Application of a Constructivist Approach to Developing Theories of Educational Technology

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Peer Reviewed by Lana Grover

EdTech 503: Theoretical Foundations of Educational Technology

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April 11, 2011
Abstract

Constructivist theory states that learning occurs when the learners determine what goals are going to be achieved in an authentic real-world context. Central to constructivist theory is individuals sharing collaboratively with others about their own prior knowledge and experiences. Constructivism has played an important role in defining learning for instructional design in the classroom. In the twenty-first century technological advancements and the need for educational technology have led to new emerging theories in the field of education. These emerging theories include; activity theory and student centered learning environments, TPCK, connectivism and transactional distance theory. Although these theories further define how a learner in a modern learning environment use and gain knowledge, it is evident that constructivist theory remains the spring-board from which these theories are defined. Furthermore, with the foundation of the constructivist model and the use of emerging theories educators will be able to develop instruction that is engaging, relevant, and meets the needs of today’s learner. Practical application of these learning theories includes; providing learners the opportunity to investigate their own learner driven problems, and the use of technology to gather information, compile and organize data, and collaborate.

Keywords: constructivist, educational technology, emerging educational theories
Foundational Principles of Constructivism

There are a wide range of educational schools of thought and learning theories, many of these theories can be mapped to three broad educational approaches: behaviorism, socio-cultural, and constructivism (Conole et al., 2004). The focus of this paper is to draw conclusions about how constructivism has influenced theories of educational technology and to give practitioners a practical application of how to use a constructivist approach in the learning environment.

Constructivism focuses on the processes by which learners build their own mental structures when interacting with an environment (Conole et al., 2004). Constructivists believe that learners build these mental structures through several key principles of learning. Jonassen & Land summarize the key values shared among constructivist designers as (a) centrality of the learner in defining learning, (b) importance of situated, authentic contexts, and (c) negotiation and interpretation of personal beliefs and multiple perspectives, (d) importance of prior learning experiences in meaning construction, and (e) use of technology to scaffold higher mental processes (2000). Petraglia’s research adds that collaboration amongst students provides motivation, enabling learners to share knowledge and skills and provide opportunities for them to observe the learning processes of others (1998).

Constructivist Approach to Developing Theories of Educational Technology

Educational technology is an ever changing field that includes the implementation and use of technological media to plan, enrich, or assess learning. Technologies of the twenty-first century include interactive media, use of mobile devices, blogs, internet, Web 2.0, and the
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emerging tools of tomorrow. These modern technologies allow for instruction that encompasses worldwide knowledge, experiences, and collaboration.

As technologies advance and emerge educational technology and subsequent theories must also advance and emerge. Technology is advancing so rapidly that educational technologists are finding difficulty in defining current theories that accurately address the needs of today’s learner. There are several emerging theories that theorist believe do address the way in which learners now interact with knowledge and learn in our technologically advancing society. These theories hold their own key values, but it is evident that they have been influenced by constructivist principles. Some of these emerging theories include activity theory and student centered learning environments, technological pedagogical content knowledge (TPCK), connectivism and transactional distance theory.

**Activity Theory and Student Centered Learning Environments**

Activity theory may be used when designing student centered learning environments. The basis of this theory is that the focus of learning is around a real world question, issue or problem. Learners are given or establish their own problem that they would like to research collaboratively to produce a product. Instead of giving direct instruction in prerequisite knowledge the learners work collaboratively to understand necessary concepts, plan, and solve the problem (Jonassen, & Land, 2000). Activity theory aligns very well with constructivist epistemology; students direct their learning and bring their prior knowledge to collaborate with others. Activity theory engages the use of technologies in providing knowledge and collaborative tools to the learner. Some examples of technologies and collaborative tools available for learners of today include Web 2.0, wikis, internet, blogs, and discussion boards.
Learners should use these technologies as tools to gather information, organize, collaborate, and produce a final product.

**Technological Pedagogical Content Knowledge (TPCK)**

TPCK is a theory intended to define the necessary skills, knowledge, and aptitude for an effective teacher in a modern society. TPCK recognizes that with technological advances, teachers must move well beyond a simple understanding of subject matter into a well developed knowledge of how to best teach the content. In order to know how to best teach the content a teacher must encompass content, pedagogy, knowledge of learners, understanding of how particular topics are to be taught to a diverse population, and technology (Angeli & Valanides, 2008). When a teacher possesses the skills and knowledge, as delineated by TPCK, then they bring the necessary skills needed to support a constructivist learning environment in a technologically advancing society.

**Connectivism**

Connectivism believes that knowledge is distributed across an informational network and can be stored in a variety of digital formats. Learning and knowledge rest in the diversity of opinions and transpires through the use of both the cognitive and affective domains (Kop & Hill, 2008). Fundamental pieces of constructivism still play a role in connectivist theory. Constructivism places value on the sharing of experiences. In a technologically connected society individuals are able to share their experiences with the world and also internalize the experiences shared from other individuals across the world.
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It is important to note that constructivist theory and connectivist theory do differ in their understanding of how knowledge is obtained. Constructivists believe that knowledge is gained internally through the mental constructs of the mind through the experiences of the learner and the sharing of other individual’s experiences. Connectivism believes that in a world with an overabundance of knowledge, information and knowledge is shared externally through the collection of information and through the “collection” of individuals one collaborates with. This difference does not negate that connectivism does value the collaboration of individuals and constructivist epistemology holds the same key value.

Transactional Distance Theory

Transactional Distance Theory (TDT) is an emerging theory developed to provide structure for distance education. TDT is primarily concerned with independent study and the shared responsibility of the teaching/learning enterprise. Independence of the learner through shared negotiation, dialog, and structure between teacher and learner is the most important and desired outcome. Learning occurs through mutual sharing and negotiations of meaning between the teacher and the learner exploring a common world. A teacher-learner feedback loop is necessary for this process to be effective (Gokool-Ramdo, 2008). TDT holds true to the key values of the constructivist theory; students learn from shared experiences and collaboration. Students develop their own learning based on these experiences and collaboration. Technology is used as a feedback tool between the teacher and learner providing scaffolding to the learner.

Challenges of Using Constructivist Theory in a Technologically Advancing Classroom
Many challenges occur when trying to merge technologically advancing classrooms and students with the constructivist theory. Many modern theorists would argue that constructivist theory no longer addresses the needs of learners. These theorists argue that existing knowledge is quickly becoming outdated and obsolete. We now live in a world of continuous transformation of our culture, society, and political environments. This rapidly changing world requires that citizens can think critically, problem solve, collaborate with others, communicate, use various technologies, take initiatives, and bring diverse perspectives in the learning situation (Angeli & Valanides, 2009). According to Lankshear, Peters & Knobel, with a superabundance of information available everyday learning practices should no longer be concerned with knowledge and truth as we have thought of them in the past. Instead learning goals should consider the extent to which education must prepare learners for successful participation with such superabundance of information (2000).

Another challenge in the technologically advancing classroom is the failure to establish a theory in educational technology. According to Angeli and Valanides, until we share some theoretical vision of educational technology, we will never glimpse the larger picture that could give our everyday classroom efforts direction and meaning (2009).

**Practical Application of Constructivism in the Learning Environment**

Constructivism has several implications for the modern classroom. Constructivist theory can be used as a guide for designing learning goals and activities. According to constructivism, students learn when learners are able to define their own learning within an authentic context while collaborating and sharing prior learning experiences. In order for instructional designers to capitalize on best practices for learners, instruction must apply the key components of
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Constructivism. Instruction should provide meaningful learning through ownership of the problem or learning goal. It is important to present learners with interesting, relevant, and engaging problems to solve. Problems should be ill-structured, so that some aspects of it are emergent (Jonassen & Land, 2000). Petraglia further supports these findings and concludes that learning environments should support the learning process by providing multiple perspectives or interpretations of reality and enable knowledge construction in the learner through providing context-rich, experience based activities. Learning goals should provide knowledge that they will experience in the workforce. In order to convince learners of a problem’s authenticity practitioners should look at the discipline of rhetoric: the study of persuasion and argumentation. Furthermore, Petraglia adds that a successful learner is one who can readily cast and recast knowledge in response to situational demands (1998).

Application within Educational Technologies

In a technology dependent and advancing society, learners need to know what technology offers and how it can be used to problem solve. Proper use of technology in the learning environment is vital to providing learners with the necessary skills needed to become a contributing member of the work force. Simply placing the equipment into the classroom and providing students time to explore what the computer has to offer is not beneficial to meeting learning goals or preparing learners for real-world problem solving. Technology can be applied to the learning environment in many beneficial ways. Some examples of technology supporting education are: (a) as a tool to support experimentation, manipulation, and idea generation, (b) as multiple representations of content, and (c) as a tool to scaffold learning (Jonassen & Land, 2000).
Technology can provide several tools for a practitioner who wishes to establish a problem-based learning activity in which learners are actively participating in a collaborative community. Conole et al. suggest that technology toolkits and other support systems which guide and inform users through a process of activities could be used to effectively embed and enable constructivist principles. Access to resources and expertise offers the potential to develop more engaging and student-centered, active and authentic learning environments (2004). These technology tools and support systems don’t just give learners access to information but include information gathering systems, interactive processing, organizational tools, and collaborative tools. Available collaborative tools and social networking sites provide learners with opportunities to collaborate globally and network with other knowledge experts. Even without social person to person online communication simply the interactive nature of technology engage students in the material. Users can mine the technological environment for information sought much like they would if eliciting information through conversation (Petraglia, 1998). Lankshear, Peters & Knobel point out that use of the internet is so diverse, it is no longer acceptable to think of the internet in terms of an information infrastructure involving multiple discrete but connectable technologies, nor is it solely information and data. Instead, we can think of the internet as a range of technologically-mediated spaces of communicative practice that are amazingly diverse (Lankshear, Peters, & Knobel, 2000).

The internet can engage learners in ways that have not been possible in traditional instructional design involving a classroom of learners, teacher and student body. The multimedia realm of a digital world makes possible the convergence of text, image and sound in ways that break down the primacy of propositional linguistic forms of truth bearing. Images and sounds can be evoking, attacking us sensually, shifting and evolving constantly. Online
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information can arrive in spatial as well as textual expressions (Lankshear, Peters & Knobel, 2000). Information is now used and acted on by the learner all within the virtual world.

There are several examples of learning activities in which technology has enhanced the learning goal. Scanlon reports on three different occasions in which technology within a project-based learning environment greatly enhanced the capabilities of learners to gain a diverse understanding of the knowledge gained. In one instance learners within a remotely accessible laboratory worked collaboratively with other students using communication tools to analyze and interpret data. Scanlon’s second example was of learners who used video recording to survey students, through the use of eye-tracking software, screen capture and video analysis tools. Through using these technologies learners were able to draw inferences about the intent of the individual they were surveying. Finally, Scanlon shares an example about a group of learners who worked on a personal inquiry project using technology enhanced instruction to help school students learn the skills of evidence-based inquiry, on topic themes of personal relevance (2010).

Role of the Educator

Constructivism asks educators and technologists to accept the importance of their own assumptions and meaning-making practices, for as task setters, informational resources and arbiters of performance, teachers have an enormous impact upon student learning. Instructors not only should attend to students’ ability to demonstrate their knowledge of information in traditional ways, but also that we support their ability to articulate this understanding and share it with others effectively and convincingly (Petraglia, 1998). Educators must assist learners to set
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into place a self-directed problem. An educator should scaffold learning so that a learner can come to their own conclusions and be able to share these conclusions with others.

Educators must also provide time and appropriate support systems for learners to collaborate with others. With the advancing of technology learners have more opportunities than ever to collaborate worldwide with experts or other learners. In order to provide effective collaboration educators have to recognize three elements to online collaboration. These three elements are outlined by Lankshear, Peters and Knobel and they are (a) that the way academics understand and approach the internet is only one way, and that it may differ greatly from the way non-academic publics understand and use the spaces and technologies in question, (b) we need to know a lot more about what people actually do on the internet than we know at present, and we need to look for patterns of practice and purpose and production that go far beyond our current knowledge, (c) we must problematise our limited and often mystified understandings of the internet (2000).

Conclusions

Constructivism has laid the groundwork for effective ways in which individuals can learn. Fundamentally, constructivists value learning that is self directed by the learner, individual perspectives help to scaffold learning, and collaboration amongst individuals who share their own perspectives with each other. Technology has helped to provide information, interactive interfaces, organizational structures for data compilation and collaborative tools. Rapidly advancing technology has changed our society and the necessary skills a contributing citizen must possess. Therefore, new educational theories have emerged in order to meet the needs of today’s learner. Elements of constructivism can be seen in each of these emerging
Application of a Constructivist Approach to Developing Theories of Educational Technology theories. However, constructivism focuses on the gaining of knowledge and many of the emerging theories would argue against the need for knowledge obtainment. Instead, it is recognized that technology is advancing so quickly that the manipulation and digital storage of information through networking is a more important skill. Regardless of advancing technology, the skills of using and gathering information and sharing collaboratively within a network are still fundamentally based in constructivist epistemology. Learner success in the twenty-first century is dependant on educators who use technology to scaffold learning within a constructivism framework.

References

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