THEORIES OF LEARNING

3. COGNITIVIST THEORIES

3.1. Cognitivism Overview

In psychology, cognitivism is a theoretical framework for understanding the mind that gained credence in the 1950s. The movement was a response to behaviorism, which cognitivists said neglected to explain cognition. Cognitive psychology derived its name from the Latin cognoscere, referring to knowing and information, thus cognitive psychology is an information-processing psychology derived in part from earlier traditions of the investigation of thought and problem solving. Behaviorists acknowledged the existence of thinking, but identified it as a behavior. Cognitivists argued that the way people think impacts their behavior and therefore cannot be a behavior in and of itself. Cognitivists later argued that thinking is so essential to psychology that the study of thinking should become its own field. Cognitivism has two major components, one methodological, the other theoretical. Methodologically, cognitivism adopts a positivist approach and the belief that psychology can be (in principle) fully explained by the use of experiment, measurement and the scientific method. This is also largely a reductionist goal, with the belief that individual components of mental function the, cognitive architecture, can be identified and meaningfully understood. The second is the belief that cognition consists of discrete, internal mental states (representations or symbols) whose manipulation can be described in terms of rules or algorithms.

Cognitivism became the dominant force in psychology in the late-20th century, replacing behaviorism as the most popular paradigm for understanding mental function. Cognitive psychology is not a wholesale refutation of behaviorism, but rather an expansion that accepts that mental states exist. This was due to the increasing criticism towards the end of the 1950s of simplistic learning models. The main issues that interest cognitive psychologists are the inner mechanisms of human thought and the processes of knowing. Cognitive psychologists have attempted to shed some light on the alleged mental structures that stand in a causal relationship to our physical actions.

3.2. Attribution Theory

In social psychology, attribution is the process by which individuals explain the causes of behavior and events. Attribution theory is the study of various models that attempt to explain those processes. Psychological research into attribution began with the work of Fritz Heider in the early part of the 20th century, subsequently developed by others such as Harold Kelley and Bernard Weiner. Psychological research into attribution began with the work of Fritz Heider, often described as the "father of attribution theory", during the early years of the 20th century. In his 1920's dissertation Heider addressed a fundamental problem of phenomenology: why do perceivers attribute the properties of an object they sense, such as its color, texture and so on, to the object itself when those properties exist only in their minds? Heider's answer was to consider the object being perceived and the physical media by which it is sensed, the ticking of a watch causing vibrations in the air for instance, to be quite distinct, and that what the perceiver's senses do is to reconstruct an object from its effect on the media, a process he called attribution. Heider subsequently extended his ideas to the question of how people perceive each other, and in particular how they account for each other's behavior, person perception. Motives played an important role in Heider's model where motives, intentions, sentiments are considered the core processes which manifest themselves in overt behavior. Heider distinguished between personal causality, such as offering someone a drink, and impersonal causality such as sneezing, or leaves falling. Later attribution theorists have tended to see Heider's fundamental distinction as being between person (or internal) causes and situation (or external) causes of behavior.

Explanatory Attribution

People make explanatory attributions to understand the world around them and to seek reasons for a particular event. With explanatory attributions, people can make judgments as to what was the cause of a certain event, even if it turns out the proposed cause is unrelated to the event. For example, if Jacob’s car tire is punctured he may attribute that to a hole in the road; by making attributions to the poor condition of the highway, he can make sense of the event without any discomfiture that it may in reality have been the result of his bad driving.

Interpersonal Attribution

Sometimes, when your action or motives for the action are questioned, you need to explain the reasons for your action. Interpersonal attributions happen when the

causes of the events involve two or more individuals. More specifically, it is likely that one will always want to present oneself in the most positive light in interpersonal attributions. For example, if a sibling were to accidentally break their mother's favorite tea pot, the sibling will be more likely to blame the other sibling in order to shift blame away from him/herself.

3.3. Cognitive Load Theory

Cognitive load theory has been designed to provide guidelines intended to assist in the presentation of information in a manner that encourages learner activities that optimize intellectual performance. John Sweller's theory employs aspects of information processing theory to emphasize the inherent limitations of concurrent working memory load on learning during instruction. It makes use of the schema as primary unit of analysis for the design of instructional materials. Studying learners as they solved problems, he and his associates found that learners often use a problem solving strategy called means ends analysis. He suggests problem solving by means ends analysis requires a relatively large amount of cognitive processing capacity, which may not be devoted to schema construction. Sweller suggests that instructional designers should prevent this unnecessary cognitive load by designing instructional materials which do not involve problem solving. Examples of alternative instructional materials include what are known as worked examples and goal-free problems.

In the 1990s, cognitive load theory was applied in several contexts. The empirical results from these studies led to the demonstration of several learning effects: the completion-problem effect; modality effect; split-attention effect; worked example effect; and expertise reversal effect. Cognitive load theory provides a general framework and has broad implications for instructional design, by allowing instructional designers to control the conditions of learning within an environment or, more generally, within most instructional materials. Specifically, it provides empirically-based guidelines that help instructional designers decrease extraneous cognitive load during learning and thus refocus the learner's attention toward germane materials, thereby increasing germane (schema related) cognitive load. This theory differentiates between three types of cognitive load: intrinsic cognitive load, germane cognitive load, and extraneous cognitive load.

3.4. Cognitive Theory of Multimedia Learning

E-learning theory describes the cognitive science principles of effective multimedia e-learning. Cognitive research and theory suggest that selection of appropriate concurrent multimedia modalities may enhance learning, as may application of several other principles. Richard E. Mayer's modality principle states that if materials contain both verbal and graphical information, the verbal information should be given in auditory format only, and not as written text as well. Theoretically, the modality principle is based on a model of working memory by Alan Baddeley and Graham Hitch who proposed that working memory has two largely independent sub-components that tend to work in parallel one visual and one verbal/acoustic. This gave rise to dual-coding theory, first proposed by Allan Paivio and later applied to multimedia by Richard Mayer. According to Mayer, separate channels of working memory process auditory and visual information. Consequently, a learner can use more cognitive processing capacities to study materials that combine auditory verbal information with visual graphical information than to process materials that combine printed (visual) text with visual graphical information. In other words, the multi modal materials reduce the cognitive load imposed on working memory.

In a series of studies Mayer and his colleagues tested Paivio's dual-coding theory, with multimedia. They repeatedly found that students learning given multimedia with animation and narration consistently did better on transfer questions than those who learn from animation and text-based materials. That is, they were significantly better when it came to applying what they had learned after receiving multimedia rather than mono-media (visual only) instruction. These results were then later confirmed by other groups of researchers. The initial studies of multimedia learning were limited to logical scientific processes that centered on cause-and-effect systems like automobile braking systems, how a bicycle pump works, or cloud formation. However, subsequent investigations found that the modality effect extended to other areas of learning. Split attention effect Mayer found that students learn better from animation and narration than from animation, narration, and on-screen text. Thus, it is better to eliminate redundant material. Learners do not learn as well when they both hear and see the same verbal message during a presentation. This is a special case of the split attention effect of Sweller and Chandler. Learning is enhanced when related components such as words and pictures are presented in spatial contiguity, referring to the components being physically close to each other on the page or screen, rather than being separated. Similarly, temporal contiguity refers to simultaneous presentation of corresponding words and pictures, rather than successive delivery. Learning is more effective

when extraneous material is excluded rather than included, which Meyer termed, coherence. The effects of improved design have more benefit for low knowledge than high knowledge learners, and for high-spatial than for low spatial learners.

3.5. Elaboration Theory

According to elaboration theory, instruction should be organized in increasing order of complexity for optimal learning. For example, when teaching a procedural task, the simplest version of the task is presented first; subsequent lessons present additional versions until the full range of tasks are taught. In each lesson, the learner should be reminded of all versions taught so far (summary/synthesis). A key idea of elaboration theory is that the learner needs to develop a meaningful context into which subsequent ideas and skills can be assimilated. Elaboration theory proposes seven major strategy components: (1) an elaborative sequence, (2) learning prerequisite sequences, (3) summary, (4) synthesis, (5) analogies, (6) cognitive strategies, and (7) learner control. The first component is the most critical as far as elaboration theory is concerned. The elaborative sequence is defined as a simple to complex sequence in which the first lesson epitomizes (rather than summarize or abstract) the ideas and skills that follow. Epitomizing should be done on the basis of a single type of content (concepts, procedures, principles), although two or more types may be elaborated simultaneously, and should involve the learning of just a few fundamental or representative ideas or skills at the application level.

It is claimed that the elaboration approach results in the formation of more stable cognitive structures and therefore better retention and transfer, increased learner motivation through the creation of meaningful learning contexts, and the provision of information about the content that allows informed learner control. Elaboration theory is an extension of the work of Ausubel's advance organizers and Bruner's spiral curriculum. Elaboration theory applies to the design of instruction for the cognitive domain. The theoretical framework has been applied to a number of settings in higher education and training.

3.6. Stage Theory of Cognitive Development

According to psychologist Jean Piaget, children progress through a series of four key stages of cognitive development. Each stage is marked by shifts in how kids understand the world. Piaget believed that children are like little scientists and

that they actively try to explore and make sense of the world around them. Through his observations of his own children, Piaget developed a stage theory of intellectual development that included four distinct stages: the sensorimotor stage, from birth to age 2; the preoperational stage, from age 2 to about age 7; the concrete operational stage, from age 7 to 11; and the formal operational stage, which begins in adolescence and spans into adulthood.

Piaget's stage theory describes the cognitive development of children. Cognitive development involves changes in cognitive process and abilities. In Piaget's view, early cognitive development involves processes based upon actions and later progresses into changes in mental operations.

A Quick Summary of Cognitive Development

- The Sensorimotor Stage: During this stage, infants and toddlers acquire knowledge through sensory experiences and manipulating objects.
- The Preoperational Stage: At this stage, kids learn through pretend play but still struggle with logic and taking the point of view of other people.
- The Concrete Operational Stage: Kids at this point of development begin to think more logically, but their thinking can also be very rigid. They tend to struggle with abstract and hypothetical concepts.
- The Formal Operational Stage: The final stage of Piaget's theory involves an increase in logic, the ability to use deductive reasoning, and an understanding of abstract ideas.

It is important to note that Piaget did not view children's intellectual development at a quantitative process; that is, kids do not just add more information and knowledge to their existing knowledge as they get older. Instead, Piaget suggested that there is a qualitative change in how children think as they gradually process through these four stages. A child at age 7 doesn't just have more information about the world than he did at age 2; there is a fundamental change in how he thinks about the world.