Cognitive Psychology

Anytime we categorize any phenomena, we run the risk of misinterpretation. Today, most psychologists classify human growth and development as cognitive, social, psychological, and physical. And although an individual grows and develops along all these fronts, most psychologists agree that learning in school is mainly cognitive in nature. Despite this acknowledgment, some psychologists, known as developmentalists, are more concerned with the developmental aspect of human learning; others, known as cognitive structuralists, focus more on the way in which content is structured for learning; and a third major group, the cognitive scientists, investigates the various cognitive structures that individuals create in order to generate meaning and ultimately knowledge. Constructivism, a fashionable and overused term today, is nothing more than old-fashioned John Dewey, Jean Piaget, and Jerome Bruner mixed together with some new vocabulary in which students acquire learning strategies and integrate (or construct) new information with social experiences to form new knowledge. It represents the learners' awareness of and control over cognitive processes—usually high-order mental processes.

Constructivism is rooted in the pedagogy of progressivism and humanistic education. Curriculum and teaching are student centered, focusing on child-centered activities and projects (Pestallozi, Froebel, Kilpatrick, and Rugg), problem-solving methods (Dewey, Piaget, Sternberg, and Tyler), and discovery learning (Ausubel, Broudy, Bruner, and Vygotsky). These teaching and learning methods have been the basis of school reform since the turn of the twentieth century, coinciding with the rise of progressivism and the decline of perennialism (which dominated U.S. education for the first 150 years). In theory, the idea is to reduce or eliminate the teacher-centered, text—centered, and rote-centered method of instruction, and to change to a student-centered approach. In practice, however, many of the progressive and student-centered ideas have remained as reform slogans, printed in education textbooks, purported as recommendations among most professors of elementary education and educational psychology, but seldom adopted by teachers on a large scale.

Most, if not all, psychologists and educators would agree that cognitive psychology (and constructivism) represents the dominant school of thought, and learning is the sum total of the results of human interactions with their world. However, there is no agreed-upon way to determine exactly to what extent the characteristics (cognitive, social, psychological, and physical) of an individual are the result of

inherited limitations or potential (harmful or favorable circumstances), or his or her environment. Considerable controversy continues about the extent or role of heredity versus environment in determining cognitive outcomes (that is, IQ scores and achievement scores) in school. As an increasing number of educators view the results of schooling as more than just achievement scores, these debates are likely to intensify. It is essential that teachers be aware of these debates because the issue affects teaching and learning theories.

Piaget's Cognitive Theory

Most cognitive theory is developmental; that is, it supposes that growth and development occur in progressive stages. Jean Piaget resents the most comprehensive view of this theory. The Swiss psychologist's work came to the attention of American educators during the 1950s and 1960s—coinciding with the rising influence of cognitive developmental psychology, environmentalist theories, and the subsequent compensatory education movement.

Like many other investigators today, Piaget describes cognitive development in terms of stages from birth to maturity. The overall stages can be summarized as follows:

1. Sensorimotor stage (birth to age 2). The child progresses from reflex operations and undifferentiated surroundings to complex sensorimotor actions in relation to environmental patterns. The child comes to realize that objects have permanence; they can be found again. He or she begins to establish simple relations between similar objects.

2. Preoperational stage (ages 2 to 7). In this stage, objects and events begin to take on symbolic meaning. For example, a chair is for sitting; a sweater is for wearing, and so on. The child shows an increased ability to learn more complex concepts from experience so long as familiar examples are provided from which to extract criteria that define the concept. (For example, oranges, apples, and bananas are fruit; the child should have the chance to touch and eat them.)

3. Concrete operations stage (ages 7 to 11). The child begins to organize data into logical relationships and gains facility in manipulating data in problem-solving situations. This learning situation occurs, however, only if concrete objects are available or if actual past experiences can be drawn upon. The child is able to make judgments in terms of reversibility and reciprocal relations (e.g., that the left and right are relative to spatial relations) and conservation (e.g., a long narrow glass may hold the same amount of water as short wide one).

4. Formal operations stage (age 11 and onward). This stage is characterized by the development of formal and abstract operations. The adolescent is able to analyze ideas and comprehend spatial and temporal relationships. The young person can think logically about abstract data, evaluate data according to acceptable criteria, formulate hypotheses, and deduce possible consequences from them. He or she can construct theories and reach conclusions without having had direct experience in the subject. At this stage (by age 15 to 16), there are few or no limitations on what the adolescent can learn; learning depends on his or her intellectual potential and environmental experiences. Theoretically, by age 16, a student should be able to learn any subject, including advanced courses in calculus, physics, statistics, or philosophy. The only possible barrier, besides the teacher's low expectations of the student, is in the lack of learner's prerequisite content. In short, there is no longer need to postpone "tough" or highly abstract subject matter.

Piaget's cognitive stages presuppose a maturation process in the sense that development is a continuation and is based on previous growth. The mental operations are sequential and successive. The stages are hierarchical, and they form an order of increasingly sophisticated and integrated mental operations. Although the succession of stages is constant, stages of attainment vary within certain limits that are a function of heredity and environment. Although hereditary or environmental factors may speed up or slow down cognitive development, they do not change the stages or the sequence.

Environmental experience is the key to Piaget's cognitive theories, as it was also the crux of Dewey's learning principles. The educator's role involves "the shaping of actual experience by environing conditions" and knowing "what surroundings are conducive to having experiences that lead to growth." Three basic cognitive processes form the basis of the environmental and experiential theories of both Piaget and Dewey.

For Piaget, assimilation is the incorporation of new experiences into existing experiences; it represents a coordination of the child's experiences into his or her environment. But assimilation alone does not have the capacity to handle new situations and new problems in context with present cognitive structures. The child must organize and develop new cognitive structures in context with existing structures—that is, how he or she thinks. This is accommodation, whereby the child's existing structures are modified and adapted in response to his or her environment. Equilibration is the process of achieving balance between those things

that were previously understood and those yet to be understood; it refers to the dual process of assimilation and accommodation of one's environment.

This coincides with Dewey's "conceptions of situation and interaction [which] are inseparable from each other" and which form the basis of continuity. For Dewey, a situation represents the experiences of the environment affecting the child, similar to Piaget's assimilation. Interaction is concerned with current or latitudinal transactions taking place between the child and his or her environment, including his or her, capacities to establish meaning, similar to Piaget's accommodation. Continuity refers to longitudinal learning or to situations and interactions that follow, similar to Piaget's equilibration.

Bruner: Structure of Subject Matter

The notion of structure of subject matter advocated by Jerome Bruner and Phil Phenix during the post-World War II era encourages the teacher to teach "deep understanding" of the content, the basic logic or structure of each major discipline—the key relationships, concepts, principles, and research methods. This is what Harry Broudy called "applicable knowledge," what Lee J. Schulman called "proc/tizclural knowledge," what E. D. Hirsh called "process," and what some old-fashioned educators, including John Dewey, might call "problem solving" and some more recent educators, such as Lauren Resnick and Robert Sternberg, might call "critical thinking."

The idea is to go beyond the realm of knowledge to a higher-order process—such as understanding, analysis, and problem solving by teaching the underlying concepts and principles of a subject. It is important to teach learners how to learn on their own, to inquire and hypothesize, by using the investigative methods of the subject to acquire and assimilate new information. The student who cultivates fluency with this mode of inquiry attains mastery of the content area and is able to continue, independently, self-paced learning in the subject area. As Jacques Barzum said more than half century ago, the results of a good education produce learners who are capable of, and very much inclined toward, lifelong growth and education.

Age is not a hindrance. The process can start at the primary-grade levels. The need for the teacher is to teach the concepts and principles of the subject that are relevant and meaningful to the age (and abilities) of the student. For instance, first graders may be asked by the teacher to rub their hands together and feel the heat produced—a concept that deals with high school physics but taught in a manner suitable for the child. For supporters of this approach, when learning

science or mathematics, students would employ the methods of scientists or mathematicians. When studying history or geography, the students would employ the methods of historians and geographers. The goal is for students to become "little scholars" in their respective fields—and for high-achieving students to take more demanding coursework.

Subjects such as language arts, social studies, general science, and global studies are not considered "real" subjects, or what Brunet refers to as "disciplines," because they lack structure and a clear domain of knowledge. These are broad field subjects, an idea originally popularized in the 1940s and 1950s, and based on an interdisciplinary design in an effort to correct what many educators (including John Dewey and later Ralph Tyler) considered the fragmentation and compartmentalization of subject matter. Whereas the broad fields approach is an attempt to integrate content that appears to fit logically (language arts, social studies, etc.), the notion of "structure" and "disciplined knowledge" represents the content of a separate field of study (English, mathematics, history, science or foreign languages).

Piaget's equilibration forms the basis of Bruner's notion of a spiral curriculum, in which previous learning is the basis of subsequent learning, learning is continuous, and content in a subject field is related to and built and expands on a foundation (from grade to grade). Bruner is also influenced by Dewey, who uses the term continuity in learning to explain that what a person has already learned "becomes an instrument of understanding and dealing effectively with the situations that follow." Bruner uses the term continuity, in the same way as Piaget and Dewey, to describe the spiral curriculum: how subject matter and mental operations can be "continually deepened by using them in a progressively more complex form."

Bruner considers that the act of learning consists of three related mental processes, similar to Piaget's cognitive processes:

1. Acquisition is the grasping of new information; it mainly corresponds to Piaget's assimilation. Such information may be new to one's store of data, may replace previously acquired information, or may merely refine or further qualify previous information.

2. Transformation is the individual's capacity to process new information so as to transcend or go beyond it. Means for processing such information are extrapolation, interpolation, or translation into another form; it overlaps somewhat with Piaget's accommodation.

3. Evaluation is the determination of whether information has been processed in a way that renders it appropriate for dealing with a particular task or problem. It closely corresponds with equilibration.