

Cognitive Theories that Guide Online Course Design

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INTRODUCTION

Cognitivism comes from one of three schools of psychology in which theories are categorized. The other two schools are the schools of behaviorism and humanism. It is believed that one school of theory is not better than the other, and individuals are encouraged to apply the theory that is the most appropriate for the student. Theories from the school of cognitivism guide students to process information in ways that are meaningful to the student. One of the most important goals of cognitive theories is for students to become independent learners. Struggling learners are guided through the learning process with learning strategies, and the lessons are based on declarative and procedural learning tasks in authentic learning environments (Grabinger, 2004; Tomei, 2007).

COGNITIVE THEORIES AND ONLINE DESIGN

In the past, theorists such as Jean Piaget, Lev Vygotsky, Erik Erikson, and David Ausubel developed theories that not only became widely accepted, but they brought other professionals from the field to develop other cognitive theories. Piaget is known for his work on schemes of knowledge. He presents two ways in which individuals adapt new knowledge. They either use assimilation theory by taking the new knowledge and making sense of it with schemes of knowledge that they already know, or they use accommodation theory by taking their existing schemes of knowledge and adjusting them so that the new knowledge can fit into a scheme. Piaget is also remembered for the stages of cognitive development. The four stages, sensorimotor, preoperational, concrete operational, and formal operations, take place during certain years of an individual's life. Educators are encouraged to keep these stages in mind when designing instruction (Joyce, Weil, & Calhoun, 2000; Tomei, 2007).

Lev Vygotsky is known for zone of proximal development theory. His theory guides instructors to guide students to work in the developmental zone in which they are capable of learning. Erik Erikson's work presents the stages of psychosocial development through which individuals develop as they grow older. This theory guides educators to focus on a student's needs based on the society in which they are growing. David Ausubel shows us how to use his theory on advanced organizers. The organizers are supposed to serve as a conceptual bridge between the current and new knowledge. He believes that people acquire knowledge through reception, not discovery (Joyce et al., 2000; Tomei, 2007). The work of these accomplished theorists is being used in learner-centered theory and practice in various distance education programs. Other forms of theory from the school of cognitivism that are being used by instructors include theory of multiple representations, cognitive flexibility theory, Bruner's three-form theory, dual-coding theory, Gagne's conditions of learning, Merrill's instructional transaction theory, and Moore's theory of transactional distance.

Theory of Multiple Representations

Applying multiple representations that connect to content of subject matter is thought to be a valuable practice, because students can build mental representations with the information. They can make the information meaningful to themselves by assigning different representations to the information. Web environments and computer mediated discussions are said to be conducive to the application of multiple representations during course design (Huang & Liaw, 2004). Researchers provide support and they raise cautions when it comes to using multiple representations during instruction (Gfeller, Niess, & Lederman, 1999; Huang & Liaw, 2004; Moreno, 2002; Ying-Shao & Fu-Kwun, 2002). Cognitive psychologist Allan Paivio states that this is a difficult concept, because there are two coding approaches to the concept. It is not easy, because

individuals are required to figure out how to represent the information mentally, and they have to find ways to apply the information in the real world. It is also a difficult theory to utilize, because the information that needs to be represented can be concrete and abstract. Instructors who use this theory when designing curriculum need to remember that individuals have their own internal representations of information which can cause the message that the instructor is trying to get across to come out differently as the information becomes externalized (Paivio, 1990).

Cognitive Flexibility Theory

Jonassen (2003) explains that much research looks at the presentation of problems to learners and identifies two conflicts with how problems that need to be solved are presented. First, the problems are presented as structured problems. Real life problems are ill-structured. Second, students do not transfer problem solving skills very well. Research considers the role of tools that can be used to help externalize students' internal representations. Semantic networks, expert systems, and systems modeling tools are three types of cognitive tools that this researcher uses to study the efficacy of using them to externalize internal representations. Learning how to represent the problems being solved is vital when it comes to transferring skills so structured and ill-structured problems can be solved. According to Jonassen, problem representation is the main factor. Students must be helped by the instructor to learn to build problem representations that integrate their internal representations with knowledge domains. The better a student is at externalizing representations the better the student is at solving problems. Jonassen writes that there are three ways learners can go about building representations: through the development of mental representations, making internal maps of problems, and using tools to externalize problem representations. An example of a cognitive tool is a concept or semantic map. These maps or graphs help students build spatial representations of concepts that help them see connections between abstract concepts and reality so they can solve a problem more realistically.

Bruner's Three-Form Theory

Bruner (1990) states that there are three ways from which individuals see the world: through action,

through icons, and through symbols. They use action to perform or demonstrate what it is they see about the world from their perspective. Icons or mental images are used to present a path, summary, or pattern. Symbolism which is an abstract way of visualizing reality through the use of words and numbers is the third form that individuals use. According to Bruner, these three forms of representation are founded on the theory that development must be effectively related to theories of knowledge and instruction.

Vacca and Vacca (1998) discuss Bruner's work on scaffolding and the development of categories. They refer to scaffolds as a form of support and compare it to the scaffolds used by construction workers to lift themselves up so they can make achievements that they could not make without the support. Instructors are to provide all learners with support. Helping students recognize what they know, what is new, and building new categories makes the environment less complex and more constant. According to Bruner (1990), how learners make meaning relies greatly on cultural connections with their own convictions, objectives, aspirations, and dedication to the learning. Eisner (1991) extends this thought by saying that students' whose interests are ignored lack motivation to learn. Vacca and Vacca (1998) find that building schemes of knowledge with categories is linked with the need to be motivated. Learners need to be emotionally involved, and instructors need to identify what the students know, what they need to know, and how well the learners already know so learners have an opportunity to be emotionally motivated to become active learners.

Dual-Coding Theory

Another strategy used by online instructors when designing and implementing courses is to apply dual-coding theory. Through this theory, the systems of verbal and imagery processing can be used independently or simultaneously through the support of verbal and imagery subsystems. The verbal subsystems help with the presentation and processing of information. Imagery subsystems aid in the development of images, sounds, actions, and responses of emotion that are not always available when nonverbal cues cannot be shared (Huang & Liaw, 2004).

Conditions of this construct hold that we use both aural and visual paths to process information and make meaning. The aural and visual modalities that we each

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