An Examination of Constructivist-Driven Instructional Design and its Pedagogical Implications for Effective Learning

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Abstract:

The advances in technology, emphasis on constructivist instructional design methodologies, and an overall need for meaningful learning have catapulted the need for effective learning environments and delivery models. This paper provides some of the background necessary to better understand the integration of these symbiotic elements and the need for facilitators, instructors and teachers to better understand the design and development of learning programs that promote cognitive growth and promote learner success. The main advantage of high-tech learning environments can be found in their ability to provide a variety of effective instructional methods delivered in accord with cognitive and constructivist learning principles.

Key Words:

Constructivist, instructional design, learner success, instructional methods.

Introduction

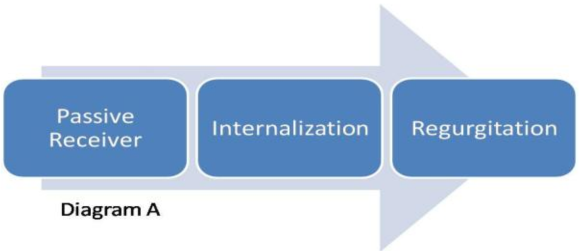
Constructivist principles have for many years provided a methodology for recent pedagogical and instructional design movements. These pedagogical reform efforts reflect the view that “the acquisition of knowledge is not a simple straightforward matter of ‘transmission,’ ‘internalization,’ or ‘accumulation’ but rather a matter of the learners’ active engagement in assembling, extending, restoring, interpreting, or in broadest terms, constructing knowledge out of raw materials of experience and provided information” (Salomon & Perkins, 1998, p. 115). In today’s era of rapid advancing technologies and instructional design strategies, the learner has in many ways become a learner in the knowledge era. According to Staron, Jasinski, and Weatherley (2006), the knowledge era is defined by its complexity and rapidity generating multiple priorities and creating high levels of energy and opportunities for learners and workers: “It is an ‘intangible era’ where the growing economic commodity is knowledge itself more so than goods and services. It is not just about accessing information but about how we learn to continually select, borrow, interpret, share, contextualize, generate and apply knowledge to our work” (p. 3).

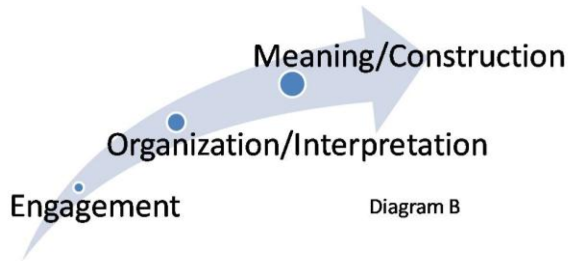
This view of the learner – as an active sense-maker who must apply knowledge to be successful – has resulted in learners who must be advance organizers. An advance organizer uses information that is presented prior to learning to organize and interpret new incoming information (Mayer & Massa, 2003). In addition, for these learners to be effective, they must understand and apply knowledge in increasingly ascending levels of complexity. This cognitive need demands that instructional strategies and techniques employ scaffolding principles.

Scaffolding was originally described by Presseley, Hogan, Wharton- McDonald, and Mistretta, (1996) “as an instructional technique wherein the instructor models the activity in detailed steps, then gradually shifts the responsibility to complete the task onto the learner” (Bellefeuille, Martin, & Buck, 2005, p. 381). Ausubel (1980) described schemata as providing ideational scaffolding, containing slots that can be instantiated with particular cases: “These schemata allow learners to organize information into meaningful units. This theory implies that the learner’s cognitive structure at the time of learning is the most important factor in determining the likelihood of successful learning. One instructional design principle derived from this theory pertains to the advance organizer--a brief outline based on the learner's existing knowledge, which serves as “ideational scaffolding” for new learning. He proposed that advance organizers could activate broader and more inclusive knowledge, providing a cognitive structure for new meaningful learning” (Molenda, Reigeluth, & Nelson, 2001).

Abrami (2001) indicated that constructivist approaches to learning endorse active (rather than passive) response for construction of meaning, in realistic (rather than artificial or non-referent) contexts for the learner. Construction of adaptive knowledge and authentic activities can give facilitators, instructors, and teachers the declarative and procedural scaffolding necessary for designing and implementing quality education. According to MacDonald (2005) “active learning is a process whereby learners are actively engaged in constructing knowledge in a meaningful, realistic context through exploration, reflection and social discourse with others, rather than passively receiving information.” As Martinez and Bunderson (2000) argue, learners will learn adaptively from an active environment that is designed to meet the objectives of a learning orientation. MacDonald (2005) recognizes that instructional designers must consider the four domains of active learning for active learning to be successful in an asynchronous environment: “Designers must provide, suggest, or enable various inputs within an authentic context, design contextually relevant activities that will promote transformation while providing any necessary support for performing theses activities, and call for contextually relevant outputs that demonstrate the learner’s new knowledge” (p. 4).

In the movement from the transmission-passive receiver model to the transmission-active engager model, the emphasis is on scaffolding so that the learner can construct complex, higher levels, of content interpretation and understanding. This fosters the learner’s ability to assimilate and assemble information so as to make meaning and build connections between the content and internalized schematic relevancies and constructed interpretations. In essence, we need to ensure our instructional design techniques and strategies follow the movement from diagram A to B.





Instructional Design and Technology

It is well accepted that those who desire to promote the use of technology as an effective delivery medium will contend that technology does not only serve as a meaningful delivery mechanism but can through instructional design methodologies facilitate thinking and knowledge construction (Jonassen, Campbell, & Davidson, 1994). It is also well established since Cooper (1993) that a relationship exists between instructional theory, its dependent technologies, and an implementation of designed instruction. The beginning of the instructional design movement centered on the concept of programmed instruction and its three primary stages: (1) analysis; (2) design; and (3) evaluation. The early success of programmed instruction seemed to suggest that machine technology and behaviorist principles were an effective combination. Although programmed instruction eventually declined as a substantive movement in American education, it provided much of the groundwork for contemporary instructional technology (e.g., Jonassen, et. al. 1994).

From a cognitive perspective, programmed instruction must meet the demands of individual learner differences. Therefore, the analysis phase of programmed instruction has to accommodate the evaluation of individual learner requirements and capabilities – among them cognitive styles and the ability to apply cognitive strategies. As a result, we can infer that instructional technologies should share a common purpose: to improve learning. Lamos (1984) argues that we continue to transition to a more complex CAI Paradigm, which is exemplified in experimental mechanisms, to move us closer to accommodating the individual differences in learning styles. The CAI – computer aided instruction – paradigm derives from behavioral and experimental psychology where the emphasis is on the instructional benefits of the technology components. The problem of integrating cognitive theory into the design of computer-based instruction has been systemic in the past in that instructional design models have not traditionally supported cognitively based activities.

One similarity between programmed instruction and contemporary online learning concerns the assumption of technological determinism. Another such similarity exists in that advocates of online learning see technology as a powerful change agent as well as a channel of efficiency. Instructional designers as well as technologists and development team members desire to maximize the efficiency of web-based instruction. As a result, the deployment of standardized, scaleable techniques drives much of the innovation, which is similar to the well-defined guidelines of programmed instruction.

The Development Process: Cognitive Strategies

Until the early 1990s, there was no proven theoretical or empirical framework to guide the effective design of web-based instruction. Schank (2002) reviews some of the basic learning theories, beginning with Dewey. He asserts that in order to create or design effective e-learning, there must be an emphasis on “what the learners should experience” (p. 17) and how we understand. The goal is to focus on the learner’s acquisition of “non-conscious” knowledge and the “reminding process.” Schank then delineates four-steps that should be practiced before starting the e-learning course design or development process. These four steps are (1) identify “well-defined, repeatable skills;” (2) identify the most pressing training need; not necessarily the most immediate; (3) identify the best subject matter expert’s (SME) appropriate to the job or task; and (4) gather “corporate memories” and stories since these have the most impact when integrated into the e-learning curriculum.

Schank (2002) reiterates the need for e-learning to be centered in the learner’s personal goals and emphasize practice. He suggests scriptlets (which focus on real-life situations) that allow for, what he terms, “in order to” learning. This effectively recreates a “doing,” practice-centered type of learning. The scriptlets, when combined together, work in conjunction to accomplish the goals of the learner. He also describes a methodology for the instructional design process that should have at its core the question “what will the learner be doing when the learner is using the courseware?” (pp. 91). Schank delineates the problem, the process, the instruction, the design, the timeline, the implementation review, and the final conversion to the overall specifications. His model is not, in my opinion, a rapid prototyping model but more akin to a traditional design specification process. A rapid prototyping model, as an instructional design process, emphasizes the “on-the-fly” development of the technology that is then tested, modified, and re-designed while engaged by users whereas the traditional design process urges deliberate design and testing without user engagement until there is a final, fully functional product.

According to Clark (1983), it is important to distinguish between media and methods, and carefully examine the role of each in the use of technology. Clark (1983) defines method as the “physical systems or vehicles used to deliver the information—such as face-to-face interaction, textbooks, or desktop computers and media as the techniques that are used to promote learning, such as multimedia” (p. 453). Frequently, media and methods are intertwined and combined in ways that prompt the question: What are the roles of media and method in instructional technology?

Two conflicting hypotheses have been offered to answer this question (Moreno & Mayer, 2002). “According to the media-affects-learning hypothesis, more advanced instructional technologies promote deeper learning, regardless of the instructional method. This hypothesis is consistent with 20th century efforts to integrate newer technologies into education and is based solely on the assumption that state-of-the-art technologies are more effective learning tools than older technologies. Conversely, the method-affects-learning hypothesis states that as long as the instructional methods embedded in the media promote appropriate cognitive processing during learning, the type of media delivering the method does not matter” (Moreno, 2006).

A central theme in cognitive load theory (Paas, Renkl, & Sweller, 2004) is that effective learning is dependent upon the interaction between the “architecture of their cognitive system and the learning environment.” In addition, there must be alignment in the instructional design process with cognitive tasks so as to promote deep and meaningful learning. “The design of powerful learning environments, in which instructional conditions are aligned with the cognitive architecture, requires understanding of the learner characteristics that affect the underlying knowledge structures and their interactions with the learning task” (Moreno, 2006).

It becomes obvious that the question of what makes instruction effective and meaningful has been the focus of educational and psychological research for many decades. Kauffman (2004) notes that cognitive strategy is one of the essential aspects of academic success and that in a web-based environment “prompts that encourage cognitive strategy use” can be very beneficial. In recognizing the positive influence of cognitive constructs, Martinez and Bunderson (2000) expand the application of cognitive strategies to study how individual learning differences impact the learning experience. Von Glasersfeld (1995) argues that ‘‘from the constructivist perspective, learning is not a stimulus-response phenomenon. Knowledge is the result of active learning, which is a generative process. It requires self-regulation and the building of conceptual structures through reflection and abstraction” (p. 14). Johnson and Aragon (2002) emphasize that future studies should empirically test the effectiveness of different instructional techniques in maximizing learning opportunities and achievement in online learning. They suggest that the learning environment should comprise the elements in behavioral, cognitive, and social learning theory.

According to Huitt (2003), the emphasis of the constructivist approach is that “an individual learner must actively ’build’ knowledge and skills (e.g., Bruner, 1990) and that information exists within these built constructs rather than in the external environment.” The NOVEX approach to instructional design advanced by Taylor (1994) and Tennyson (1992) implicitly integrates the constructivists’ approach that “suggests that educators first consider the knowledge and experiences students bring with them to the learning task” (Huitt, 2003). In assessing the learning environment, Tam (2000) evaluates constructivism and instructional design and proposes that instructional design methodologies must not only include constructivist perspectives but also create a powerful learning environment. The questions driving Tam’s paper ask “what do constructivist perspectives offer instructional design and practice? What do computing technologies offer? And what do the two afford in combination?” The implications of his research provide correlations between the foundational views of constructivist learning and e-learnin7g: “If learning truly depends on the unique base of experience and knowledge brought to the learning environment by the learner, the learner certainly should play a role in determining the learning goals, strategies and methods for building on his or her base of knowledge and understanding.” Is this not one of the principles for constructive learning? In summary, meaningful pedagogy requires not only excellent content but appropriate instructional design, methodologies and synergies between medium and modality. It is incumbent on academics engaged in teaching to promote constructivist learning through well-aligned instructional design strategies that promote depth and breadth of knowledge acquisition, transfer, and application.

Practical Questions for Application

If we use technology as a strategy based on pedagogical-driven instructional design for applications that are most relevant to the learners then they are unable to construct new ideas and understanding, in other words, make meaning. Our instructional design needs to be more than replicating the performance of others and acquiring knowledge transmitted in instruction; the content must be acquired in a context that is not in the abstract. For example, we need to assess the relationship between the instructional content and the learner. How can we balance and combine practical problem-solving methods that engage active sensing with notions of fundamental understanding that require intuitive, reflective learning? How can we provide instructional activities that are active and encourage peer influence and collaboration? How can we construct a learning environment that recognizes the learner as a sense maker through developmental stages? How can we provide open-ended problems and questions that require analysis and synthesis so as to foster intuitive, reflective, and global learning? Further, have we inquired what is significant and intriguing to our learners and used instructional design strategies and the functionalities of technology to deliver schema-based learning that is aligned with learners' needs and goals and is navigable by the learner? Are we using the model for learning depicted in diagram C?

Diagram C

If so, then we can design instructional activities that are engaging, meaningful, and relevant to our learners by emphasizing collaboration, creative thinking, and experimentation.

For example, researchers suggest that the effectiveness of active learning, adaptive transfer, metacognitive embedded constructs, and exploration can be further evaluated using a novel model referred to as the: construction-deconstruction-connectionist process (CDC Model) using collaborative in-class activities. The CDC model is built upon the premise that learning in the classroom is not only a cognitive event; it is also a psychodynamic, social process (Illeris, 2004). In such, the CDC model considers classroom instruction as involving four metacognitive domains: the domains of self, professor, classmates, and learning environment (Pang, 2008). Research conducted by Pang suggests that a pedagogy founded upon active learning instructional strategies facilitates the development of metacognitive ability, improves learner performance, and enhances the learner's overall learning experience. In a study emphasizing problem-based learning, Reeves and Francis (2002) found that pharmacy students were more inquisitive in the learning process and retained content better when instruction strategies required them to apply new information for real life scenarios they might encounter in the working world. Vaughn, Gonzalez del Rey, and Baker (2001) developed a novel instructional method they named "microburst learning" that combined role-plays, experiential activities, group discussions, and simulations that are presented as "short bursts." Their outcomes indicated more effective learning, including increased attention and motivation.

From an instructional strategy perspective, learners must be encouraged to develop an understanding of the relevance of each lesson by connecting it to previously acquired learning and then demonstrate their ability to build upon that learning by the new construction and deconstruction of knowledge. Instruction must be designed so students acquire knowledge and develop understanding by continually upgrading previously established associations of content knowledge. When an instructional strategy is employed that combines an active, constructivist methodology with activities that engage metacognitive skills and that promote motivation and personal meaning-making we construct an ideal model for learner development.

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