication table (verbal information), which is different in fundamental ways from learning to solve scientific problems (intellectual skill).

The differences in conditions of learning across categories of learning outcomes provide guidelines for which conditions must be included in instruction for specifically defined instructional goals. For example, instruction on the goal of "perform CPR" (motor skill) is likely to include a demonstration of the procedure, individual practice on the procedure, and perhaps a job aid depicting each step. On the other hand, instruction on an attitudinal goal implicit in job training on an electronic support system (such as, "choose to use the help function before seeking human assistance") is likely to provide a human model and focus on the benefits of making the desired choice.

In addition to conditions of learning that are unique to each learning outcome, there are conditions of learning which facilitate the process of learning in general. Gagné conceived of the nine events of instruction as learning conditions to support internal processes such as attention, encoding, and retrieval. The events of instruction are presented briefly below:

1. Gaining attention—a stimulus change to alert the learner and focus attention on desired features.
2. Informing the learner of the objective—a statement or demonstration to form an expectancy in the learner as to the goals of instruction.
3. Stimulating recall of prior learning—a question or activity to remind the learner of prerequisite knowledge.
4. Presenting the stimulus—an activity or information that presents the content of what is to be learned.
5. Providing learning guidance—a cue or strategy to promote encoding.
6. Eliciting performance—an opportunity to practice or otherwise perform what is being learned.
7. Providing feedback—information of a corrective nature that will help learners improve their performance.
8. Assessing performance—an opportunity to demonstrate what has been learned.
9. Enhancing retention and transfer—examples or activities that prompt the learner to go beyond the immediate context of instruction.

The application of Gagné's theory in instructional design is often a highly analytical affair, and it is therefore possible to lose sight of the overall context for learning while dealing with all the details of instruction. As a means of helping instructional designers integrate multiple goals into instruction, Gagné and Merrill (1990) proposed the notion of an enterprise schema. The enterprise schema defines the context for learning, the reason for learning a particular set of goals in the first place. For example, the enterprise schema of "managing a lemonade stand" provides a meaningful context for learning how to exchange currency, how to calculate needed supplies based on an anticipated volume of business, and so on.

Constructivism

The final theory to be considered in this chapter is not a single theory, but rather a collection of views sharing a fundamental assumption about learning that contrasts sharply with the assumptions underlying theories such as information processing. The contrast can be drawn this way. In information processing theory, learning is mostly a matter of going from the outside in. The learner receives information from the environment, transforms it in various ways, and acquires knowledge that is subsequently stored in memory. In constructivist approaches, on the other hand, learning is more a matter of going from the inside out. The learner actively imposes organization and meaning on the surrounding environment and constructs knowledge in the process.

From a radical constructivist point of view, knowledge constructions do not have to correspond with reality to be meaningful, but most constructivist researchers agree that not all knowledge constructions are equally viable. To sort out which ideas are viable and which are not, learners must test their personal understandings against those of others, usually peers and teachers.

Constructivism has been keenly felt in the world, partly because it seems to contrast so starkly with the other foundations, such as information processing and Gagné's theories, that have influenced practices in our field. Some of the philosophical issues related to these views are taken up in Chapter 5 and so will not be repeated here. Rather, I have chosen to describe a few of what I perceive to be the greatest impacts of constructivism on the field.

To begin with, constructivist researchers focused attention on high level, complex learning goals, such as "the ability to write persuasive essays, engage in informal reasoning, explain how data relate to theory in scientific investigations, and formulate and solve moderately complex problems that require mathematical reasoning" (Cognition and Technology Group at Vanderbilt, 1991, p. 34). While these kinds of goals are certainly definable using taxonomies such as Gagné's, under such approaches they do not necessarily assume the prominence that constructivists would assign to them. Addressing broad and complex learning goals is also consistent with constructivist beliefs that individuals do not all learn the same things from instruction.

Constructivism has also had a substantial impact on views pertaining to the learning conditions and instructional strategies believed to support constructivist learning goals. To engage learners in knowledge construction, facilitate tests of their understanding, and prompt reflection on the knowledge generation process itself, constructivist researchers have recommended the creation and use of complex learning environments. Such learning environments should:

- engage learners in activities authentic to the discipline in which they are learning;
- provide for collaboration and the opportunity to engage multiple perspectives on what is being learned;
- support learners in setting their own goals and regulating their own learning; and
- encourage learners to reflect on what and how they are learning.

The rapid growth in computer technologies has assisted researchers in creating different kinds of technology mediated learning environments that implement these strategies. It remains somewhat difficult to judge the effectiveness of these systems, however, because advances in assessment have not kept up well with advances in technology. Furthermore, constructivists argue that assessment of individual student learning should involve authentic practices observed during learning and would not necessarily reveal a uniform level of accomplishment across learners.

The popularity of constructivist learning environments and the difficulty in designing effective ones has led to recent criticism that they simply do not work. Kirschner, Sweller, and Clark (2006) conducted an analysis of "minimally guided" learning environments and concluded that, "Insofar as there is any evidence from controlled studies, it almost uniformly supports direct, strong instructional guidance rather than constructivist-based minimal guidance during the instruction of novice to intermediate learners" (p. 82). While others have taken issue with Kirschner, et al.'s analysis (e.g., Hmelo-Silver, Duncan, & Chinn, 2007), an important point to take from it is that constructivist learning environments can and do differ greatly in the amount and kind of instructional support that they provide for learners. In a study of conceptual change in science, for example, Hardy et al. (2006) found that all students benefitted through their participation in a constructivist learning environment on the topic of "floating and sinking." But students held fewer misconceptions and adopted better scientific explanations when the teacher structured tasks to highlight relevant aspects and facilitated student reflection on their insights.

Conclusion

This chapter has presented a brief introduction to some of the major psychological principles and avenues of thought that have contributed (and continue to contribute) to professional practices in the field of instructional design. Behavioral and cognitive information processing theory came out of research programs dominating psychology in the 1960s and 1970s. Gagné's theory evolved through two decades of research from the 1960s to 1980s and integrates cognitive with behavioral views. These theories collectively form the bedrock on which the field of instructional design was founded and initially developed. They provided, and continue to provide, useful and reliable guidance for designing effective instruction.

Constructivism, schema theory, and situated learning theory now offer the ID field other ways of thinking about learning. Along with advances in technology, they promise design strategies for producing learning environments more complex, more authentic, and more appealing than ever before. The long-term implications of these theories to the ID field are not yet fully known, but they surely offer an invitation to professionals new to the field to help shape that legacy.

Summary of Key Principles

Taking into consideration the various theories of learning and instruction that have been described in this chapter, listed below are some key principles instructional designers should keep in mind as they engage in the design process:

1. Observe the behavior of learners to identify what students need to know, where they need practice, and when they have met a desired standard of performance. This can also help you make judgments about the effectiveness of instruction in facilitating students' learning.
2. Use instructional strategies that direct learners' attention, help them make relevant information personally meaningful, and provide them practice in a variety of contexts to facilitate transfer.
3. To help students learn complex skills, use instructional strategies such as worked examples and partially completed problems to reduce cognitive load.
4. Provide opportunities for students to work in communities of learning, where they tackle complex problems, share information, challenge each other's perspectives, and arrive at common understandings.
5. Align conditions of learning with the type of learning outcome students are expected to attain. Be sure to incorporate the nine events of instruction to facilitate the overall process of learning.
6. Engage learners in authentic activities and collaborative problem solving. Use instructional strategies that enable students to set their own goals, monitor their own progress, and reflect on their own learning.

Application Questions

1. Assume that you are trying to teach learners how to calculate and compare the unit costs (e.g., price per ounce) of various sizes and/or brands of the same product. Select three of the theories of learning discussed in this chapter. For each of the three, describe the nature of the instructional activities that you would design if you were adhering to that theory as you were planning the instruction.
2. Select two instructional goals that represent simple versus complex learning outcomes. How would the learning theories discussed in this chapter be employed to develop instruction to teach the goals you have selected? How would the instruction differ in each case? Would one or another theory be more applicable to one goal versus the other? Why?

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Chapter 5

Constructivism in Practical and Historical Context

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If you spend time with professional educators—K-12 teachers, education professors, or even corporate trainers—you will run into the term *constructivism.* As its name suggests, constructivism sees learning as a process of constructing or making something. Constructivism says that people learn by making sense out of the world—they make meaning out of what they encounter. Exactly how people construct meaning is something that learning theorists debate—some arguing for fairly mechanistic processes of information encoding and retrieval, others seeing the process in qualitative, experiential terms. Whatever the exact process of meaning construction, instructors and instructional designers try to create conditions for meaningful learning to happen in classrooms and courses, and on the job.

Constructivism is a theory or philosophy of learning "based on the idea that knowledge is constructed by the knower based on mental activity" (Skaalid, no date). It can be defined as "*meaning making* . . . rooted in the context of the situation . . . whereby individuals construct their knowledge of, and give meaning to, the external world" (Babb et al., no date). As an educational philosophy it came to prominence in the early 1990s. Based on writing of that time (Dunlap & Grabinger, 1996; Merrill, 1991; Savery & Duffy, 1996; and Wilson, Jouchoux, & Teslow, 1995), the basic precepts are:

- Learning is an active process of meaning-making gained in and through our experience and interactions with the world.
- Learning opportunities arise as people encounter cognitive conflict, challenge, or puzzlement, and through naturally occurring as well as planned problem-solving activities.
- Learning is a social activity involving collaboration, negotiation, and participation in authentic practices of communities.
- Where possible, reflection, assessment, and feedback should be embedded "naturally" within learning activities.
- Learners should take primary responsibility for their learning and "own" the process as far as possible.

Note that the first several bulleted precepts are descriptive in nature, and then the last couple shift to a prescriptive tone. This reflects the nature of constructivist theorizing—it rests on a descriptive base, but extends to guidelines for instructional design.

The bulleted precepts above suggest a renegotiation of teacher and learner roles. Instruction is not so much *done to* learners as it is meant to *engage learners* in a process of inquiry and activity. The instructor shifts role from "sage on the stage" to "guide on the side"—still sharing information where needed, but primarily engaging learners in authentic and challenging learning activities.

Constructivist teaching is often contrasted with "the lecture approach" (less charitably referred to as "knowledge dumping"), which involves students passively receiving content presented in lectures and textbooks. This approach