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Describing Instruction: The Role of Learning Theory

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A 1977 graduate of Dordt College, Dr. Moes has received his Masters Degree from Montana State University, and his Ph.D. in experimental psychology from Texas Christian University. His research interests have been in the areas of hyperactive children, biofeedback, and brain function, and he has presented several papers on the topic of recovery from brain damage.

For decades, educators have sought to find the best methods for teaching people. However, in order to determine the best method for teaching, a teacher must know how the learner learns. To understand how learning occurs the educator must understand the characteristics of the learner as well as the nature of the learning process. Theories of instruction, therefore, have relied on psychological theories of learning for a foundational framework.

Unfortunately, learning theories have not acknowledged the Biblical principle of the wholeness of human beings. The result is that instructional theories have concentrated almost exclusively on behavior or perfor-

mance, resulting in a very mechanistic approach. The present presentation seeks to apply the Biblical principle of the wholeness and unity of human nature to a reinterpretation of past and current psychological learning theories with the hope that a more unified and Scriptural interpretation of research results can be established and applied to instruction.

The fundamental question I will address is, how does learning occur? I propose that there is one unified process common to all learning situations. I feel this unified approach is not only Biblically reliable but is also supported by much of the current research. The key word in this approach will

be that of *principles*. While a more complete description will follow, for now I will describe a principle as a summary or abstraction of two or more bits of information into one bit of information. The notion of abstraction is not a new one, but in the past abstraction was thought to occur apart from the man's emotional and spiritual nature.

The idea of the formation of principles will be greatly expanded to include the whole being: mind, body, and soul. The course of this expansion will involve four basic steps:

1. Biblical directives for studying the learning process will be established to serve as guides in interpreting research and the related theories.
2. A critique of the development of behavioristic learning theories and research in animal and human learning will be given. The reexamination of research approaches and results is especially important at this point. Past attempts to apply Christian principles to the field of learning have criticized learning theories without regard to the underlying research. Empirical studies have, for the most part, been ignored or glossed over as a somewhat nonessential feature of a Christian approach to learning. While Biblical principles must be assumed from the onset, no reformulation of learning theory is complete without reinterpreting the relevant research.
3. The third step will involve the reformulation of old interpretations in the light of the foundational Biblical directives and in the light of new research findings which also point to a more Biblically consistent picture of man. For as Gordon Spykman (1983) has stated: ". . . divine revelation has a way of breaking through even the most apostate systems of thought as [people] respond to it" (p. 19).
4. Finally, a somewhat revised and expanded cognitive learning theory will be applied to educational settings. For teachers must apply Biblically founded teaching methods

(in addition to contents) if students are to be dowered with "serviceable insight" into Kingdom living.

Biblical Directives

To work toward the establishment of a truly Christian understanding of learning theory and research, one must first confirm certain Biblical assumptions. Duane Kauffman has in his article, "Toward a Christian Theory/Model of Learning" (1978) skillfully articulated several Biblical assumptions which he says should serve as "control beliefs" for a Christian learning theory. Therefore, I restate three of his nine assumptions here, appended with two assumptions of my own. Note that not all of these control beliefs are as directly defensible from Scripture as are others; some require a more indirect argument of proof and are subject to debate.

1. God has communicated and is communicating His desire to His people. Christians thus believe in the authority of the Bible as the guide for life, and that God continues to work in His people through the ministry of His Spirit.
2. Man, created in God's image, is a responsible being, engages in purposeful activity, makes choices between alternatives, demonstrates a life of wholeness before God and his fellow men (i.e. growth in wisdom, stature, and favor with God and man). As such, man is discontinuous from the animal world in the higher levels of his functioning.
3. The Christian emphasis on the whole person makes learning more than a cognitive activity. Knowledge and skill demand the involvement of the complete person, especially affective and interpersonal responses to cognitive learning.

I add the following assumptions:

4. True "spiritual" wisdom should be the ultimate goal of learning for any person.

All learning should bring the person closer to a fuller knowledge of God's unfolding of creation, and of human responsibility.

5. All learning operates according to certain created principles in two respects, (a) different situations, although they may result in different outward behavior, always reflect a fundamental change in the total understanding of God's creation, (b) certain basic principles of learning are common to human beings and animals because of the order in creation and common design found in all living beings.

and behavior—all interact in the learning process. Kauffman also seems to be suggesting here that responses (behaviors) are not completely separable from the rest of the person. This is similar to the concept expounded by John Van Dyk in his discussion of the relation between faith, reason and action (1982). Concerning the Old Testament view of faith and action, he states, ". . . teaching, learning, and responding were united. Hearing, believing and doing blended into one continuous act." In very simple terms what we are (i.e. our beliefs, knowledge,

True "spiritual wisdom should be the ultimate goal of learning for any person. All learning should bring the person closer to a fuller knowledge of God's unfolding of creation, and of human responsibility.

Some of these assumptions need clarification or comment. Assumption one suggests that God is active in the learning process. Through the mysterious working of the Holy Spirit and through Christ's upholding hand, learning is guided according to the Father's will and is not haphazard. The second assumption suggests that, while God is at work in the learning process, people are still responsible creatures before God and are commanded to learn (actively) and respond in certain ways. This issue runs head on with the deterministic notions of most behavioristic theorists. However, only limited discussion will be afforded this issue, since it is beyond the scope of this paper. (For a thorough discussion of the free will/determinism problem as relating to learning see Mackay (1979), Jones (1981), and Bufford (1981).

The idea in the third assumption is that the whole person—mind, body, soul, emotion

etc.) is what we do. (More on this later.)

Assumption number four is self-evident from Scripture (See Proverbs 2). However, one fundamental truth can be gleaned from this assumption: if learning can be divided at all, it should be divided between true learning (i.e. gaining wisdom and knowledge of God's working) or false learning (i.e. learning which perverts man's thoughts and actions away from a true understanding of God's working).

Finally, the last assumption is a working assumption which will receive support later in the paper. It is stated here since I feel some basic Biblical concepts lend support to the idea. First of all no distinction is made in Scripture between any type of learning. All types of learning seem to reflect gaining new insights in the context of our total spiritual condition. In other words learning does not occur in a vacuum. For example, the writer of Proverbs, after observing the slothful

man's vineyard and the growth of thorns that results, states that, "I applied my heart to what I observed and learned a lesson from what I saw" (Prov. 24:32; NIV).

This pattern of gaining understanding is a common one throughout the Old Testament; "instruction" is gained in a similar way from nature (Eccl. 1:13), from the study of human nature (Eccl. 16:3-12), by object lessons (Exodus 16:32), and by parables. In each situation raw information is taken in and a new insight or principle is gained based on the application of the heart. This application of heart, I feel, occurs whether or not the person is aware of it. Ruth Beechick in her book *A Biblical Psychology of Learning* (1982) suggests that this Biblical reference to heart implies the sum total of spiritual, moral, emotional, motivational, and thought patterns. Although this consistent pattern does not prove that there is only one type of learning, it does suggest at least from a Scriptural standpoint that there is no basis for making a distinction between spiritual learning and secular learning.

The second part of the last assumption may seem contradictory in some respects since animals do not respond to God as human beings do. Indeed there should be a difference in the way human beings and animals learn, both qualitatively and quantitatively (See Psalm 32:9). Certainly, animals cannot apply the heartfelt aspects of their being in the same way that human beings do. However, I believe animals do apply emotion and motivation to learning situations. In addition we share a common design with animals. Ecclesiastes 3:18-21 points out that animals and human beings are all formed from the dust of the earth. Indeed, we as human beings share with many animals a similar visual apparatus, auditory apparatus, and nervous system. If God is consistent and has created a consistent and systematic universe, I feel that it is not unreasonable to expect that human beings will share common psychological characteristics, as well as common physical characteristics. Therefore, an understanding of

some basic learning principles can be gleaned from animals. At the same time we must not over-generalize findings from animal studies since animals are not created in God's image. Rather, the study of animal learning should serve as a springboard for establishing an understanding of the learning process in human beings.

Research and Theory in Learning

With several Biblical directives to guide our thinking, past and current research on learning can now be evaluated in a "brighter light." The history of learning theory begins with the familiar experiments of the Russian physiologist, Pavlov, and with the American psychologist, Thorndike (Schultz, 1981). These two men have so shaped the thinking and research in learning psychology that their work deserves a brief overview.

Being a physiologist, Pavlov was not originally interested in learning at all but in the functioning of neurological reflexes (Mackintosh, 1974). For example, he studied how food placed in a dog's mouth resulted in saliva being produced. (I will contend that this predisposition of Pavlov toward studying reflexes is of great significance since it is one of the contributing factors in the development of the notion of a reflexive type of learning in behavioristic thought.) Pavlov noted that not only would the animal salivate when food was placed in its mouth, but it would salivate shortly before the feeding if regular cues that the food was coming were provided. Pavlov astutely followed through with a series of experiments in which he presented a stimulus, such as a tone, which was followed closely by the presentation of food causing the salivation. When the tone and the food were presented in close pairings on several occasions, the animal began to salivate in response to the tone, before the food was presented. The food and the original salivating response were called the unconditional stimulus (US) and unconditional response (UR), respectively, because they were part of a natural or

FIGURE 1

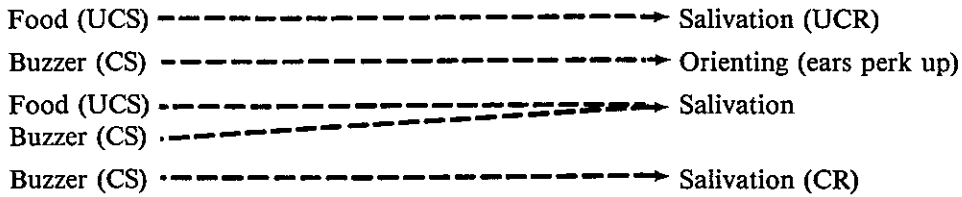


FIGURE 1. Classical conditioning. Food elicits salivation in a dog, but a buzzer does not. After successive pairings of food and buzzer, the buzzer begins to elicit salivation.

“unconditioned” reflex. The tone and the salivation in response to the tone were called the conditioned stimulus (CS) and the conditioned response (CR), respectively, since these represented the two components of a learned or “conditioned” reflex.

The establishment of new reflex responses was for Pavlov the basic element of all types of learning. The apparently complex behavior of animals and humans, if broken up into component parts, would reveal simple connections and “chains” of connections¹ between stimuli and responses. Pavlov even hypothesized that the brain was a sort of switching center that received stimuli and after enough training would cause an output of the appropriate response (Mackintosh, 1974). Therefore, some reflexes were learned and were found in “higher” centers.

Thorndike, unlike Pavlov, was trained as a psychologist and was influenced a great deal by the functionalist movement of the late 18th century. He more deliberately set out to understand the basic components of the learning process. By monitoring simple responses of animals and then giving the animal a reward following the response, Thorndike noted that the animal was likely to repeat the response in the future. Therefore, in this type of learning situation there is no reflex at the onset; rather a new

reflex is established between some stimulus and some previously random behavior. This finding led Thorndike to formulate the law of effect. Stated simply, the law of effect says that when a response is followed by something pleasant, the response is more likely to occur in the future; when a response is followed by something unpleasant, the response is less likely to occur (Hilgard & Bower, 1975).

The research generated by Pavlov and Thorndike, as well as many of their predecessors seemed to lend a great deal of credence to their views. Indeed, animals appeared to learn a variety of responses with certain carefully prescribed situations and reinforcements. In America, Watson demonstrated that Pavlov’s type of learning could be accomplished in humans by demonstrating that a child could develop a phobia to an animal by Pavlovian type conditioning. Although a split existed in America for quite some time between Pavlovian (or classical) conditioning and Thorndike’s approach (also known as operant conditioning), the distinction between classical and operant conditioning has diminished over the years (Rescorla & Wagner, 1972). Thus, despite their false guiding principles and their mechanistic approach, behavioristic researchers were at

first, on an operational level, quite successful in producing their predicted results. The desire to make psychology a respectable science pushed many psychologists to accept without question behaviorism with its scientific rigor.

By the 1930's and 1940's, behaviorism was thoroughly embedded in psychological thought. Theoretical model building continued to grow and reached a pinnacle with Hull. Hull (1943, 1952) developed an elaborate and thoroughly mechanistic model of learning which was called a "drive-reduction" theory of learning because of its reliance on motivation as a major component in the learning process. Motivation for Hull was a very integral part of the learning process. Without a basic drive such as hunger or thirst to motivate the animal, learning simply did not occur.

B.F. Skinner in his work *Science and Human Behavior* (1953) attacked the idea of building theoretical models to predict behavior, since he felt that there was no need to complicate the picture with elaborate hypothesizing. Rather, Skinner sought a descriptive and "technological" approach which sought to describe all possible conditions and their necessary behavioral outcomes. Skinner was simply pushing behaviorism to its logical mechanistic conclusion. At this point Skinner also took behaviorism out of the academic animal laboratory and applied it to a variety of situations including education and the control of abnormal behavior. The techniques that Skinner used in the classroom and in clinical settings showed phenomenal success in certain situations. Indeed, behaviorism seemed to be riding the crest of its successes. As P. Lichtenstein states,

By the 1930's behaviorism was dominant and solidly entrenched in American psychology. Of course there were the competing views of Tolman, Hull, Guthrie, and Skinner, but the belief was widely held that eventually one would emerge as

superior. In the 40's it seemed that Hull might be a clear winner with his hypothetic-deductive approach which seemed to bring to psychology needed rigor and precision. Hullian papers abounded at professional meetings and in the journals so that young and older psychologists alike felt that in order to be abreast of the times they must master the somewhat esoteric Hullian symbols. (1980; p. 450)

How should Christians respond at this point? Is the behavioristic approach one that we should adopt? Many Christians have accepted behaviorism at varying levels of acceptance (Kauffman, 1977). Some have adopted the theories in their entirety, while others reject the mechanistic and deterministic "beliefs" but have accepted the "technology" and have painstakingly contorted behavioristic and theological concepts in order to bring the two into an uneasy juxtaposition. The fundamental problem with this marriage of thought is that not only do the presuppositions of behaviorism run contrary to Scripture, but the "technique" of behaviorism falls far short in describing the true process of learning as pointed out in the Bible and as shown in much of the research. We can be thankful, however, that behavioristic notions have not gone unchallenged; a challenge not only of its presuppositions but of its research predictions and techniques as well.

The death rattle for behaviorism actually came very early on from the "neobehaviorist"² Tolman. Tolman felt that rats and humans alike possessed a more purposive behavioral ability than was assumed by the strict behaviorist and conducted a number of experiments to demonstrate this capability. One of Tolman's classic experiments serves to illustrate his findings best. The experiment involved a three-way maze (see Figure 2) in which the rat is allowed on several occasions to leave the start box and to explore the maze by random choices to find the food in

FIGURE 2

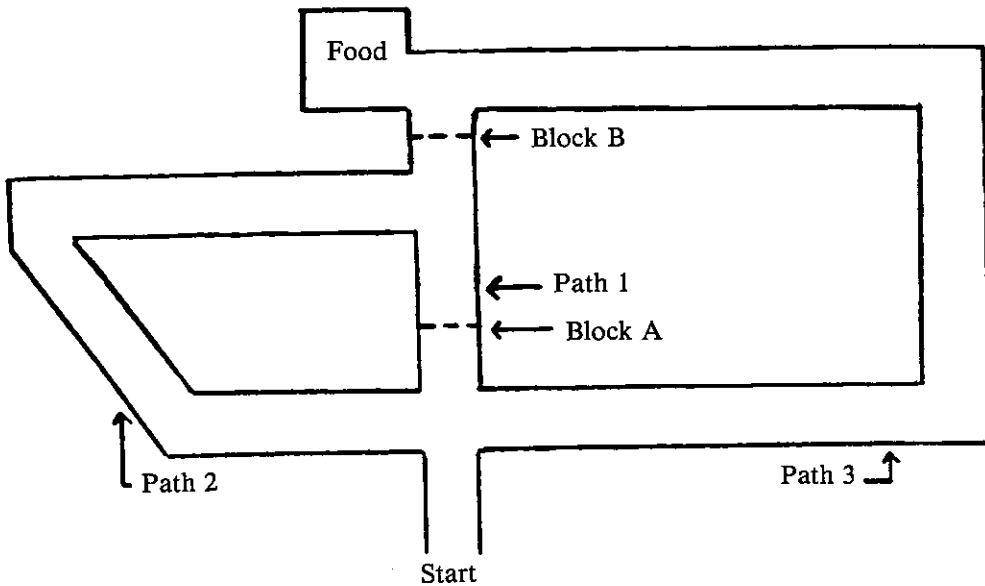


FIGURE 2. Maze used in Tolman's "cognitive map" experiment.

the goal box. The rat was shown as having established a preference for alley one over alley two over alley three. This result was accountable by behavioristic theory since it predicted that the sooner a response is followed by a reward the more likely the response is to be performed. Therefore alley one is preferred because the reward is obtained most quickly.

But what should happen if a block was put in alley one at point A? Behavioristic theory predicted that alley two would be chosen, which is in fact what did occur. What should happen if a block was put at point B? Again, behavioristic theory predicted that the animal would choose alley two, despite being a dead end solution, because it was still the second strongest "reflex" for the animal. However, the animal consistently chose alley three when faced with the block at point B, contrary to the behaviorists prediction, but much more intuitively logical.

What these findings imply is that even animals are capable of selecting responses from an integration of information rather than responding automatically and mechanically to sensory input. (I would add that if rats can perform such mental manipulations, human beings should be capable of this and much more). Tolman further explained these results by suggesting that the rat doesn't learn "because of the reinforcer but rather he learns about the reinforcer" (Rescorla, 1978; p. 39). In this particular situation the rat made the correct choice because, as Tolman suggested, the animal made sense of all the relevant information, including the reward, and organized it according to a logical pattern. Stated another way, it made a "cognitive (mental) map" of its environment.

Of course this one experiment did not completely preclude the existence of simple stimulus-response associations or reflexes; it

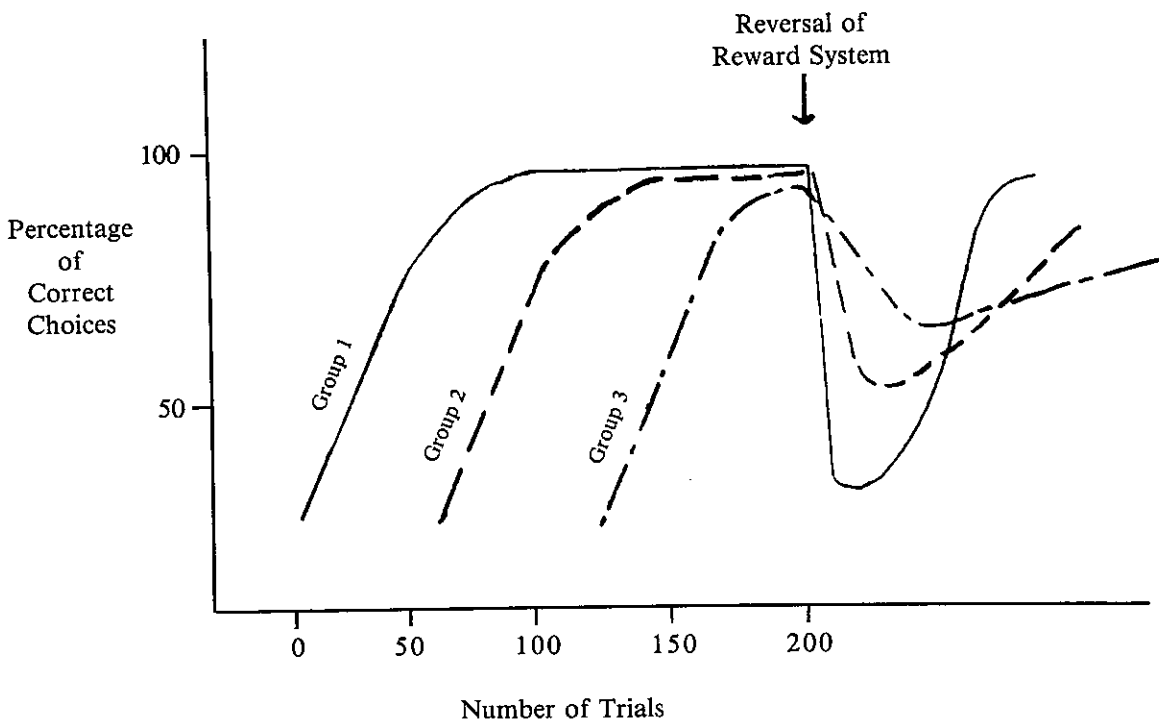
only suggested that other possibilities do exist. In fact, Tolman provided evidence to support, at least with a casual analysis, the potential for reflexive stimulus-response associations being made under some conditions. If in the same maze a rat was forced to traverse each alley separately to obtain a reward, a somewhat different result was obtained. At first all alleys were blocked, except alley one, with the animal going through 100 trials of this procedure. This procedure was repeated 50 times for alley two and 10 times for alley three. When a block was then placed at point B (with the other two alleys open) the animal did choose the ultimately futile alley two. Thus when the animal was not able to form an integration of the available information, it appeared that a stimulus-response type of reflex was created.

As a result of this and subsequent studies some psychologists suggested that there were two types of learning, one being response

oriented, the other being concept oriented. However, Tolman's finding went relatively unnoticed during the heyday of behavioristic research. Therefore, the notion of two types of learning did not develop in strength until Tolman was rediscovered in the 60's and 70's.

Another example of both rule or concept learning and response oriented learning in animals was given more recently by Reid (1953). In this experiment rats were trained in a two arm maze to discriminate between black and white. A white alley signalled the presence of food at the end of the alley while a black alley signalled no food. The position of the color was randomly alternated to avoid learning a certain position. Three groups of rats were trained in this task. Each group was trained until they had reached a criterion of nine of ten correct choices. Then one group was trained an additional 150 trials, a second group an additional 50 trials, and a third group was given no additional

FIGURE 3



trials (see Figure 3); in other words, two groups were overtrained. Then the reward system was reversed with white now signalling no reward and black signalling reward. What occurs is that all of the groups initially make more errors because they have difficulty with the new situation. However, the group receiving the most overtraining relearned the task the fastest.

Therefore, the more the animals were overtrained the easier it was to make a reversal. Why might this be the case? The conclusion of most researchers (Mackintosh, 1974) is that the animal has learned a *rule* (i.e. one color means food, and the other means no food) rather than learning to respond reflexively. However, a closer examination of the data in figure 3 reveals that initially the most overtrained group actually makes more mistakes before they quite suddenly relearn the task. This result suggests that while animals do learn a rule with more training, they also begin to respond quite automatically (reflexively?). Again it appears that both concept learning and reflexive learning were possible, even though concept learning was predominant.

Further decline in the behavioristic monopoly came with a devastating critique of Hull and others by Koch (1954). Koch criticized not only the philosophical and theoretical aspects, but the research predictions as well. The simple truth was that many behavioristic theories simply could not make accurate predictions of animal responses. Since that time several researchers and writers have slowly undone many behavioristic ideas. Even Thorndike's law of effect, one of the hallmarks of behavioristic theories, has been called into question. As N. J. Mackintosh states in his review of the data, "There is a considerable body of evidence inconsistent with the analysis provided by the law of effect" (1974, p. 268). Thus, one of the cornerstones of behavioristic theory which has been applied to all types of human endeavors is slowly crumbling, not because of human studies but because of the very type of animal studies

which were originally thought to support such theories.

Before turning to some of the new directions in learning, we must examine one more aspect of animal learning. Early behavioristic approaches assumed that any stimulus could be associated with any response, provided the correct reinforcements were given. More recent research findings (Seligman, 1970; Kalat & Rozin, 1977) suggest that some associations are made much more easily than others. For example, rats associate sweetened water to an induced illness much more easily than they associate a light stimulus to illness. This finding is not unreasonable since it seems to suggest that an organism's learning system is ready to associate logically related information. In other words, an organism's brain is organized in such a way that it is complementary to the organization inherent in creation.

New Directions

Cognitive Theory

As we have seen, behavioristic notions have been found to be lacking in their ability to explain how learning occurs. New cognitive or mentalistic theories of learning have gained popularity in explaining much of the animal research. The usual explanation now given for the process of learning in classical or operant conditioning situations is that the animal or person gathers information relevant to any learning task, organizes that information into some meaningful scheme or rule, and then acts on that scheme when motivated to do so. Therefore, the definition of learning is no longer based solely on performance, but is thought to reflect a change in the person's cognitive structure. From this starting point cognitive psychology has attempted to determine how this organizing occurs and how information is processed by examining such internal mental processes as memory, consciousness, and concept formation.

However, cognitive psychology is a long way from being able to tie together all aspects of the learning process. We as Christians need to respond to the challenge and help to shape the ongoing development of cognitive learning theory.

One of the fundamental precepts of cognitive psychology is that new incoming information alters old, previously stored information, and old information affects the way in which new information is received, organized, and stored. A simple example of how an older memory structure affects incoming information is the way in which people memorize a list of words. If a group of subjects in an experiment are given a list of words to memorize, and then ten minutes later are asked to recall the list, they tend to recall the list according to categories rather than in the order presented. For example, if the list had been "apple, tree, horse, bush, orange, cow," the subjects would tend to recall as follows: "apple, orange, horse, cow, tree, bush." Most people do this type of mental organization without being aware of it. This type of recall suggests that we tend to organize new information according an existing organization.

New information can also affect old memories. In one experiment (Loftus & Palmer, 1973) subjects were shown a film about a traffic accident and were then asked questions about what they had witnessed. Those who were asked, "How fast were the cars going when they smashed into each other?" gave much higher estimates of speed than those subjects who were asked "How fast were the cars going when they hit each other?" A week later when asked if they had seen any broken glass, the people who had been asked the question "smashed into" were twice as likely to say yes, even though no glass had actually been broken.

What these and many other experiments suggest is that we are constantly organizing and reorganizing new and old information into coherent schemes. This process has been termed bottom-up and top-down processing. Both of these ideas are similar to Piaget's

notions of assimilation and accommodation. Top-down processing refers to applying a certain principle, already formed, to the processing of new information. The organizing principle in any set of information is imposed onto it by a preexisting scheme. Bottom-up processing refers to abstracting a new principle or discovering a common element inherent in the pieces of information without the aid of preexisting schemes. In other words bottom-up processing is data-driven. Thus learning involves the constant interplay between new abstractions and existing principles. As Palmer (1975) notes, it is impossible to determine which type of processing comes first or is most important,

. . . which happens first: interpreting the whole or interpreting the parts? How can someone recognize a face until he has first recognized the eyes, nose, mouth, and ears? Then again, how can someone recognize the eyes, nose, mouth, and ears until he knows that they are part of a face? This is often called the parsing paradox. It concerns the difficulties encountered with either a pure "bottom-up" (part-to-whole) or a pure "top-down" (whole-to-part) strategy in interpretive processing. (p. 295)

One solution to the dilemma is to assume that organisms possess a preexisting structure of knowledge when they enter the world. As stated previously, organisms appear to have a learning structure which contains an inherent organization.

Before assuming that we have a complete picture of cognitive theories, we must recognize recent findings in cognitive psychology related to personality. Increasingly, studies in problem solving and concept formation demonstrate that individuals differ greatly in the way they integrate information into a new principle. Although learning is unified and operates according to basic principles, God has

created a variety of individual styles within this framework. Certainly this must be considered when developing a theory of instruction.

A final issue related to cognitive issues which must be resolved is whether or not we are still capable of a reflexive type of learning in addition to concept learning. As we have seen, animals appear to respond automatically or reflexively at times. We may also recognize that learning principles alone will not help us in playing basketball; we must also practice so that certain actions become automatic. Indeed principles, abstractions, and rules seem to have little relevance when executing a "slam-dunk." Although cognitive psychology has been weak in explaining this type of learning, an understanding of brain function may help us here.

When a ballet dancer first executes a new move, a portion of the brain responsible for voluntary movement is at work. However, with practice the movements become almost programmed and are increasingly controlled by a different area of the brain, the cerebellum, which is responsible for controlling finely tuned movements. Thus learning still occurs by a constant modification of a principle or rule, but when the task becomes well-learned, it is put on "automatic-pilot."

We experience this phenomenon sometimes when driving our cars. When going to the bread store we may make a turn toward our place of employment rather than toward the bread store if we are not paying close attention. We do this because we tend to set in motion a whole set of prerecorded behaviors (often called scripts) whenever we begin a familiar task. However, we can at any time override these habits or alter the habit with new practice. Therefore, practice with constant feedback is important for translating concepts into behavior.

We have now arrived at a totally different view of what learning is: the abstraction of information into principles and then, with informational feedback, being able to put

those principles into practice. Under this approach, rote memorization is not a form of learning. This should not be too surprising since our everyday language already reflects this idea. For example, when discussing the progress of human society we often say, "Humankind is learning more all the time." This statement does not imply the acquisition of more facts as a society but suggests that humankind has discovered principles—principles which already exist in the created order.

Toward a Christian Theory of Learning

Cognitive approaches should not be considered to be synonymous with a Christian theory of learning. Cognitive theories still reduce learning to specific mechanical events which are sterile and lack any notion of personhood. However, we can see that the cognitive approach comes much closer to the Biblical principle that man makes responsible choices. In addition, the notion that we organize incoming information according to existing principles has close parallels to the idea of applying the heart to what we see.

When we learn, we first of all learn from the "laws written on our hearts," as well as from the Holy Spirit. We are not blank slates when we enter this world as the behaviorists propose but come endowed with a cognitive structure shaped by genetic, physical, emotional, and spiritual characteristics (all of which are established by our creator). Our cognitive structure is ordered in such a way that relationships in the created order coincide with the way in which we learn. We do not acquire new information in a vacuum but we come with a set of presuppositions about the world. When we see the world for the first time we already know that God is in control and this should shape how we organize information.

Top-down and bottom-up processing, if they are occurring, are constantly being shape by God's guiding hand. We not only apply our cognitive structure to new learning, but we apply the sum total of our

emotional, cognitive, and spiritual nature to new information. In this way we are truly discontinuous from the animals because God has not established a special relationship with animals as with humankind. An animal enters the world with a cognitive structure established only by its genetic inheritance and is not endowed with the ability to apply spiritual principles to new learning.

Of course there is a dark side to human learning. Sin has perverted human nature, our relationship to God, and our heart. Therefore in an apostate condition, a person can organize new information but oftentimes that organization is perverted and does not match the original order created by God. True wisdom comes only when, through redemption, regeneration, and sanctification, our whole being is restored.

Educational Applications

How does this somewhat expanded cognitive theory of learning relate to education? Many educators, despite the demise of behaviorism, have clung to the behavioristic notions that learning involves shaping or training behavior through rewards. Classroom instruction methods have emphasized strict adherence to behavioral principles and to a technological approach of recording and modifying behavior (Ornstein & Levine, 1981). Even newer cognitive approaches to instruction emphasize the importance of behavioral output while ignoring the heart of the person.

Given the previous discussion, what are some of the specific flaws with current approaches to education? First of all, behaviors, as we have seen, are not reflexive or automatic but are responsible and involve acting out all of our knowledge, experience, emotions, etc. Therefore behavioristic programs emphasizing output may change behavior but they may be doing little to increase learning. Second, current approaches overemphasize the distinction between learning and motivation, assuming that motivation must be present for learning to

occur. Learning occurs spontaneously as we have seen and the student is constantly acquiring and integrating information. The question educators should be asking is what type of learning is already occurring and how can I influence the process. Third, the behavioristic influence causes educators to emphasize the output of facts, or the performance of discrete skills. Tests become geared to rote memorization or systematic restatements of information given. This restating of facts is not learning.

What possible solutions can we glean from a Christian theory of learning? Although it is beyond the scope of this paper to give a comprehensive approach to instruction, I will offer a few guidelines.

1. Learning must involve Biblically based abstraction. Only when teachers aid students in abstracting from the basic information by constantly applying a Christian framework for abstraction can students truly learn Biblical principles.

2. Learning in the classroom must involve the whole person. Information should not be presented sterilely or out of the context of a whole person. By involving the student's emotions, actions, and knowledge, teachers help students learn to abstract more easily and with very little memorization because the knowledge will now be part of the student's whole intellectual and emotional nature. Visual aids make only a small step in this direction by allowing more than verbal aspects of information to be integrated. More work must be done to discover experiential learning approaches (such as role playing) which allow all of the student's personality and senses to take part in the learning process. Very little extrinsic motivation needs to be applied if students are able to make discoveries and see relationships that involve the whole person.

3. Learning must become more than memorization or repetition. Lectures, exercise, and tests must be able to lead the student to a new level of understanding. For example, instructors should present information, then organize the information, and

then lead the student to abstract the information into a new principle. It is important that the students actually abstract (always with the teacher's guidance), rather than having the teacher do it for them. The tests should ask not only about the specific information but also about the new principles which should have been abstracted from the information.

4. Since practicing and performance are important as we have seen, and since concepts need to be translated into action, teachers must allow students to practice the principle through drills, exercises, performances or any experience which calls for the student to be active. Feedback is always a necessary component in learning.

5. Teachers must always remember that some types of information are not as easily learned as other types. Our brains easily receive some concepts such as "all squares are parallelograms," but have a difficult time with such concepts as the Holy Trinity. In addition, cognitive styles, personalities, and approaches are unique to each individual. Teachers must find new methods to determine basic individual abilities and styles of learning and individualize instruction to help each student integrate information more successfully.

Endnotes

¹In a chain of associations one CS can serve as a US for a new CS (after extensive training) producing a chain of CS's diagramed as: CS₃ → CS₂ → CS₁ → CR.

²A Neobehaviorist still puts an emphasis on measuring behavior as the primary method of psychological study but usually assumes a more elaborate underlying process.

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