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Half of the mandate for New Directions for Teaching and Learning *is to monitor developments in learning theory and research. This chapter discusses the changes in learning and motivation theory that have influenced the field since the beginning of the series.*

New Directions in Learning and Motivation

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At the time of the inaugural issue of *New Directions for Teaching and Learning* in 1980, psychological research and theory in the area of learning and motivation were about to undergo a sea change, one that would have important implications for the design of instruction. The shift was from a behavioral perspective on learning to a cognitive perspective and its successors in constructivist and personal responsibility models of learning. The purpose of this chapter is to discuss each of these models in turn and the instructional paradigms that were based on them. We have not abandoned earlier instructional methods as new theories have come along, but we have realigned some of our interpretations of what is going on when learning takes place.

The Behaviorist Model

In the 1960s and early 1970s, the behaviorist model had become the dominant model in psychology (Greeno, Collins, and Resnick, 1996). According to that model, learning was the development of associations between stimuli and responses or stimuli and other stimuli through the act of pairing and the delivery of contingencies based on responses. Behaviorism was a very important movement for psychology at the time, even though it had rejected much of the work that had gone before it as unscientific. The reasoning was that in order for psychology to be a science, it had to focus on repeatable, verifiable, observable events that everyone could agree had taken place. There was no advantage to resorting to nonobservable mediating events like thinking because environmental consequences were capable of explaining even very complex chains of behavior (Skinner, 1953).

Though the model may seem a bit drastic in retrospect, it was an important step in psychology's attempt to be accepted as a science. Adopting the scientific criteria of observation and replication meant that psychology was trying to move away from speculative and mysterious causes of behavior into a more positivist approach that identified verifiable cause-and-effect relationships.

Instructional Implications. During its tenure as the dominant theory, behaviorism provided a lot of good information and ideas about the causes of learning. The purpose of instruction under behavioral models was to increase the frequency of correct responses and minimize errors. Learners were fairly passive participants in the whole process. They merely responded and experienced the consequences of the response. Positive consequences increased the response's probability; negative consequences decreased it. The instructor organized the learning environment to ensure that correct responses were likely to occur, and when they did, they were rewarded. Incorrect responses were either punished or ignored and as a result lost strength.

Perhaps the most prominent and long-lasting instructional method that came from the behaviorist tradition was self-paced instruction. A typical self-paced instruction course has the following components that derive from behaviorist traditions:

The outcome is specified in clear, observable terms known as behavioral objectives. Still in use today in the somewhat modified form of instructional objectives, the goal of behavioral objectives was to identify the actual behavior that the learner would be able to display at the end of instruction, the conditions under which it would be displayed, and the criteria that would determine acceptable performance. This was clearly an outgrowth of the behaviorists' desire for reliable measures of behavior that could be observed objectively. The existence of such objectives went a long way toward persuading educators to be clearer in their goals and outcome measures, a noble goal regardless of one's theoretical background. (For more details on objectives, see Mager, 1962.)

The target behaviors were divided into small, easy-to-achieve steps presented in a logical sequence that would build toward the final complete behavior. Such a careful sequencing of behavior components required that the final task be analyzed into its components and each component taught to mastery before going on to the higher-level components, another useful concept.

The mastery criterion for moving on was an important part of self-paced instruction and its counterpart, mastery learning. Mastery learning itself was shown to be the form of group learning that came closest to the results of individual tutoring (Bloom, 1984).

From this practice came the idea of criterion-referenced evaluation of learning. Rather than compare students with one another to determine progress, students were measured against their own progress toward specified criteria.

Students receive immediate feedback on the correctness of their response. A critical component of behavior theory was the contingent and proximal relationship between the learner's response and its consequences. In some self-paced methods, such as programmed texts, the learning materials themselves were designed to provide immediate feedback to the learner.

Although behavior theory itself might be out of vogue, self-paced instruction and its derivatives live on in several guises. The most obvious is computer-assisted instruction. One of the reasons that programmed instruction texts never quite made it big in education was their tediousness, forcing every student through the same sequence regardless of performance or purpose. Some textbook authors tried to incorporate a form of individualization into the text by using branching, in which one's next step in the book is determined by one's answer to the previous step. This was a much better system from the learner's perspective, but the intricacies of developing such printed materials were viewed with disfavor by publishers.

Enter the computer, which is able to handle branching with ease. In fact, although hypertext was actually derived from a different theory of psychology, the support programs it spawned allowed computer-assisted instruction to pick up where programmed instruction left off and successfully implement self-pacing on a large scale. Successful computer-assisted instruction incorporates virtually all of the values of self-paced instruction along with some new wrinkles that allow the program to be even more tailored to the individual user (Cognitive and Technology Group at Vanderbilt, 1996).

Behavior theory also suggested the concept of hierarchical sequencing of behaviors and the value of teaching components in a particular order. This strategy involved analyzing the components of the final behavior and having the learner master each one in order as a way of achieving the target behavior. Robert Gagné (1965) expanded on this idea with his concept of systematic instructional design based on a hierarchy of behavior types. He also proposed that each different type of learning target would require a different type of instruction. Although Gagné's model does not adhere strictly to a lot of the tenets of behavior theory, it does have a strong behaviorist slant and has been quite influential in educational design.

Today the predominant use of behaviorist recommendations is in the area of class organization and management (Chance, 1999). The specification of course objectives helps both learner and instructor understand the target behaviors or level of understanding being sought in a course. The concept of criterion-referenced grading, basing the grade on the level achieved rather than the comparison with other students, is strongly encouraged as a way of minimizing the detrimental effects of competition and encouraging the beneficial effects of cooperation. The concepts of reinforcement, punishment, and extinction are still very valuable in thinking about ways to encourage and discourage behavior. As a heuristic for making management decisions in class design, behavior theory has served us well.

However, behavior theory has not been as helpful in advising instructors about how to structure the actual teaching material. Aside from the concepts of task analysis and small steps carefully sequenced, behavior theory does not speak directly to the design of instruction. And it ignores the one thing we most equate with learning: thinking. As educators and learners ourselves, we know that the bulk of what is happening in education is the restructuring of thinking and understanding, and about those behavior theory was relatively mute. However, along with the rest of psychology, behavior theory eventually came to the conclusion that much of the behavior we see really was based on internal mediation, that is, thinking. Part of this conversion of behavior theory and the rest of psychology was a result of the next wave of theories, known as cognitive theories (Pressley and McCormick, 1995).

The Cognitive Model

In the 1970s and 1980s, the ideas of cognitive psychology began to resurface in the field. The initial versions of cognitive theory were still fairly mechanistic and continued to revolve around the concept of associations among stimuli, but now the focus was on mental associations, which could only be inferred from external responses made by the learner (Anderson, 1983). Learners were still somewhat at the mercy of environmental input, but at this point, the influence of the learner began to be considered. This influence was primarily a result of the effects of the learner's prior knowledge and existing schemata (concepts) on the storage and organization of new information, so it was not as if the learner was actively directing his or her learning yet. Storage of new information in memory could still theoretically occur without active direction by the learner. In a fairly simplistic way, incoming information could bounce around in the learner's consciousness until it was matched with the same or a similar pattern already stored in memory, at which point the memory pattern was either strengthened or modified to accommodate the new information.

These early cognitive theories focused on learning as a structuring and restructuring of memory. Information coming in from the environment received the learner's attention and as a result entered consciousness (working memory), where it was held briefly until either processed into long-term memory, discarded as unimportant, or displaced by incoming information. These theories, called information processing theories, were most useful in advising teachers how to design instruction that would benefit this form of learning; they were not very useful in classroom or behavior management.

Instructional Implications. The goal of instruction under this paradigm is to organize the presentation of new information so that it can be easily stored in memory. To maximize learning, the instruction needs to focus learner attention on the critical features of information; provide supports for using storage strategies, such as analogies, examples, clear defini-

tions, and well-organized presentations; and incorporate opportunities for learners to respond, on the basis of their understanding of material, in order to determine if it had been correctly stored. One can see that under this system, the learner's preexisting storage system (prior knowledge) would have a strong impact on how new information would be stored. An inaccurate or inefficient filing system in long-term memory would seriously hamper information retrieval, so it was important to get it right the first time or to ferret out misconceptions (inaccurately filed information) (Chi, Slotta, and De Leeuw, 1994; McCloskey, 1983).

Let us look at some of the instructional strategies that derive from early cognitive theory.

Strategies for Directing Student Attention to Key Points. These include highlighting of main ideas in information presentations, either verbally ("the next main idea is . . .") or visually with bold print, underlining, and italics in text material or visual aids in oral material.

Strategies for Emphasizing How Material Is Organized. These include outlines, concept maps, flow diagrams, analogies, advance organizers (given before the information is presented), tables, comparative charts, and verbal cues that signal structure, such as "I have three main points" or "Now let's consider the other side of the argument." It is also useful to have the learners articulate the organization of the material for themselves by drawing their own concept maps, outlines, or analogies.

Strategies for Making Information More Meaningful for the Learner. Because cognitive theory is based on the idea of mental associations and a network structure to long-term memory, it holds that the more associations a learner can make between new and old information, the easier retrieval will be. To facilitate this, the instructor can activate the learners' prior associations by asking the learners to think about what they already know, using examples that are within the ken of the learners and might be part of their personal experiences, asking the learners to supply examples of the concept being learned, giving vivid or richly detailed descriptions of instances of the concept, and giving multiple examples of the concept in a variety of contexts.

A variant on this meaningful learning recommendation is the related issue of understanding the learner's prior knowledge before starting instruction (Alexander, Kulikowich, and Schulze, 1994; Ausubel, Novak, and Hanesian, 1978). As noted earlier, the learner's existing long-term memory structures could either support or hinder new learning. In the first case, the instructor would be able to build on preexisting structures and take advantage of the rich information base the learner already has, if the teacher knows what that is. In the latter case, the instructor could confront misconceptions early in learning so that they don't get in the way.

An interesting sidelight about how this particular aspect of cognitive theory has made its way into instructional practice is the advent of hypertext and hypermedia. This contemporary instructional concept is directly related to the way cognitive theory proposes that long-term memory is structured

(Bakker and Yabu, 1994). We think of long-term memory as a network of associations, some well organized and some unique. This is translated into the network structure of hypertext. Concepts are linked to one another, some in well-organized ways and other in unique ways. Hypermedia was intended to mimic the way we actually think: through associations that are often idiosyncratic, based on our experiences, but logical nevertheless. This connection between computer hypermedia use and cognitive theories of learning has led to a great deal of interesting research and product development. For example, one very common problem in hypermedia environments is the phenomenon of getting lost in the network and being unable to reproduce the thinking that got one there. Theoretically, this could be a result of not having a "big picture" of the overall structure of the content area. Researchers are now suggesting that having access to a concept map of the overall database, known as a site map, with one's current position highlighted (a sort of "you are here" aid) and one's path marked, could keep learners from getting lost in hyperspace (Bakker and Yabu, 1994).

Strategies for Encouraging Active Checking of Understanding. Most of the instructional strategies that encourage active learning derive from the value of retrieving information from long-term storage early enough in learning to monitor how it is being stored and correct any errors before they become too deeply ingrained. These include asking frequent questions during the presentation of material, having students explain their understanding to other students (the think-pair-share model), and using classroom assessment techniques (Angelo and Cross, 1993) like minute papers. From a motivational standpoint, these activities also provide an opportunity for learners to get feedback on their understanding.

Strategies That Recognize the Limitations of the Learning System. One aspect of the cognitive model that has not yet been mentioned is the proposed limited capacity of working memory and the implications for instruction. Although long-term memory is theoretically unlimited and permanent, working memory storage is very temporary. What we are conscious of at the moment is what is present in working memory. Our ability to cope with the immediate demands of the environment is circumscribed; we can attend to only a part of what is going on around us. The now famous "seven plus or minus two bits of information" dictum even quantifies exactly how much (or little) we can remember for a short period of time (Miller, 1956).

There are all kinds of implications of this limited capacity. For example, a continuous stream of new information with no breaks cannot be processed rapidly enough by most learners. Therefore, lecturers need to attend to the density of information they are delivering if they want the learners to do more than simply write down everything they say. Actually stopping talking for a while after giving a very important piece of information is a recommendation. Another way to provide a break without actually stopping is to repeat or rephrase the point just made. No new information is coming in, so the learner is able to digest what is being said more readily.

The same effect can be accomplished by giving examples: no new information, just an elaboration on the existing point.

Another implication of the capacity of working memory is that when multiple demands are being made on the learner, capacity is being divided up among them, thus leaving less for each. We can see this whenever we are going to hand back an exam at the end of class. The students spend the whole class dividing their attention between what we're saying and worrying about the exam. The latter steals capacity away from the former, and there is no way to combat it effectively (Ormrod, 1999). Not even giving back the exams at the beginning of class will do it: in that case, students' attention shifts from worrying about the exam to trying to figure out what they did wrong. This same mechanism is postulated as one of the bases for the effects of test anxiety. Instead of being able to devote their entire working memory capacity to answering test questions, test-anxious students have part of that capacity taken up by worry over how they're doing. Anything that increases that worry will cause more attentional capacity to be occupied unproductively. As a result, programs that treat test anxiety are often focused on helping the learner focus less on worry and more on the test itself.

The Cognitive Model, Phase II: Metacognition

The model just described was extremely useful in making recommendations about the way to structure learning materials and situations to maximize understanding, but it was not totally satisfactory. There were still unexplained results and a feeling of dissatisfaction with the role of the learner (or the lack of a role) in the learning process. Identical instruction provided to two different learners with similar experience and background still couldn't produce the same learning with 100 percent certainty. Something was missing from the equation. That something was the full participation of the learner. Granted that cognitive theory took into account prior knowledge and individual differences in processing capacity, but the learner could still be a fairly passive respondent under the original models. What was missing was active learner involvement at all levels of processing. Thinking of ourselves as passive learners doesn't fit with our personal experiences. We believe that we are in charge and actively directing the course of learning. This belief led to the next phase of cognitive theory, one in which the learner is aware of learning and actively directing it. The process was named *metacognition,* or "thinking about thinking" (Brown, 1978).

Although the learning processes of storage and retrieval are still the same, in metacognition the learner is involved in directing that process. Current theory proposes that we are learning for a purpose, to achieve a goal we have set, and we are aware of that goal, using it throughout the learning process to assess progress. To achieve the goal, we have analyzed the requirements of the task, our skills, and alternative strategies (if we have any) for moving toward the goal. We have selected one alternative for any number of

reasons (some good, some not so good) and implemented it. Now we begin to monitor our comprehension and progress. If we start to go astray, we back up and reassess our strategies for learning. Is a different strategy called for at this point, or is it just a matter of more effort? Through this continuous cycle, we progress toward the goal and eventually achieve it.

As one can see, this is a much more learner-centered, learner-directed interpretation of learning and motivation than either the behaviorist model or the initial cognitivist model.

Instructional Implications. Most of the instructional implications that were true in the original cognitive model remain true under metacognition. The difference is in who is responsible for invoking them. In the original version of cognition, the *instructor* was the director of the process; with metacognition, that responsibility is turned over to the *learner* with support from the instructor. Unfortunately, many, if not most, learners are not particularly metacognitively aware. They have often mastered only one or two strategies for learning, strategies that are fairly applicable but not universal. They may have adopted inappropriate criteria for deciding whether or not they have learned and as a result stop too soon or fail to recognize an inappropriate strategy until they get independent feedback from the outside, usually in the form of a failed exam. In the face of such negative feedback, they don't know what to do or they react in emotionally inappropriate ways that limit their ability to correct their errors. So the advent of the concept of metacognition meant that instructors needed to raise student awareness of themselves as learners and sometimes even teach them how to learn.

Let us examine some instructional strategies that derive from the concept of metacognition.

The instructor should model thinking. Skills are often best taught through a type of apprenticeship. In this case, that apprenticeship revolves around metacognition: it is a *cognitive apprenticeship.* Instructors can demonstrate how they monitor and direct their own learning by thinking aloud while solving problems in front of the class. Following this with a discussion about the kinds of strategies the instructor invoked will give learners a model to copy in their own thinking (Collins, Brown, and Newman, 1989).

Instructional methods should support metacognition. Instructional methods such as writing journals, describing problem solutions in prose as well as mathematical format, and discussing problem-solving strategies in a group context are all ways of encouraging students' metacognitive growth. Metacognition, like any other skill, requires practice opportunities, so an instructor should build these into the regular activities of the class (Collins, Brown, and Newman, 1989).

Sometimes direct teaching of strategies is needed. As noted earlier, some students have limited strategies for problem solving. Especially if they are studying in a content area outside their own field, they may not be aware of what kinds of strategies are possible. Even brief demonstrations of alterna-

tives or written suggestions about strategies to use can alert students to the fact that there is more than one way to solve a problem and teach them new strategies, a method called *supplemental instruction* (Martin and Arendale, 1994). Granted, most students when they are under pressure revert to old strategies, but with additional practice, they may at least come to understand the value of trying different methods (Pressley and others, 1989).

The Cognitive Model, Phase III: Learner-Centered Models

Since the mid-1980s, there has been a subtle shift in learning and motivation theory toward the concept of learner-centeredness, including constructivist theory in epistemology (Fosnot, 1996), self-regulation in learning control (Pintrich, 1995), and self-determination in motivation (Deci, Vallerand, Pelletier, and Ryan, 1991), which mirrors a larger social shift toward personal responsibility. Metacognition was the first wave of theorizing to promote the idea that the learner had to be driving the process of learning. Since then, more and more attention has been paid to active control by the learner and the motivational value of that control. Also known as *strategic learning,* the concept of a learner who sets goals, marshals resources, makes strategic decisions about resource use, and evaluates the entire process in an ongoing manner seems a better fit for our own experiences and those reported in the literature (Weinstein, 1996).

In fact, some theorists have proposed various versions of *constructivism* to emphasize the degree to which learners are constructing their own worldview. These theories lie on a continuum from the simple influence of prior knowledge on the understanding of new information to the idea of knowledge existing only in and drawing on the context of the learning situation, an idea called *distributed cognition* (Bereiter, 1990). Here the basis for understanding by learners involves not just their own prior knowledge and present experience but that of other individuals who are interacting with them in the situation, as well as the situation itself. These are the concepts of social constructivism (Bruner, 1990) and situated cognition (Brown, Collins, and Duguid, 1989), respectively.

Constructivism and social constructivism form some of the foundation for collaborative learning strategies that are gaining popularity (Hertz-Lazarowitz, Kirkus, and Miller, 1991). These theories assert that learning is the process of developing a *construction* of reality in the mind of the learner. Through interactions with the environment and interpretations of those interactions, the learner comes to create a worldview consistent with past experience and present data. Collaboration among learners is a very potent way in which an individual learner forms an interpretation of the environment and develops understanding. Some constructivists believe that this understanding is an accurate reflection of an external reality, while others hold that one cannot really talk about an objective reality because all

understanding is filtered through the perceptions of the learner. Despite these divergent views, constructivism has been the basis of many of the most recent instructional innovations, particularly collaborative learning.

The concept of situated cognition (sometimes called *situative learning* in the literature [Greeno, Collins, and Resnick, 1996]) actually has a long history behind it even though it has only recently been named. In the past, what we now refer to as situated cognition was played out as issues of transfer of learning. In fact, it was the difficulty of getting students to transfer what they had learned in one setting to a new setting that started psychology down the path toward situated cognition. There was quite a lot of controversy about whether there were general rules of thinking and problem solving or only content-specific rules (Perkins and Salomon, 1989). Although the argument is too complex to discuss here, one of the main points was that it might be that some of the cues needed to solve a problem existed only in the context of that problem itself—in other words, the solution was *situated* in the context (Resnick, Levine, and Teasley, 1991). When one attempted to remove the solution from the context and apply it elsewhere, those cues were no longer available, and therefore the solution would no longer work unless one could find analogous cues in the new situation (Greeno, Collins, and Resnick, 1996). Such a proposition obviously has tremendous implications for instruction.

Instructional Implications. With the advent of learner-centered theories of learning and motivation have come some new instructional methods.

Strategic Learning and Self-Regulation. As outlined in the previous discussion, the first of these methods is the idea of strategic learning (Weinstein, 1996) and self-regulation (Pintrich, 1995). Instructors can create opportunities for students to learn and exert self-regulation of their learning by involving the students in setting learning goals, in selecting and implementing learning strategies, and in monitoring their own learning.

Learning in Groups. Even beyond the teaching of learning strategies, today's instructors are encouraged to offer the learner more opportunities to make decisions about what and how to learn, if not individually, then at least as part of a collaborative group. Learners and instructors become partners in a learning community. The most recent instructional innovations in collaborative learning (Brown and Palincsar, 1989) and communities of learners (Brown and Campione, 1994; MacGregor, Cooper, and Smith, in press) have their roots in this shift toward increased individual control over learning, strange as that may seem. This is one justification for collaborative learning structures. In working with others to understand material, the learners have more open access to their own understanding and thinking processes (Johnson and others, 1981). They get more immediate and more personal feedback to assist in the monitoring process. And they have more of a sense of personal control and ownership of the material and thus more motivation

(Deci, Vallerand, Pelletier, and Ryan, 1991). They are also motivated by participating in a community of practice (Lave and Wegner, 1991).

Authentic Problem Solving. Instruction should be based on authentic problem-solving tasks. From the standpoint of situated cognition and improving the potential for transfer of learning, several new instructional methods have been developed. All depend on creating learning environments that are as close to the real environment of practice as possible. By reproducing or involving the learner in "legitimate peripheral participation" (Lave and Wegner, 1991) in the actual functions of the discipline, the instruction provides both the situational cues for responding and the motivation for putting forth the effort.

The methods that are still classroom-based, which simulate the problem-solving process of field professionals, are quite diverse in implementation but common in purpose and process. For example, problem-based learning (Wilkerson and Gijselaers, 1996) and discovery learning (Bruner, 1991) both require learners to solve problems that are similar in nature and complexity to the real thing. For problem-based learning, this might be a medical problem; for discovery learning, it might be a natural phenomenon to investigate. In some cases, such as in anchored instruction (Cognition and Technology Group at Vanderbilt, 1990), the problems are lengthy and multifaceted and involve numerous domains of skills and knowledge for solution. In the terms of the theorists, the instruction is *anchored* in a very complex and realistic task. With the advent of multimedia, it has become possible to present learners with very complex problems and very realistic environments even in the context of the classroom.

In both discovery-based and problem-based learning, the focus is on the process of problem solving rather than the solution itself. Learners, usually working in groups, determine the questions to ask, the methods to gather data, and the ways to interpret the data obtained. More important, they are asked to reflect on their own problem-solving process in an effort to increase their awareness of it.

Taking the situations a step further toward situated learning, some instructors are moving students out of the classroom and into authentic learning settings. This has long been the case in some disciplines, as evidenced by laboratory or fieldwork and clinical placements. Those tended to be fairly specific to the sciences in the case of the former and professions in the case of the latter. Now, however, more general educational goals are being pursued in programs like service learning (Rhoads and Howard, 1998). In these forms of instruction, the instructor often becomes less of a master and more of a co-learner.

Cognitive Apprenticeship. Instruction can take advantage of the concept of learning by observing an expert model. An interesting blend of old instruction and new is the discussion of the *cognitive apprenticeship* (Collins, Brown, and Newman, 1989). In the past, skills were learned by working in

an apprenticeship relationship with a master craftsman who explained the craft while demonstrating it and involving the learner with slowly increasing responsibility. Collins, Brown, and Newman (1989) suggest that a similar instructional process can be used for cognitive skills. Here the learner (the apprentice) would observe the instructor (the master craftsman) go about the business of thinking about the field while describing the thought processes aloud. The instructor gradually places more and more responsibility for problem solution on learners until eventually the learners can solve the problems on their own. During this transition, the instructor supports the learners' efforts, coaches them with questions and suggestions, and encourages them to think aloud about their solution processes. Collins and colleagues provide several examples of how this is done in different educational settings.

The Unique Learner

Another area of research on learning that warrants discussion is the role of individual differences among learners and the contributions those differences make to learning and motivation (Corno and Snow, 1986). Attempts to categorize learners by ability levels or learning styles for the purpose of simplifying the design of instruction (for example, "all visual learners benefit from pictures") have resulted in less than convincing data or in burgeoning subcategories as more and more differences among learners appear with further study (Jonassen and Grabowski, 1993). In the end, we must acknowledge that human learning is the product of so many different variables—some of which can be measured, most of which cannot—that our efforts to simplify it are doomed from the start. The best we can hope to do is list some small portion of those variables that have been studied scientifically and design sufficient variety into our instruction that most learners will find something to meet their needs. At the same time, we can equip learners with a range of experiences and learning strategies so that they become self-regulated learners as discussed earlier and therefore capable of adapting to any style of instruction.

What are some of the learner variables that we can consider? Here are just a few of the most frequently mentioned ones.

Level of prior knowledge. If there is one thing that all psychologists can agree on, it is that the level of prior knowledge that the learner brings to the situation is the biggest individual variable in determining how much is learned. There is not much an instructor can do to guarantee homogeneous backgrounds among the learners, but the instructor can certainly make an attempt to find out what the range is and offer remediation for students whose backgrounds are below standard (Bransford and Johnson, 1972; Anderson and Pearson, 1984; Chi, Glaser, and Farr, 1988).

Cognitive processing variables. Learners process information in many ways. For example, some learners prefer to take their learning in a series of logical steps from beginning to end, building to a conclusion (serial learners); others prefer to begin their learning with an overview, the "big picture," and then fill in with the details later (holistic learners) (Entwhistle, 1981). It is probably more efficient to offer an overview initially and then provide the details, because this strategy will benefit the most students and has other advantages from a cognitive processing standpoint.

Personality variables. Some theorists include personality variables in the list of individual differences. For example, some learners can look at a whole picture and isolate or abstract individual pieces with ease (field-independent learners); others are strongly influenced by the whole picture and do most of their interpreting of new information in the context in which it occurs (field-sensitive learners) (Witkin and Goodenough, 1981). Abstraction is easier for the former type of learners, and integration is probably easier for the latter. An instructor can include both types of tasks in learning so as to benefit those students when their preference is being matched and to help them learn to adjust to task challenges that do not match their preferences.

Another personality variable is that learners may be impulsive or reflective (Schmeck, 1988b), tending to respond either quickly or more thoughtfully. This dichotomy is sometimes interpreted as risk-taking versus cautious learning. Whatever its underlying mechanism, this variable can have an influence on students' responsiveness in class, on their test-taking behavior, and even on their choice of assignments.

Strategies for learning. Recent theorists have proposed the concept of *learning strategies* as an area of individual difference (Weinstein and Meyer, 1986). These strategies are learned rather than part of a learner's basic personality structure. They include such techniques as creating visual images to assist with memory, relating new information to already learned information, and organizing information into an easily remembered outline structure. Students show a preference for different types of strategies based on their past experiences. For example, some students use surface strategies that concentrate primarily on memorization or the identification of surface features to aid in retention. Other students look beyond the surface features and try to understand the underlying structure of information; they are called deep processors. Many systems of learning strategies have been studied (Entwhistle, 1987; Marton and Säljö, 1976; Weinstein and Meyer, 1986; Weinstein, Goetz, and Alexander, 1988; Schmeck, 1988a), and each system makes a valuable contribution to our understanding of how students invest their time during learning.

Beliefs about learning and thinking. Student beliefs about knowledge and what it means to understand contribute to the individual variability we see in the effects of teaching (Wigfield, Eccles, and Pintrich, 1996; Hofer and Pintrich, 1997; Halpern, 1998). Students who believe that knowledge

is a resource provided by an authority will have a very different approach to learning and goals from a student who believes he can create his own understanding. This is a particularly interesting perspective on how different learners might be influenced in their approaches to learning. In addition, it has been suggested that students need to have a disposition toward problem solving, a tolerance for ambiguity, and several other qualities to work successfully at some of the higher cognitive levels.

Demographics. Variables such as age, gender, and ethnic background each contribute some special qualities to learners (Pascarella and Terenzini, 1991; Baxter-Magolda, 1992; Anderson and Adams, 1992). This has been an area of great interest, but not a source of much usable advice for faculty.

Many areas of difference have been proposed as having an influence on learning. In reality, many of these tendencies are simply the result of preferences or experiences rather than some inborn trait of the individual. A good example is the proposed difference between auditory, visual, and kinesthetic learners (Dunn, Beaudry, and Klavas, 1989). This particular system for classifying learners is very strongly ingrained in our experience. I have even been known to use it myself (Svinicki and Dixon, 1987). But evidence that it is anything but a preference remains to be gathered. As a preference, this distinction does have a useful role to play in the design of instruction, but it does not explain the why behind the preference.

Another fairly commonly held belief about learning is that each individual has his or her own learning style and that attempts to circumvent that style will be thwarted because their basis is deeply grounded in the individual's psyche. The concept of learning style, however, is a slippery one and not as strongly supported in the literature as one might think (Jonassen and Grabowski, 1993). Each "style" inventory reflects an underlying model of learning, which is often not articulated for the user. Theories that attempt to simplify or classify individuals into a small number of "types" do an injustice to the complexity of human behavior. Even in the individual differences discussed in this chapter, the range of individual response is so great and the overlap so encompassing that I hesitate to support any system that seeks to classify people. Perhaps the most egregious error along these lines is the belief that if we can identify a person's type, we know all we need to know about that person, as if naming were the same thing as explaining—or the belief that "once a Type A, always a Type A," as if behavior were driven by some basic individual force that cannot be modified. Neither of these assertions is justified, at least at this point in the growth of the field (Jonassen and Grabowski, 1993).

The same cautions should be exercised when talking about the current "brain-based learning" methods. Although physiological psychology is making huge strides in its ability to study the brain processes, it is nowhere near being able to explain behavior on the basis of which area of the brain is being used. Rather, the more research is done, the more it appears that each

hemisphere of the brain is being used in most activities. Therefore, it is inappropriate or at least premature to speak of a person as "left-brained" simply because he or she shows a preference for logical analysis over holistic analysis. Such claims, and the accompanying instructional methods they purport to underlie, should be viewed with caution and skepticism at this point.

Instructional Implications. The crux of this discussion is that it is appropriate to acknowledge that there are individual variables among students that can influence the effectiveness of instruction. However, more research is needed to verify which of the proposed differences is most strongly grounded in empirical data and has the best record of relating to learning. Until those data have been gathered and properly analyzed, our best instructional strategy to cope with individual differences is to provide an array of learning alternatives and let the learner choose among them rather than trying to force one on everyone or even on a single individual.

Motivation from a Learning Perspective: The Answer to Everything?

I teach students who aspire to be teachers at a variety of levels from preschool to college level, and I find that they all have inordinate faith in the ability of motivation to overcome all obstacles. I don't share their confidence in motivation; after all, no matter how motivated I am to be as good a tennis player as Martina Hingis, I'll never reach that goal owing to age and lack of physical prowess. But I understand how potent a force motivation can be and how much face validity it has for teachers and learners alike. For that reason, it has been the subject of an entire *New Directions* issue (Theall, 1999). Even though we've touched on it at several earlier points in the chapter and its relation to teaching will be illustrated more thoroughly in Chapter Two, I will review a few of the more standard theories of motivation from the perspective of the learner rather than the instructor.

Theories of motivation have followed the same sequence as theories of learning in terms of their conceptual basis. They have evolved from a behavioral perspective to a cognitive perspective and beyond. For a really complete summary of theory, I recommend Theall (1999) or Pintrich and Schunk (1996). See Table 2.1 in Chapter Two as well.

Behavior Theory and Motivation. Motivation had a peculiarly unique status in early behaviorist traditions. In essence, it didn't exist. Because behaviorists originally believed that behavior was caused solely by past contingencies, motivation, which implied a looking ahead or anticipation of future consequences, couldn't really exist. A learner engaged in a behavior not in anticipation of being reinforced when he finished but rather because that behavior had been reinforced in the past. Modern versions of behaviorism include a concept of the incentive value of future rewards or anticipated consequences as a factor in influencing the occurrence of a response.

What behaviorist theory did contribute, however unintentionally, to motivation was the concepts of reinforcement and punishment as drivers of behavior. As noted earlier, reinforcement is a very useful construct for teaching. We should provide positive consequences when students engage in a desired behavior. If we do, that behavior is more likely to occur again in the future. Likewise, we should provide negative consequences when students engage in undesirable behavior, which will lower its frequency. This is a perfectly legitimate way to think about classroom management, and most instructors naturally use these strategies all the time.

Under the *cognitive paradigm,* motivation for learning was thought of primarily in terms of the need to have consistent, accurate, and useful understandings of the world. Learners were motivated to learn when feedback on their responses indicated a mismatch between their memory structure and the "real world." If learners made a choice based on their associations or their understanding of how the world worked and that choice produced negative feedback (by turning out to be wrong), they were motivated to seek more information and to change either the response or the underlying association.

Of course, there is a whole array of theories that speculate on why negative feedback would be so motivating. For example, self-worth theory maintains that individuals respond in a way that will maintain their image of self-worth (Covington, 1984). One possible response to information that they have made a mistake (and therefore might experience reduced self-worth) is to figure out what went wrong and correct it. Other ways to respond to mistakes are to deny that the initial response was wrong, to try to find some mitigating circumstance that caused the wrong response but still preserves self-worth, or to blame someone or something else for the mistake—all popular student responses to negative feedback and ones we would like to discourage.

Motivation in other versions of the cognitive model is based on how learners think about the consequences of their behavior. Here theory emphasizes learner goals, expectations, and beliefs—in short, cognitions. A particularly useful motivation theory along these lines is called expectancy-value theory (Atkinson and Birch, 1978; Eccles, 1983). In this theory, a learner's motivation is a function of how likely success at a task is (expectancy) and the value the learner places on that task (value). Both components must be present in some degree for the learner to be motivated. Instructors can intervene to help raise student expectancy for success or to increase the value of the task for that learner.

Expectancy for success is also discussed as *self-efficacy* in many theories (Bandura, 1989). The concept of self-efficacy is a belief in one's own ability with regard to a specific task. Learners with high self-efficacy for test taking believe in their general ability to cope with test-taking situations. However, self-efficacy can be destroyed if learners experience a disconnection between their behavior and its consequences. When learners have this

kind of experience, they often exhibit what is called *learned helplessness,* a general low level of motivation attributed to the belief that nothing they could do will make a difference (Seligman, 1975). This condition and its associated symptoms of lethargy, passivity, and dependence are frequently seen in students.

Goals and their impact on learning are another cognitive motivational concept that is very useful (Schunk and Zimmerman, 1994). In this version of the theory, student motivation is tied to progress toward a goal in several ways. First, the difference between current level of performance and the goal is thought of as a source of motivation. Learners will work to narrow that gap. And when students see they are making progress toward the goal, they will be more motivated to continue. Finally, when students see that others who have reached the goal receive positive benefits, they develop an anticipation that if they, too, reach the goal, they will receive those same benefits.

Another particularly useful cognitive theory is attribution theory (Weiner, 1980) and its offspring, explanatory style (Peterson and Seligman, 1984), in which learners' motivation is based on what they believe causes their success or failure. For example, if they attribute success to luck rather than ability, they are not as motivated, because luck is hard to predict. If they attribute failures to outside forces, they may also be unmotivated, for they have no control over those forces. In general, attribution theories recommend focusing learners' attention on things over which they have some reasonable control and accepting the fact that sometimes one has no control over the outcome.

One recent addition to the cognitive models of motivation has been goal orientation theory (Ames, 1992; Dweck, 1986). In this theory, the learner's behavior is determined to a great degree by the type of goal for learning. The two major goal orientations are mastery goal orientation and performance goal orientation. Students with a mastery goal orientation are motivated by the desire to learn something new. They are not concerned with how long it takes or how many mistakes they have to make to learn. Students with a performance goal orientation are motivated by the desire to demonstrate existing competence, especially in comparison with peers. One might think of these two orientations as related to Eison's learning orientation/grade orientation model (1981). The latter model would be a natural extension of the former.

One can imagine the differences in overt behavior under these two orientations (Ormrod, 1999). A mastery orientation tolerates risk-taking; performance doesn't. Mastery seeks corrective feedback; performance wants only confirmatory feedback. Mastery views mistakes as learning opportunities; performance views them as evidence of failure. This particular model has many implications for working with students and their goals, as we shall see.

With the advent of more models based on personal control concepts, motivation theory has also moved in that direction. One recent manifestation of that move is self-determination theory (Deci, Vallerand, Pelletier, and

Ryan, 1991). In this theory, motivation is based on the learner's perceptions of being in control of his or her own destiny. In self-determination theory, the greatest motivation is felt when learners makes their own choices about how to learn or what direction to take. Also connected to self-determination theory is the attributional concept of belief in an internal control over outcomes, known as locus of control (Weiner, 1986). When learners have choices and believe that their success rides on those choices, they are highly motivated to put forth effort.

A very familiar topic in motivation is the issue of intrinsic versus extrinsic sources of motivation. Intrinsic sources are those that arise from engaging in the task itself, whereas extrinsic sources come from outside the learners. Current theory and research have concluded that the best sources of motivation are those that are intrinsic (Deci, Vallerand, Pelletier, and Ryan, 1991; Ames and Ames, 1991; Csikszentmihalyi, 1975). Intrinsic motivation comes from having choices, from choosing challenging yet attainable goals, from feelings of being in control, and from self-efficacy for the task at hand. The combination of choice, challenge, and competence is proposed as the best situation for fostering intrinsic motivation.

A new concept in motivation is the idea of volition. If motivation is the force that gets a behavior started, volition is the force that keeps it going in the face of obstacles (Corno, 1993). Volition involves using strategies that help the learners overcome obstacles, cope with frustration, and carry the task through when completion seems far away. We can see lack of volition strategies in the tendency of some students to give up if they can't solve a problem immediately. One possible way to improve student motivational strategies is to teach them how to carry through as well as how to get started.

Instructional Implications of Motivation. Each motivation theory offers slightly different recommendations for teachers, but all are useful in thinking about how to create a learning environment that is motivating for the learners. The following are some of the instructional strategies that derive from the various theories discussed.

Provide reinforcement for activities you wish to encourage. Praise, positive feedback, points, or access to highly desirable activities (like not having to take a final) all can be used to reinforce students for participating in class or completing work as scheduled. The advantage of using positive consequences such as praise is that it has a net positive effect on the class atmosphere, which then contributes to better learning itself.

Emphasize internal reinforcers and motivation. Giving students choices about what they will do or organizing learning around existing student interests is a way of tapping into internal motivation with the advantage that the activities become self-reinforcing and the teacher's role is minimized.

Set challenging yet attainable goals for learning, and provide feedback on progress. Note the emphasis on attainable goals. Students need to believe that they have a chance of meeting expectations. The goals cannot be so simple that they are meaningless, but they should also not be beyond the

capacity of the learners. In addition, involving the learners in setting their own goals is a useful enhancement to this recommendation. The opportunity to set one's own goals is motivating and gives the learner more of a vested interest in their attainment.

Change learner beliefs and attitudes about learning. In terms of motivation, several theories revolve around learners' beliefs and attitudes. To increase motivation, instructors are advised to help learners develop appropriate attributions about what causes their successes or failures. Most research points to encouraging students to make the connection between effort and success. If the learners believe that effort is responsible for their successes, they will be more willing to work hard and persist in the face of difficulties.

Encourage a mastery goal orientation. From a motivational perspective, instructors are advised to help students adopt a mastery orientation to their work. There are many suggestions for doing so, but most involve removing or minimizing student-to-student comparisons that we so often make and focusing more on self-comparison or comparison with the end goal.

Enhance the perceived value of the task. Expectancy-value theory recommends helping students understand the value of a learning task. This can be done by making the task more challenging or more interesting, by showing the utility of the skills to be learned, or by showing how the task matches the goals of the learner.

Convince the learners they can succeed; increase their self-efficacy. The other half of the expectancy-value theory is about raising student expectations about their own capacities to succeed. Instructors can help learners believe that they can accomplish the target task by pointing out the correspondence between already established skills and the new task, by giving the learners some early successes, by verbally supporting their effort—anything that will bolster their self-confidence.

Give the learner choices about goals and strategies for achieving them. Although it is not always possible to achieve the ideal of self-determination, instructors can give students choices over how they will pursue a fixed goal ("use whatever works for you as long as you learn this week's vocabulary") or choices over which goal to pursue using a fixed procedure ("write a research paper, create a display, or give a presentation on the topic of your choice using a particular information searching model").

Conclusion

It is impossible in the confines of this publication to discuss all the research on learning that has influenced instructional design over the past twenty years. What is presented here merely skims the surface. The theories and recommendations continue to evolve even as I write these words.

If I had to summarize what the research and theory on learning and motivation have to say to teachers at the turn of the twenty-first century, it

would be that more than ever we believe that learners are at the center of the teaching and learning process. As teachers, we can filter, highlight, guide, give feedback, and encourage, but the biggest variable in what determines final performance is what the learners bring to the table. The learners' prior knowledge and its structure, their learning strategies, goals, beliefs, self-efficacy, and motivations all contribute to their learning. This view is complex, but there is no cause for despair. Although we as instructors may have less personal influence on learning than we thought, we certainly know more about the process of learning, and that is suggesting a lot of ways to support learning.

What may be the biggest development in learning for higher education is the simple fact that we are now starting to pay attention to it at all. Researchers are making progress in identifying variables that affect learning, instructors are recognizing that knowing about learning can significantly improve teaching, and students are becoming more informed about alternative ways to improve their own learning. As theories of learning, bolstered by better research, are giving us more accurate descriptions of learning and predictions of its outcomes, we are moving toward a more unified vision of what needs to be done to make learning happen.

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