Behaviorism, Cognitivism, Constructivism: Comparing Critical Features From an Instructional Design Perspective

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The way we define learning and what we believe about the way learning occurs has important implications for situations in which we want to facilitate changes in what people know and/or do. Learning theories provide instructional designers with verified instructional strategies and techniques for facilitating learning as well as a foundation for intelligent strategy selection. Yet many designers are operating under the constraints of a limited theoretical background. This paper is an attempt to familiarize designers with three relevant positions on learning (behavioral, cognitive, and constructivist) which provide structured foundations for planning and conducting instructional design activities. Each learning perspective is discussed in terms of its specific interpretation of the learning process and the resulting implications for instructional designers and educational practitioners. The information presented here provides the reader with a comparison of these three different viewpoints and illustrates how these differences might be translated into practical applications in instructional situations.

The need for a bridge between basic learning research and educational practice has long been discussed. To ensure a strong connection between these two areas, Dewey (cited in Reigeluth, 1983) called for the creation and development of a "linking science"; Tyler (1978) a "middleman position"; and Lynch (1945) for employing an "engineering analogy" as an aid for translating theory into practice. In each case, the respective author highlighted the information and potential contributions of available learning theories, the pressing problems faced by those dealing with practical learning issues, and a general lack of using the former to facilitate solutions for the latter. The value of such a bridging function would be its ability to translate relevant aspects of the learning theories into optimal instructional actions. As described by Reigeluth (1983), the field of Instructional Design performs this role.

Instructional designers have been charged with "translating principles of learning and instruction into specifications for instructional materials and activities" (Smith & Ragan, 1993, p. 12). To achieve this goal, two sets of skills and knowledge are needed. First, the designer must understand the position of the practitioner. In this regard, the following questions would be relevant: What are

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the situational and contextual constraints of the application? What is the degree of individual differences among the learners? What form of solutions will or will not be accepted by the learners as well as by those actually teaching the materials? The designer must have the ability to diagnose and analyze practical learning problems. Just as a doctor cannot prescribe an effective remedy without a proper diagnosis, the instructional designer cannot properly recommend an effective prescriptive solution without an accurate analysis of the instructional problem.

In addition to understanding and analyzing the problem, a second core of knowledge and skills is needed to "bridge" or "link" application with research—that of understanding the potential sources of solutions (i.e., the theories of human learning). Through this understanding, a proper prescriptive solution can be matched with a given diagnosed problem. The critical link, therefore, is not between the design of instruction and an autonomous body of knowledge about *instructional* phenomena, but between instructional design issues and the theories of human *learning.*

Why this emphasis on learning theory and research? First, learning theories are a *source* of verified instructional strategies, tactics, and techniques. Knowledge of a variety of such strategies is critical when attempting to select an effective prescription for overcoming a given instructional problem. Second, learning theories provide the foundation for intelligent and reasoned strategy *selection*. Designers must have an adequate repertoire of strategies available, *and* possess the knowledge of when and why to employ each. This knowledge depends on the designer's ability to match the demands of the task with an instructional strategy that helps the learner. Third, *integration* of the selected strategy within the instructional context is of critical importance. Learning theories and research often provide information about relationships among instructional components and the design of instruction, indicating how specific techniques/strategies might best fit within a given context and with specific learners (Keller, 1979). Finally, the ultimate role of a theory is to allow for reliable *prediction* (Richey, 1986). Effective solutions to practical instructional problems are often constrained by limited time and resources. It is paramount that those strategies selected and implemented have the highest chance for success. As suggested by Warries (1990), a selection based on strong research is much more reliable than one based on "instructional phenomena."

The task of translating learning theory into practical applications would be greatly simplified if the learning process were relatively simple and straightforward. Unfortunately, this is not the case. Learning is a complex process that has generated numerous interpretations and theories of how it is effectively accomplished. Of these many theories, which should receive the attention of the instructional designer? Is it better to choose one theory when designing instruction or to draw ideas from different theories? This article presents three distinct perspectives of the learning process (behavioral, cognitive, and constructivist) and although each has many unique features, it is our belief that each still describes the same phenomena (learning). In selecting the theory whose associated instructional strategies offers the optimal means for achieving desired outcomes, the degree of cognitive processing required of the learner by the specific task appears to be a critical factor. Therefore, as emphasized by Snelbecker (1983), individuals addressing practical learning problems cannot afford the "luxury of restricting themselves to only one theoretical position . . . [They] are urged to examine each of the basic science theories which have been developed by psychologists in the study of learning and to select those principles and conceptions which seem to be of value for one's particular educational situation" (p. 8).

If knowledge of the various learning theories is so important for instructional designers, to what degree are they emphasized and promoted? As reported by Johnson (1992), less than two percent of the courses offered in university curricula in the general area of educational technology emphasize "theory" as one of their key concepts. It appears that the real benefits of theoretical knowledge are, at present, not being realized.

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This article is an attempt to "fill in some of the gaps" that may exist in our knowledge of modern learning theories. The main intent is to provide designers with some familiarity with three relevant positions on learning (behavioral, cognitive, and constructivist) which should provide a more structured foundation for planning and conducting instructional design activities. The idea is that if we understand some of the deep principles of the theories of learning, we can extrapolate to the particulars as needed. As Bruner (1971) states, "You don't need to encounter everything in nature in order to know nature" (p. 18). A basic understanding of the learning theories can provide you with a "canny strategy whereby you could know a great deal about a lot of things while keeping very little in mind" (p. 18).

It is expected that after reading this article, instructional designers and educational practitioners should be better informed "consumers" of the strategies suggested by each viewpoint. The concise information presented here can serve as an initial base of knowledge for making important decisions regarding instructional objectives and strategies.

Learning Defined

Learning has been defined in numerous ways by many different theorists, researchers and educational practitioners. Although universal agreement on any single definition is nonexistent, many definitions employ common elements. The following definition by Shuell (as interpreted by Schunk, 1991) incorporates these main ideas: "Learning is an enduring change in behavior, or in the capacity to behave in a given fashion, which results from practice or other forms of experience" (p. 2).

Undoubtedly, some learning theorists will disagree on the definition of learning presented here. However, it is not the definition itself that separates a given theory from the rest. The major differences among theories lie more in interpretation than they do in definition. These differences revolve around a number of key issues that ultimately delineate the instructional prescriptions that flow from each theoretical perspective. Schunk (1991) lists five definitive questions that serve to distinguish each learning theory from the others:

(l) How does learning occur?
(2) Which factors influence learning?
(3) What is the role of memory?
(4) How does transfer occur? and
(5) What types of learning are best explained by the theory?

Expanding on this original list, we have included two additional questions important to the instructional designer:

(6) What basic assumptions/principles of this theory are relevant to instructional design? and
(7) How should instruction be structured to facilitate learning?

In this article, each of these questions is answered from three distinct viewpoints: behaviorism, cognitivism, and constructivism. Although learning theories typically are divided into two categories—behavioral and cognitive—a third category, constructive, is added here because of its recent emphasis in the instructional design literature (e.g., Bednar, Cunningham, Duffy, & Perry, 1991; Duffy & Jonassen, 1991; Jonassen, 1991b; Winn, 1991). In many ways these viewpoints overlap; yet they are distinctive enough to be treated as separate approaches to understanding and describing learning. These three particular positions were chosen because of their importance, both historically and currently, to the field of instructional design. It is hoped that the answers to the first five questions will provide the reader with a basic understanding of how these viewpoints differ. The answers to the last two questions will translate these differences into practical suggestions and recommendations for the application of these principles in the design of instruction.

These seven questions provide the basis for the article's structure. For each of the three theoretical positions, the questions are addressed and an example is given to illustrate the application of that perspective. It is expected that this approach will enable the reader to compare and contrast the different viewpoints on each of the seven issues.

As is common in any attempt to compare and contrast similar products, processes, or ideas, differences are emphasized in order to make distinctions clear. This is not to suggest that there are no similarities among these viewpoints or that there are no overlapping features. In fact, different learning theories will often prescribe the same instructional methods for the same situations (only with different terminology and possibly with different intentions). This article outlines the major differences between the three positions in an attempt to facilitate comparison. It is our hope that the reader will gain greater insight into what each viewpoint offers in terms of the design and presentation of materials, as well as the types of learning activities that might be prescribed.

Historical Foundations

Current learning theories have roots that extend far into the past. The problems with which today's theorists and researchers grapple and struggle are not new but simply variations on a timeless theme: Where does knowledge come from and how do people come to know? Two opposing positions on the origins of knowledge—empiricism and rationalism—have existed for centuries and are still evident, to varying degrees, in the learning theories of today. A brief description of these views is included here as a background for comparing the "modern" learning viewpoints of behaviorism, cognitivism, and constructivism.

Empiricism is the view that experience is the primary source of knowledge (Schunk, 1991). That is, organisms are born with basically no knowledge and anything learned is gained through interactions and associations with the environment. Beginning with Aristotle (384–322 B.C.), empiricists have espoused the view that knowledge is derived from sensory impressions. Those impressions, when associated contiguously in time and/or space, can be hooked together to form complex ideas. For example, the complex idea of a tree, as illustrated by Hulse, Egeth, and Deese (1980), can be built from the less complex ideas of branches and leaves, which in turn are built from the ideas of wood and fiber, which are built from basic sensations such as greenness, woody odor, and so forth. From this perspective, critical instructional design issues focus on how to manipulate the environment in order to improve and ensure the occurrence of proper associations.

The goal of instruction for the behaviorist is to elicit the desired response from the learner who is presented with a target stimulus.

Rationalism is the view that knowledge derives from reason without the aid of the senses (Schunk, 1991). This fundamental belief in the distinction between mind and matter originated with Plato (c. 427–347 B.C.), and is reflected in the viewpoint that humans learn by recalling or "discovering" what already exists in the mind. For example, the direct experience with a tree during one's lifetime simply serves to reveal that which is already in the mind. The "real" nature of the tree (greenness, woodiness, and other characteristics) becomes known, not through the experience, but through a reflection on one's idea about the given instance of a tree. Although later rationalists differed on some of Plato's other ideas, the central belief remained the same: that knowledge arises through the mind. From this perspective, instructional design issues focus on how best to structure new information in order to facilitate (1) the learners' encoding of this new information, as well as (2) the recalling of that which is already known.

The empiricist, or associationist, mindset provided the framework for many learning theories during the first half of this century, and it was against this background that behaviorism became the leading psychological viewpoint (Schunk, 1991). Because behaviorism was dominant when instructional theory was initiated (around 1950), the instructional design (ID) technology that arose alongside it was naturally influenced by many of its basic assumptions and characteristics. Since ID has its roots in behavioral theory, it seems appropriate that we turn our attention to behaviorism first.

Behaviorism

How does learning occur?

Behaviorism equates learning with changes in either the form or frequency of observable performance. Learning is accomplished when a proper response is demonstrated following the presentation of a specific environmental stimulus. For example, when presented with a math flashcard showing the equation "2 + 4 = ?" the learner replies with the answer of "6." The equation is the stimulus and the proper answer is the associated response. The key elements are the stimulus, the response, and the association between the two. Of primary concern is how the association between the stimulus and response is made, strengthened, and maintained.

Behaviorism focuses on the importance of the consequences of those performances and contends that responses that are followed by reinforcement are more likely to recur in the future. No attempt is made to determine the structure of a student's knowledge nor to assess which mental processes it is necessary for them to use (Winn, 1990). The learner is characterized as being reactive to conditions in the environment as opposed to taking an active role in discovering the environment.

Which factors influence learning?

Although both learner and environmental factors are considered important by behaviorists, environmental conditions receive the greatest emphasis. Behaviorists assess the learners to determine at what point to begin instruction as well as to determine which reinforcers are most effective for a particular student. The most critical factor, however, is the arrangement of stimuli and consequences within the environment.

What is the role of memory?

Memory, as commonly defined by the layman, is not typically addressed by behaviorists. Although the acquisition of "habits" is discussed, little attention is given as to how these habits are stored or recalled for future use. Forgetting is attributed to the "nonuse" of a response over time. The use of periodic practice or review serves to maintain a learner's readiness to respond (Schunk, 1991).

How does transfer occur?

Transfer refers to the application of learned knowledge in new ways or situations, as well as to how prior learning affects new learning. In behavioral learning theories, transfer is a result of generalization. Situations involving identical or similar features allow behaviors to transfer across common elements. For example, the student who has learned to recognize and classify elm trees demonstrates transfer when (s)he classifies maple trees using the same process. The similarities between the elm and maple trees allow the learner to apply the previous elm tree classification learning experience to the maple tree classification task.

What types of learning are best explained by this position?

Behaviorists attempt to prescribe strategies that are most useful for building and strengthening stimulus-response associations (Winn, 1990), including the use of instructional cues, practice, and reinforcement. These prescriptions have generally been proven reliable and effective in facilitating learning that involves discriminations (recalling facts), generalizations (defining and illustrating concepts), associations (applying explanations), and chaining (automatically performing a specified procedure). However, it is generally agreed that behavioral principles cannot adequately explain the acquisition of higher level skills or those that require a greater depth of processing (e.g., language development, problem solving, inference generating, critical thinking) (Schunk, 1991).

What basic assumptions/principles of this theory are relevant to instructional design?

Many of the basic assumptions and characteristics of behaviorism are embedded in current instructional design practices. Behaviorism was used as the basis for designing many of the early audio-visual materials and gave rise to many related teaching strategies, such as Skinner's teaching machines and programmed texts. More recent examples include principles utilized within computer-assisted instruction (CAI) and mastery learning.

Specific assumptions or principles that have direct relevance to instructional design include the following (possible current ID applications are listed in brackets [ ] following the listed principle):

- An emphasis on producing observable and measurable outcomes in students [behavioral objectives, task analysis, criterion-referenced assessment]
- Pre-assessment of students to determine where instruction should begin [learner analysis]
- Emphasis on mastering early steps before progressing to more complex levels of performance [sequencing of instructional presentation, mastery learning]
- Use of reinforcement to impact performance [tangible rewards, informative feedback]

- Use of cues, shaping and practice to ensure a strong stimulus-response association [simple to complex sequencing of practice, use of prompts]

How should instruction be structured?

The goal of instruction for the behaviorist is to elicit the desired response from the learner who is presented with a target stimulus. To accomplish this, the learner must know how to execute the proper response, as well as the conditions under which that response should be made. Therefore, instruction is structured around the presentation of the target stimulus and the provision of opportunities for the learner to practice making the proper response. To facilitate the linking of stimulus-response pairs, instruction frequently uses cues (to initially prompt the delivery of the response) and reinforcement (to strengthen correct responding in the presence of the target stimulus).

Behavioral theories imply that the job of the teacher/designer is to (1) determine which cues can elicit the desired responses; (2) arrange practice situations in which prompts are paired with the target stimuli that initially have no eliciting power but which will be expected to elicit the responses in the "natural" (performance) setting; and (3) arrange environmental conditions so that students can make the correct responses in the presence of those target stimuli and receive reinforcement for those responses (Gropper, 1987).

For example, a newly-hired manager of human resources may be expected to organize a meeting agenda according to the company's specific format. The target stimulus (the verbal command "to format a meeting agenda") does not initially elicit the correct response nor does the new manager have the capability to make the correct response. However, with the repeated presentation of cues (e.g., completed templates of past agendas, blank templates arranged in standard format) paired with the verbal command stimulus, the manager begins to make the appropriate responses. Although the initial responses may not be in the final proper form, repeated practice and reinforcement shape the response until it is correctly executed. Finally, learning is demonstrated when, upon the command to format a meeting agenda, the manager reliably organizes the agenda according to company standards and does so without the use of previous examples or models.

Cognitivism

In the late 1950s, learning theory began to make a shift away from the use of behavioral models to an approach that relied on learning theories and models from the cognitive sciences. Psychologists and educators began to de-emphasize a concern with overt, observable behavior and stressed instead more complex cognitive processes such as thinking, problem solving, language, concept formation and information processing

(Snelbecker, 1983). Within the past decade, a number of authors in the field of instructional design have openly and consciously rejected many of ID's traditional behavioristic assumptions in favor of a new set of psychological assumptions about learning drawn from the cognitive sciences. Whether viewed as an open revolution or simply a gradual evolutionary process, there seems to be the general acknowledgment that cognitive theory has moved to the forefront of current learning theories (Bednar et al., 1991). This shift from a behavioral orientation (where the emphasis is on promoting a student's overt performance by the manipulation of stimulus material) to a cognitive orientation (where the emphasis is on promoting mental processing) has created a similar shift from procedures for manipulating the materials to be presented by an instructional system to procedures for directing student processing and interaction with the instructional design system (Merrill, Kowalis, & Wilson, 1981).

Cognitive theories stress the acquisition of knowledge and internal mental structures . . . [they] focus on the conceptualization of students′ learning processes and address the issues of how information is received, organized, stored, and retrieved by the mind.

How does learning occur?

Cognitive theories stress the acquisition of knowledge and internal mental structures and, as such, are closer to the rationalist end of the epistemology continuum (Bower & Hilgard, 1981). Learning is equated with discrete changes between states of knowledge rather than with changes in the probability of response. Cognitive theories focus on the conceptualization of students' learning processes and address the issues of how information is received, organized, stored, and retrieved by the mind. Learning is concerned not so much with what learners *do* but with *what* they know and *how* they come to acquire it (Jonassen, 1991b). Knowledge acquisition is described as a mental activity that entails internal coding and structuring by the learner. The learner is viewed as a very active participant in the learning process.

Which factors influence learning?

Cognitivism, like behaviorism, emphasizes the role that environmental conditions play in facilitating learning. Instructional explanations, demonstrations, illustrative examples and matched non-examples are all considered to be instrumental in guiding student learning. Similarly, emphasis is placed on the role of practice with corrective feedback. Up to this point, little difference can be detected between these two theories. However, the "active" nature of the learner is perceived quite differently. The cognitive approach focuses on the mental activities of the learner that *lead up* to a response and acknowledges the processes of mental planning, goal-setting, and organizational strategies (Shuell, 1986). Cognitive theories contend that environmental "cues" and instructional components alone cannot account for all the learning that results from an instructional situation. Additional key elements include the way that learners attend to, code, transform, rehearse, store and retrieve information. Learners' thoughts, beliefs, attitudes, and values are also considered to be influential in the learning process (Winne, 1985). The real focus of the cognitive approach is on *changing the learner by encouraging him/her to use appropriate learning strategies.*

What is the role of memory?

As indicated above, memory is given a prominent role in the learning process. Learning results when information is stored in memory in an organized, meaningful manner. Teachers/designers are responsible for assisting learners in organizing that information in some optimal way. Designers use techniques such as advance organizers, analogies, hierarchical relationships, and matrices to help learners relate new information to prior knowledge. Forgetting is the inability to retrieve information from memory because of interference, memory loss, or missing or inadequate cues needed to access information.

How does transfer occur?

According to cognitive theories, transfer is a function of how information is stored in memory (Schunk, 1991). When a learner understands how to apply knowledge in different contexts, then transfer has occurred. Understanding is seen as being composed of a knowledge base in the form of rules, concepts, and discriminations (Duffy & Jonassen, 1991). Prior knowledge is used to establish boundary constraints for identifying the similarities and differences of novel information. Not only must the knowledge itself be stored in memory but the uses of that knowledge as well. Specific instructional or real-world events will trigger particular responses, but the learner must believe that the knowledge is useful in a given situation before he or she will activate it.

What types of learning are best explained by this position?

Because of the emphasis on mental structures, cognitive theories are usually considered more appropriate for explaining complex forms of learning (reasoning, problem-solving, information-processing) than are those of a more behavioral perspective (Schunk, 1991). However, it is important to indicate at this point that the actual goal of instruction for both of these viewpoints is often the same: to communicate or transfer knowledge to the students in the most efficient, effective manner possible (Bednar et al., 1991). Two techniques used by both camps in achieving this effectiveness and efficiency of knowledge transfer are *simplification* and *standardization*. That is, knowledge can be analyzed, decomposed, and simplified into basic building blocks. Knowledge transfer is expedited if irrelevant information is eliminated. For example, trainees attending a workshop on effective management skills would be presented with information that is "sized" and "chunked" in such a way that they can assimilate and/or accommodate the new information as quickly and as easily as possible. Behaviorists would focus on the design of the environment to optimize that transfer, while cognitivists would stress efficient processing strategies.

What basic assumptions/principles of this theory are relevant to instructional design?

Many of the instructional strategies advocated and utilized by cognitivists are also emphasized by behaviorists, yet usually for different reasons. An obvious commonality is the use of feedback. A behaviorist uses feedback (reinforcement) to modify behavior in the desired direction, while cognitivists make use of feedback (knowledge of results) to guide and support accurate mental connections (Thompson, Simonson, & Hargrave, 1992).

Learner and task analyses are also critical to both cognitivists and behaviorists, but once again, for different reasons. Cognitivists look at the learner to determine his/her predisposition to learning, (i.e., How does the learner activate, maintain, and direct his/her learning?) (Thompson et al., 1992). Additionally, cognitivists examine the learner to determine how to design instruction so that it can be readily assimilated (i.e., What are the learner's existing mental structures?). In contrast, the behaviorists look at learners to determine where the lesson should begin (i.e., At what level are they currently performing successfully?) and which reinforcers should be most effective (i.e., What consequences are most desired by the learner?).

Specific assumptions or principles that have direct relevance to instructional design include the following (possible current ID applications are listed in brackets [ ] following the listed principle):

- Emphasis on the active involvement of the learner in the learning process [learner control, metacognitive training (e.g., self-planning, monitoring, and revising techniques)]
- Use of hierarchical analyses to identify and illustrate prerequisite relationships [cognitive task analysis procedures]
- Emphasis on structuring, organizing, and sequencing information to facilitate optimal processing [use of cognitive strategies such as outlining, summaries, synthesizers, advance organizers, etc.]
- Creation of learning environments that allow and encourage students to make connections with previously learned material [recall of prerequisite skills; use of relevant examples, analogies]

How should instruction be structured?

Behavioral theories imply that teachers ought to arrange environmental conditions so that students respond properly to presented stimuli. Cognitive theories emphasize making knowledge meaningful and helping learners organize and relate new information to existing knowledge in memory. Instruction must be based on a student's existing mental structures, or schema, to be effective. It should organize information in such a manner that learners are able to connect new information with existing knowledge in some meaningful way. Analogies and metaphors are examples of this type of cognitive strategy. For example, instructional design textbooks frequently draw an analogy between the familiar architect's profession and the unfamiliar instructional design profession to help the novice learner conceptualize, organize and retain the major duties and functions of an instructional designer (e.g., Reigeluth, 1983). Other cognitive strategies may include the use of framing, outlining, mnemonics, concept mapping, advance organizers, and so forth (West, Farmer, & Wolff, 1991).

Cognitive theories emphasize making knowledge meaningful and helping learners organize and relate new information to existing knowledge in memory.

Such cognitive emphases imply that major tasks of the teacher/designer include (1) understanding that individuals bring various learning experiences to the learning situation which can impact learning outcomes; (2) determining the most effective manner in which to organize and structure new information to tap the learners' previously acquired knowledge, abilities, and experiences; and (3) arranging practice with feedback so that the new information is effectively and efficiently assimilated and/or accommodated within the learners' cognitive structure (Stepich & Newby, 1988).

Consider the following example of a learning situation utilizing a cognitive approach: A manager in the training department of a large corporation had been asked to teach a new intern to complete a cost-benefit analysis for an upcoming development project. In this case, it is assumed that the intern has no previous experience with cost-benefit analysis in a business setting. However, by relating this new task to highly similar procedures with which the intern has had more experience, the manager can facilitate a smooth and efficient assimilation of this new procedure into memory. These familiar procedures may include the process by which the individual allocates his monthly pay check, how (s)he makes a buy/no-buy decision regarding the purchase of a luxury item, or even how one's weekend spending activities might be determined and prioritized. The procedures for such activities may not exactly match those of the cost-benefit analysis, but the similarity between the activities allows for the unfamiliar information to be put within a familiar context. Thus, processing requirements are reduced and the potential effectiveness of recall cues is increased.

Constructivism

The philosophical assumptions underlying both the behavioral and cognitive theories are primarily objectivistic; that is: the world is real, external to the learner. The goal of instruction is to map the structure of the world onto the learner (Jonassen, 1991b). A number of contemporary cognitive theorists have begun to question this basic objectivistic assumption and are starting to adopt a more constructivist approach to learning and understanding: knowledge "is a function of how the individual creates meaning from his or her own experiences" (p. 10). Constructivism is not a totally new approach to learning. Like most other learning theories, constructivism has multiple roots in the philosophical and psychological viewpoints of this century, specifically in the works of Piaget, Bruner, and Goodman (Perkins, 1991). In recent years, however, constructivism has become a "hot" issue as it has begun to receive increased attention in a number of different disciplines, including instructional design (Bednar et al., 1991).

How does learning occur?

Constructivism is a theory that equates learning with creating meaning from experience (Bednar et al., 1991). Even though constructivism is considered to be a branch of cognitivism (both conceive of learning as a mental activity), it distinguishes itself from traditional cognitive theories in a number of ways. Most cognitive psychologists think of the mind as a reference tool to the real world; constructivists believe that the mind filters input from the world to produce its own unique reality (Jonassen, 1991a). As with the rationalists of Plato's time, the mind is believed to be the source of all meaning, yet like the empiricists, individual, direct experiences with the environment are considered critical. Constructivism crosses both categories by emphasizing the interaction between these two variables.

Constructivists do not share with cognitivists and behaviorists the belief that knowledge is mind-independent and can be "mapped" onto a learner. Constructivists do not deny the existence of the real world but contend that what we know of the world stems from our own interpretations of our experiences. Humans *create* meaning as opposed to *acquiring* it. Since there are many possible meanings to glean from any experience, we cannot achieve a predetermined, "correct" meaning. Learners do not transfer knowledge from the external world into their memories; rather they build personal interpretations of the world based on individual experiences and interactions. Thus, the internal representation of knowledge is constantly open to change; there is not an objective reality that learners strive to know. Knowledge emerges in contexts within which it is relevant. Therefore, in order to understand the learning which has taken place within an individual, the actual experience must be examined (Bednar et al., 1991).

Which factors influence learning?

Both learner and environmental factors are critical to the constructivist, as it is the specific *interaction* between these two variables that creates knowledge. Constructivists argue that behavior is situationally determined (Jonassen, 1991a). Just as the learning of new vocabulary words is enhanced by exposure and subsequent interaction with those words in context (as opposed to learning their meanings from a dictionary), likewise it is essential that content knowledge be embedded in the situation in which it is used. Brown, Collins, and Duguid (1989) suggest that situations actually co-produce knowledge (along with cognition) through activity. Every action is viewed as "an interpretation of the *current* situation based on an entire history of *previous* interactions" (Clancey, 1986). Just as shades of meanings of given words are constantly changing a learner's "current" understanding of a word, so too will concepts continually evolve with each new use. For this reason, it is critical that learning occur in realistic settings and that the selected learning tasks be relevant to the students' lived experiences.

What is the role of memory?

The goal of instruction is not to ensure that individuals know particular facts but rather that they elaborate on and interpret information. "Understanding is developed through continued, situated use . . . and does not crystallize into a categorical definition" that can be called up from memory (Brown et al., 1989, p. 33). As mentioned earlier, a concept will continue to evolve with each new use as new situations, negotiations, and activities recast it in a different, more densely textured form. Therefore, "memory" is always under construction as a cumulative history of interactions. Representations of experiences are not formalized or structured into a single piece of declarative knowledge and then stored in the head. The emphasis is not on retrieving *intact* knowledge structures, but on providing learners with the means to create novel and situation-specific understandings by "assembling" prior knowledge from diverse sources appropriate to the problem at hand. For example, the knowledge of "design" activities has to be used by a practitioner in too many different ways for them all to be anticipated in advance. Constructivists emphasize the flexible use of preexisting knowledge rather than the recall of prepackaged schemas (Spiro, Feltovich, Jacobson, & Coulson, 1991). Mental representations developed through task-engagement are likely to increase the efficiency with which subsequent tasks are performed to the extent that parts of the environment remain the same: "Recurring features of the environment may thus afford recurring sequences of actions" (Brown et al., p. 37). Memory is not a context-independent process.

Clearly the focus of constructivism is on creating cognitive tools which reflect the wisdom of the culture in which they are used as well as the insights and experiences of individuals. There is no need for the mere acquisition of fixed, abstract, self-contained concepts or details. To be successful, meaningful, and lasting, learning must include all three of these crucial factors: activity (practice), concept (knowledge), and culture (context) (Brown et al., 1989).

How does transfer occur?

The constructivist position assumes that transfer can be facilitated by involvement in authentic tasks anchored in meaningful contexts. Since understanding is "indexed" by experience (just as word meanings are tied to specific instances of use), the authenticity of the experience becomes critical to the individual's ability to use ideas (Brown et al., 1989). An essential concept in the constructivist view is that learning always takes place in a context and that the context forms an inexorable link with the knowledge embedded in it (Bednar et al., 1991). Therefore, the goal of instruction is to accurately portray tasks, not to define the structure of learning required to achieve a task. If learning is decontextualized, there is little hope for transfer to occur. One does not learn to use a set of tools simply by following a list of rules. Appropriate and effective use comes from engaging the learner in the actual use of the tools in real-world situations. Thus, the ultimate measure of learning is based on how effective the learner's knowledge structure is in facilitating thinking and performing in the system in which those tools are used.

Although the emphasis on performance and instruction has proven effective in teaching basic skills in relatively structured knowledge domains, much of what needs to be learned involves advanced knowledge in ill-structured domains.

What types of learning are best explained by this position?

The constructivist view does not accept the assumption that types of learning can be identified independent of the content and the context of learning (Bednar et al., 1991). Constructivists believe that it is impossible to isolate units of information or divide up knowledge domains according to a hierarchical analysis of relationships. Although the emphasis on performance and instruction has proven effective in teaching basic skills in relatively structured knowledge domains, much of what needs to be learned involves advanced knowledge in ill-structured domains. Jonassen (1991a) has described three stages of knowledge acquisition (introductory, advanced, and expert) and argues that constructive learning environments are most effective for the stage of advanced knowledge acquisition, where initial misconceptions and biases acquired during the introductory stage can be discovered, negotiated, and if necessary, modified and/or removed. Jonassen agrees that introductory knowledge acquisition is better supported by more objectivistic approaches (behavioral and/or cognitive) but suggests a transition to constructivistic approaches as learners acquire more knowledge which provides them with the conceptual power needed to deal with complex and ill-structured problems.

What basic assumptions/principles of this theory are relevant to instructional design?

The constructivist designer specifies instructional methods and strategies that will assist learners in actively exploring complex topics/environments and that will move them into thinking in a given content area as an expert user of that domain might think. Knowledge is not abstract but is linked to the context under study and to the experiences that the participants bring to the context. As such, learners are encouraged to construct their own understandings and then to validate, through social negotiation, these

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new perspectives. Content is not pre-specified; information from many sources is essential. For example, a typical constructivist's goal would not be to teach novice ID students straight facts about instructional design, but to prepare students to use ID facts as an instructional designer might use them. As such, performance objectives are not related so much to the content as they are to the *processes* of construction.

Some of the specific strategies utilized by constructivists include situating tasks in real world contexts, use of cognitive apprenticeships (modeling and coaching a student toward expert performance), presentation of multiple perspectives (collaborative learning to develop and share alternative views), social negotiation (debate, discussion, evidence-giving), use of examples as real "slices of life," reflective awareness, and providing considerable guidance on the use of constructive processes.

The following are several specific assumptions or principles from the constructivist position that have direct relevance for the instructional designer (possible ID applications are listed in brackets [ ] following the listed principle):

- An emphasis on the identification of the *context* in which the skills will be learned and subsequently applied [anchoring learning in meaningful contexts].
- An emphasis on learner control and the capability of the learner to manipulate information [actively using what is learned].
- The need for information to be presented in a variety of different ways [revisiting content at different times, in rearranged contexts, for different purposes, and from different conceptual perspectives].
- Supporting the use of problem solving skills that allow learners to go "beyond the information given" [developing pattern-recognition skills, presenting alternative ways of representing problems].
- Assessment focused on transfer of knowledge and skills [presenting new problems and situations that differ from the conditions of the initial instruction].

How should instruction be structured?

As one moves along the behaviorist—cognitivist—constructivist continuum, the focus of instruction shifts from teaching to learning, from the passive transfer of facts and routines to the active application of ideas to problems. Both cognitivists and constructivists view the learner as being actively involved in the learning process, yet the constructivists look at the learner as more than just an active processor of information; the learner elaborates upon and interprets the given information (Duffy & Jonassen, 1991). Meaning is created by the learner: learning objectives are not pre-specified nor is instruction predesigned. "The role of instruction in the constructivist view is to show students how to construct knowledge, to promote collaboration with others to show the multiple perspectives that can be brought to bear on a particular problem, and to arrive at self-chosen positions to which they can commit themselves, while realizing the basis of other views with which they may disagree" (Cunningham, 1991, p. 14).

Even though the emphasis is on *learner* construction, the instructional designer/teacher's role is still critical (Reigeluth, 1989). Here the tasks of the designer are two-fold: (1) to instruct the student on how to construct meaning, as well as how to effectively monitor, evaluate, and update those constructions; and (2) to align and design experiences for the learner so that authentic, relevant contexts can be experienced.

Although constructivist approaches are used quite frequently in the preparation of lawyers, doctors, architects, and businessmen through the use of apprenticeships and on-the-job training, they are typically not applied in the educational arena (Resnick, 1987). If they were, however, a student placed in the hands of a constructivist would likely be immersed in an "apprenticeship" experience. For example, a novice instructional design student who desires to learn about needs assessment would be placed in a situation that requires such an assessment to be completed. Through the modeling and coaching of experts involved in authentic cases, the novice designer would experience the process embedded in the true context of an actual problem situation. Over time, several additional situations would be experienced by the student, all requiring similar needs assessment abilities. Each experience would serve to build on and adapt that which has been previously experienced and constructed. As the student gained more confidence and experience, (s)he would move into a collaborative phase of learning where discussion becomes crucial. By talking with others (peers, advanced students, professors, and designers), students become better able to articulate their own understandings of the needs assessment process. As they uncover their naive theories, they begin to see such activities in a new light, which guides them towards conceptual reframing (learning). Students gain familiarity with analysis and action in complex situations and consequently begin to expand their horizons. They encounter relevant books, attend conferences and seminars, discuss issues with other students, and use their knowledge to interpret numerous situations around them (not only related to specific design issues). Not only have the learners been involved in different types of learning as they moved from being novices to "budding experts," but the nature of the learning process has changed as well.

General Discussion

It is apparent that students exposed to the three instructional approaches described in the examples above would gain different competencies.

This leads instructors/designers to ask two significant questions: Is there a single "best" approach and is one approach more efficient than the others? Given that learning is a complex, drawn out process that seems to be strongly influenced by one's prior knowledge, perhaps the best answer to these questions is "it depends." Because learning is influenced by many factors from many sources, the learning process itself is constantly changing, both in nature and diversity, as it progresses (Shuell, 1990). What might be most effective for novice learners encountering a complex body of knowledge for the first time, would not be effective, efficient or stimulating for a learner who is more familiar with the content. Typically, one does not teach facts the same way that concepts or problem-solving are taught; likewise, one teaches differently depending on the proficiency level of the learners involved. Both the instructional strategies employed and the content addressed (in both depth and breadth) would vary based on the level of the learners.

What might be most effective for novice learners encountering a complex body of knowledge for the first time, would not be effective, efficient or stimulating for a learner who is more familiar with the content.

So how does a designer facilitate a proper match between learner, content, and strategies? Consider, first of all, how learners' knowledge changes as they become more familiar with a given content. As people acquire more experience with a given content, they progress along a low-to-high knowledge continuum from 1) being able to recognize and apply the standard rules, facts, and operations of a profession (knowing what), to 2) thinking like a professional to extrapolate from these general rules to particular, problematic cases (knowing how), to 3) developing and testing new forms of understanding and actions when familiar categories and ways of thinking fail (reflection-in-action) (Schon, 1987). In a sense, the points along this continuum mirror the points of the learning theory continuum described earlier. Depending on where the learners "sit" on the continuum in terms of the development of their professional knowledge (knowing what vs. knowing how vs. reflection-in-action), the most appropriate instructional approach for advancing the learners' knowledge at that particular level would be the one advocated by the theory that corresponds to that point on the continuum. That is, a behavioral approach can effectively facilitate mastery of the content of a profession (knowing what); cognitive strategies are useful in teaching problem-solving tactics where defined facts and rules are applied in unfamiliar situations (knowing how); and constructivist strategies are especially suited to dealing with ill-defined problems through reflection-in-action.

A second consideration depends upon the requirements of the task to be learned. Based on the level of cognitive processing required, strategies from different theoretical perspectives may be needed. For example, tasks requiring a low degree of processing (e.g., basic paired associations, discriminations, rote memorization) seem to be facilitated by strategies most frequently associated with a behavioral outlook (e.g., stimulus-response, contiguity of feedback/reinforcement). Tasks requiring an increased level of processing (e.g., classifications, rule or procedural executions) are primarily associated with strategies having a stronger cognitive emphasis (e.g., schematic organization, analogical reasoning, algorithmic problem solving). Tasks demanding high levels of processing (e.g., heuristic problem solving, personal selection and monitoring of cognitive strategies) are frequently best learned with strategies advanced by the constructivist perspective (e.g., situated learning, cognitive apprenticeships, social negotiation).

We believe that the critical question instructional designers must ask is not "Which is the best theory?" but "Which theory is the most effective in fostering mastery of specific tasks by specific learners?" Prior to strategy(ies) selection, consideration must be made of *both* the learners and the task. An attempt is made in Figure 1 to depict these two continua (learners' level of knowledge and cognitive processing demands) and to illustrate the degree to which strategies offered by each of the theoretical perspectives appear applicable. The figure is useful in demonstrating: (a) that the strategies promoted by the different perspectives overlap in certain instances (i.e., one strategy may be relevant for each of the different perspectives, given the proper amount of prior knowledge and the corresponding amount of cognitive processing), and (b) that strategies are concentrated along *different* points of the continua due to the unique focus of each of the learning theories. This means that when integrating any strategies into the instructional design process, the nature of the learning task (i.e., the level of cognitive processing required) and the proficiency level of the learners involved must both be considered before selecting one approach over another. Depending on the demands of the task and where the learners are in terms of the content to be delivered/discovered, different strategies based on different theories appear to be necessary. Powerful frameworks for instruction have been developed by designers inspired by each of these perspectives. In fact, successful instructional practices have features that are supported by virtually all three perspectives (e.g., active participation and interaction, practice and feedback).

The critical question instructional designers must ask is not "Which is the best theory?" but "Which theory is the most effective in fostering mastery of specific tasks by specific learners?"

For this reason, we have consciously chosen not to advocate one theory over the others, but to stress instead the usefulness of being well-versed in each. This is not to suggest that one should work without a theory, but rather that one must be able to intelligently choose, on the basis of information gathered about the learners' present level of competence and the type of learning task, the appropriate methods for achieving optimal instructional outcomes in that situation.

As stated by Smith and Ragan (1993, p. viii): "Reasoned and validated theoretical eclecticism has been a key strength of our field because no single theoretical base provides complete prescriptive principles for the entire design process." Some of the most crucial design tasks involve being able to decide which strategy to use, for what content, for which

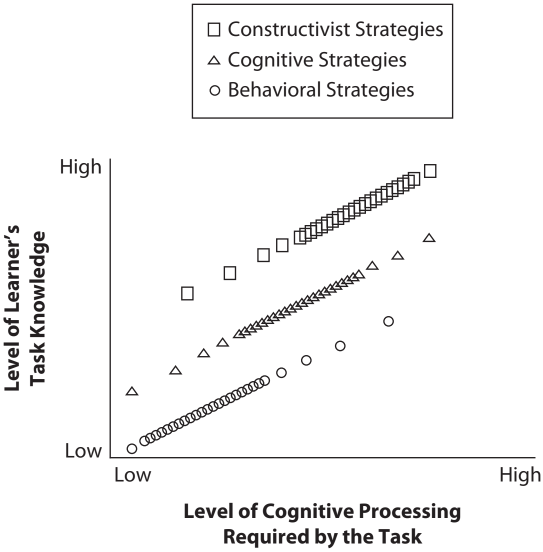

FIGURE 1. COMPARISON OF THE ASSOCIATED INSTRUCTIONAL STRATEGIES OF THE BEHAVIORAL, COGNITIVE, AND CONSTRUCTIVIST VIEWPOINTS BASED ON THE LEARNER'S LEVEL OF TASK KNOWLEDGE AND THE LEVEL OF COGNITIVE PROCESSING REQUIRED BY THE TASK

students, and at what point during the instruction. Knowledge of this sort is an example of conditional knowledge, where "thinking like" a designer becomes a necessary competency. It should be noted however, that to be an eclectic, one must know a lot, not a little, about the theories being combined. A thorough understanding of the learning theories presented above seems to be essential for professional designers who must constantly make decisions for which no design model provides precise rules. Being knowledgeable about each of these theories provides designers with the flexibility needed to be spontaneous and creative when a first attempt doesn't work or when they find themselves limited by time, budget, and/or personnel constraints. The practitioner cannot afford to ignore any theories that might provide practical implications. Given the myriad of potential design situations, the designer's "best" approach may not ever be identical to any previous approach, but will truly "depend upon the context." This type of instructional "cherry-picking" has been termed "systematic eclecticism" and has had a great deal of support in the instructional design literature (Snelbecker, 1989).

In closing, we would like to expand on a quote by P. B. Drucker, (cited in Snelbecker, 1983): "These old controversies have been phonies all along. We *need* the behaviorist's triad of practice/reinforcement/feedback to enlarge learning and memory. We *need* purpose, decision, values, understanding—the cognitive categories—lest learning be mere behavioral activities rather than action" (p. 203).

And to this we would add that we also *need* **adaptive** learners who are able to function well when optimal conditions do not exist, when situations are unpredictable and task demands change, when the problems are messy and ill-formed and the solutions depend on inventiveness, improvisation, discussion, and social negotiation.

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Article Update: Behaviorism, Cognitivism, and Constructivism: Connecting "Yesterday's" Theories to Today's Contexts

Peggy A. Ertmer, PhD, and Timothy J. Newby, PhD

It has been 20 years since "Behaviorism, Cognitivism, Constructivism: Comparing Critical Features From an Instructional Design Perspective" was first published in *Performance Improvement Quarterly* (Vol. 6, Issue 4). Although the bases of the theoretical perspectives presented in "the theory article" have not changed (that is, the answers to the seven organizing questions remain largely the same), much of the world outside of these theories, including where and with whom we learn, as well as how that knowledge is stored and accessed, has changed. In this brief update, we explore three major forces affecting the learning process today, all of which were much less prevalent in 1993. These include (1) the proliferation of the Internet, including the use of Web 2.0 tools; (2) the emergence of a new "kind" of student (for example, the digital native) who thinks and learns differently than previous generations; and (3) the adoption of a variety of new teaching methods, which build, almost exclusively, on the tenets of constructivism. We discuss each of these in more detail.

Changes in Technology

Since the theory article was written, *access to technology tools* has literally exploded. In 1993, the Internet, particularly as a resource for the masses, was still in its infancy, and the distinction between Web 1.0 and Web 2.0 had not yet been made (O'Reilly, 2005). Distance education was achieved primarily through correspondence courses, with video and audio conferencing being used to augment the delivery of instruction (Simonson, Smaldino, Albright, & Zvacek, 2006). Relatively few people owned a cell phone, and smart phones had not yet been invented. According to Sharples, Taylor, and Vavoula (2005), learning was primarily conceptualized as the construction of knowledge through information processing, modeling, and interaction.

However, as the Internet has become more accessible and the creation of content more distributed, the "participatory web" has enabled a knowledge-building and knowledge-sharing system whose value now stems from many small contributions. As described by O'Reilly (2005), "Every user whitewashes a little bit of the fence" (online). Compared to Web 1.0, users now have many and varied opportunities to affect both the nature and scope of the content being published and, in some cases, exert real-time control over it. As a consequence, informal learning has become a significant component of our daily learning experiences (Siemens, 2004). Furthermore, we no longer expect or require knowledge to reside within the individual. Rather, as Siemens (2004) described, we "store our knowledge in our friends" (Section 4).

Not only do today's students *want* and *prefer* to learn differently, they seem exceptionally capable of doing so.

This prompts us to consider whether this easy access to, and constant interaction with, others has actually transformed the learning process. According to at least one set of authors, this is indeed the case, noting that learning is now being reconceptualized as a "continual conversation with the external world and its artefacts [*sic*], with oneself, and also with other learners and teachers" (Sharples et al., 2005, p. 7). Siemens (2004) agreed, stating, "The ability to access people and information has changed the way people learn. . . . Know-how and know-what is being supplemented with know-where (the understanding of where to find knowledge needed)" (Section 4). According to Brown (2002), the web has functioned as a transformative technology, comprising not only an informational and social resource, but a learning medium as well, where learning with and from each other is both supported and facilitated.

Changes in Learners

Related to these changes in technology access and tools are changes attributed to the *learners* themselves. According to Prensky (2010), "More and more young people are now deeply and permanently technologically enhanced, connected to their peers and the world in ways no generation has ever been before" (p. 2). Not only do today's students *want* and *prefer* to learn differently, they seem exceptionally capable of doing so. Siemens (2004) suggested that technology has actually rewired learners' brains. Although we do not yet have physical proof that the brains of digital natives are structurally different than those of digital immigrants, evidence is accumulating that signifies very real differences in their thinking patterns (Barone, 2003; Brown, 2002). According to Winn (cited in Prensky, 2001), "Children raised with the computer think differently from the rest of us. They develop hypertext minds. They leap around. It's as though their cognitive structures were parallel, not sequential" (p. 3).

Siemens (2004) argues that these changes have occurred *because* of the tools students use. This idea is supported by research from social psychologists (cf. Nisbett, Peng, Choi, & Norenzayan, 2001), which suggests that thinking patterns change depending on our experiences, including the culture in which we grew up. Given that digital natives have grown up "accustomed to the twitch-speed, multitasking, random-access, graphics-first, active, connected, fun, fantasy, quick-payoff world of their video games, MTV, and the Internet" (Prensky, 2001, p. 5), the suggestion that these experiences have changed learners' thinking patterns does not require a huge leap.

According to Barone (2003), today's students possess an "information-age mindset" (p. 42) that comprises a unique ability to learn both visually and socially. As such, digital students prefer to learn by doing—if given a new tool to use, they are much more likely to get in and "muck around" than refer to an owner's manual (Prensky, 2010). In fact, for these learners, doing is more important than knowing, as this enables the development of a deeper and more authentic understanding of the task at hand. Then, when it is important to test and process their new knowledge, digital natives turn to their own learning communities, which oftentimes remain relatively disconnected from their formal educational communities. Given these new approaches to learning, Sharples and colleagues (2005) propose that *conversation* (including words, images, videos, multimedia, and more) has become the current driver of learning.

Changes in Teaching Methods

In 1993, constructivism was the new kid on the block; as such, there were very few, if any, *teaching methods* that aligned with this perspective. Currently, however, constructivism is considered the dominant educational theory; it has been embraced by nearly every educational reform initiative within the last two decades (Karagiorgi & Symeou, 2005). As a result, various constructivist theories, such as social constructivism, situated learning, and connectivism (Sharples et al., 2005), have become the foundation for the majority of teaching methods that have taken hold in recent years (for example, problem-based learning, authentic instruction, computer-supported collaborative learning).

In addition to the general acceptance of constructivism as the basis for our teaching methods, the conceptualization of learning as both a personal and social process (Sharples et al., 2005) has been enhanced by the convergence of three critical changes: (1) the development of technologies that allow for immediate and effective access to information; (2) the motivation of learners who desire and need learning experiences that promote high levels of interaction and activity; and (3) the demands of employers who now expect learners to acquire relevant 21st-century skills (for example, critical thinking, problem solving, creativity) before entering the workforce (Kay, 2010). In response to these changes, interest has increased in the theoretical perspectives (for example, connectivism, mobile learning, social constructivism) that align with those teaching methods that can develop these required skills in ways that meet the needs of today's learners.

Problem solving, for example, is a key 21st-century skill (Barell, 2010). Traditionally, problem-solving teaching methods focused on delineating the steps of the problem-solving process and subsequently allowing students to apply those steps to problems of varying difficulty (Polya, 1945). In contrast, more constructivist teaching methods, such as case- or problem-based learning, are designed to actually engage students in relevant, real-world problems (Barrows, 1986). In these methods, students are presented with authentic problem situations and then challenged to propose relevant solutions (Mayer, 2009). Furthermore, given the advancements in technology tools, students now enjoy increased access to (1) relevant case/problem background information; (2) additional cases or case repositories that may uncover partial or full solutions; and (3) individuals, including case/problem experts who can provide scaffolding, feedback, and other support for formulating solutions. As such, teaching methods such as case-based instruction, coupled with advanced technology tools, now can facilitate novices' access to the knowledge, skill, and mentoring of experts, which has the potential to advance students' levels of problem-solving expertise in more effective and efficient ways than was previously possible (Chase & Simon, 1973; Schoenfeld & Herrmann, 1982).

Today, with the use of available technologies, individuals from geographically diverse locations can form communities of learners to develop multidisciplinary solutions to important problems.

A second, related 21st-century skill is the ability to work collaboratively (Kay, 2010). While traditional school learning environments have typically promoted *independent* learning strategies, today's complex problems necessitate that people work in teams in environments that enable the free exchange of ideas, distribution of workload, and comparisons among different solution paths. Today, with the use of available technologies, individuals from geographically diverse locations can form communities of learners to develop multidisciplinary solutions to important problems. Teaching methods that incorporate the use of communities of practice have been very effective (Brown, 1992) and are closely tied to learning theories such as situated cognition (Bereiter, 1997) and constructivism. However, the concept of these communities has evolved considerably as technology has overcome the restrictions of both place and time. Through these types of cross-cultural collaborations, we all now have the opportunity to learn how to effectively communicate and interact with others from increasingly diverse backgrounds.

As demonstrated by Schwartz, Lin, Brophy, and Bransford (1999), the ability to "go public" has helped students learn from each other, learn how to view the different ways that ideas can be expressed, and learn and experience the motivational value such publication produces. With tools such as YouTube, blogs, wikis, and social networks, the ability to communicate with others and to express one's creativity has many outlets. Richardson (2010) reported that more than 80% of high school students have engaged in online publishing. Although Facebook is not a teaching method, aspects of this technology can be utilized to facilitate collaboration among peers and interested others as original artifacts (ideas, products, stories, and the like) are created, posted, and reviewed by others.

Implications and Conclusions

As noted above, there have been tremendous changes over the last 20 years that have affected the learning process—tools have changed, learners have changed, and, as a consequence, teaching methods have also changed. Yet, despite these tremendous changes, the underlying principles of our "old" theories still remain relevant. People still learn through stimulus–response associations (for example, game-based learning) and through practice and feedback opportunities (for example, computer simulations), as well as through the processes of collaboration and social negotiation (for example, collaborative wiki writing). And although learning contexts have changed (from fixed, formal settings to mobile, informal ones), as have the tools used to facilitate knowledge construction (from individual, analog tools to social, digital ones), understanding is very likely still being constructed in ways similar to the past, only with increasing opportunities to construct that knowledge 24/7.

Similarly, the role of designers remains that of understanding the strengths and weaknesses of each learning theory in order to optimally select and implement strategies that support student learning in a variety of contexts. Whether learners are learning in-transit or storing their knowledge in their friends, learning needs still emerge (as they have always) "when a person strives to overcome a problem . . . in everyday activity" (Vavoula, cited in Sharples et al., 2005, p. 5).

What *has* changed, however, is the *type* of learning experiences educators and instructional designers need to create in order to ensure that our learning designs take advantage of the affordances of current tools to engage learners in ways that best meet their needs. Quite simply, learning designs for today's students must be highly contextualized, personal, and collaborative (Herrington & Herrington, 2007). Designers must acknowledge and embrace these changes so that they remain not only relevant, but respected *partners* (Barone, 2003) in the ID work required to meet the expectations and needs of today's learners. As noted by Herrington and Herrington, ". . . it is the confluence of the advances in theory and the affordances of technology that create excellent opportunities for teachers [and designers]" (2007, p. 1).

We would be remiss if we did not take advantage of these opportunities. Indeed, our students will expect—no, they will *demand* it.

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