Constructivist Theory and Its Relationship to

One-to-one Computing in the Classroom

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One-to-one computing is an educational environment where each student has a laptop or computing device to use. This environment allows students the opportunity to personalize their learning and construct knowledge through exploration on their electronic devices (Downes & Bishop, 2012; Prettyman, Ward, Jauk, & Awad, 2012; Spires, Wiebe, Young, Hollebrands, & Lee, 2009; Stefi-Mabry, Radlick, & Doane, 2010). Students are central to their learning within this environment while being hands on and minds on with their computers. This type of hands-on learning matches the theoretical framework constructivism.

Constructivism is a theory about how people learn and the thinking process. It helps answer the question how do individuals come to know what they know (Bodner, 1986; Liu & Chen, 2010; Ultanir, 2012; von Glasersfeld, 1988). Constructivism has two basic principles. The first principle argues that learners create or construct their own understanding or meaning through the lens of their previous experiences and knowledge (Bodner, 1986; Liu et al., 2010; Ultanir, 2012; von Glasersfeld, 1988). In a constructivist model, learners are actively engaging in meaning making, not passive receptors of knowledge (Bodner, 1986; Liu et al., 2010; Ultanir, 2012; von Glasersfeld, 1988). The second principle is that cognition is adaptive and serves as an organizational tool for the learner’s knowledge (Bodner, 1986; Liu et al., 2010; Ultanir, 2012; von Glasersfeld, 1988).

Constructivism can be traced back to the 18th century to Italian philosopher, Giambattista Vico. Vico introduced the idea that "the only way to know something is to have made it" (Ultanir, 2012, p. 197). Some better known authors of constructivism are Jean Piaget, Lev Vygotsky, and Ernst von Glasersfeld. Jean Piaget studied the development of thought in children. He described learning as the result of a life-long constructive process (Bodner, 1986; Liu et al., 2010; Ultanir, 2012; von Glasersfeld, 1988). Piaget describes how a child learns through perception and how the child defines his or her views based on the knowledge they already possess, thereby constructing a new experience or idea (Bodner, 1986; Liu et al., 2010; Ultanir, 2012; von Glasersfeld, 1988). Piaget noted that development of human intellect proceeds through adaptation and organization. In contrast to Piaget, Vygotsky argues that the process of knowing involves other people, community, and culture (Jaramillo, 1996; Kanselaar, 2002; Liu et al., 2010; Powell & Kalina, 2009). Vygotsky believes that individual cognition occurs in social situations and that social experiences shape the way students think and interpret their world (Jaramillo, 1996; Kanselaar, 2002; Liu et al., 2010; Powell & Kalina, 2009). Ernst von Glasersfeld is a leading author of constructivism theory. According to von Glasersfeld, the learner is searching for a fit with reality, not a match to it. Learners use their prior experience to understand why something works or doesn't work and creates new knowledge and as a result, a new reality (Bodner, 1986; Liu et al., 2010; Ultanir, 2012; von Glasersfeld, 1988). von Glasersfeld argues "knowledge is something which is personally constructed by individuals in an active way as they try to give meaning to socially accepted and shared notions" (Kanselaar, 2002, p. 2).

Constructivism has several major strands. Cognitive constructivism, social constructivism, and radical constructivism are three of these strands. Cognitive constructivism is defined as the construction of ideas through a personal process. Piaget is the main voice of cognitive constructivism. In cognitive constructivism, learning is developmental (Bodner, 1986; Kanselaar, 2002; Liu et al., 2010; Powell & Kalina, 2009; Ultanir, 2012). Piaget argued that there are four main periods of development. These stages are the sensorimotor stage, the pre-operational stage, the concrete operational stage, and the formal operational stage (Bodner, 1986; Kanselaar, 2002; Liu et al., 2010; Powell & Kalina, 2009; Ultanir, 2012). It is through accommodation and assimilation within these stages that a child develops a cognitive structure or schema (Bodner, 1986; Kanselaar, 2002; Liu et al., 2010; Powell & Kalina, 2009; Ultanir, 2012). Vygotsky’s social constructivism argues that social experiences shape the ways of thinking and interpreting the world. Students learn through interacting with peers, teacher, manipulatives, and their contextual setting (Jaramillo, 1996; Kanselaar, 2002; Liu et al., 2010; Powell & Kalina, 2009). In social constructivism, groups are vital to learning and are often used in cooperative learning activities. From a social constructivism viewpoint, classroom instruction should be networked or taught in a schematic web (Jaramillo, 1996; Kanselaar, 2002; Liu et al., 2010; Powell & Kalina, 2009). Radical constructivism is actually an extreme strand of cognitive constructivism. According to von Glasersfeld, radical constructivism denies that we can rationally know a reality beyond our experience. von Glasersfeld argues that "knowledge develops internally, by means of learners cognitive self-organization" (Joldersma, 2011, p. 277). Individuals create or construct their own new understandings or knowledge through the interaction of what they already believe and the ideas, events, and activities with which they come into contact (Bodner, 1986; Kanselaar, 2002; Liu et al., 2010; Powell & Kalina, 2009; Ultanir, 2012). Radical constructivists believe that learners must fit knowledge to their experience (Liu et al., 2010). While all three strands of constructivism present different views on learning, they all still hold to the truth of learning by construction. All three strands appear when discussing the implications of constructivism on classroom environments. Aspects all three strands are needed to create the best learning experience for students.

Constructivism views learning as an active process. According to Ultanir, a constructivist classroom environment is "learner centered, authentic, and collaborative" (Ultanir, 2012 p. 205). A constructivist classroom encourages students to be hands on in their learning, analyze new ideas, engage in discussion with their peers, and develop new ideas and knowledge. In a constructivist classroom, the teacher acts as a facilitator or a guide. "There is a shift from teaching by imposition to teaching by negotiation" (Bodner, 1986, p. 876). The teacher leads students to question, explore, and analyze their own ideas by developing a two directional flow of information between teachers and students (Bodner, 1986; Liu & Chen, 2010; Ultanir, 2012; von Glasersfeld, 1988). Constructivist classrooms focus on realistic approaches to real world problems, not predetermined instructional sequences. In a constructivist learning environment, the teacher presents multiple perspectives and provides an environment and tools to help students interpret those perspectives (Bodner, 1986; Jaramillo, 1996; Jonassen, 1991; Kanselaar, 2002; Liu et al., 2010; Powell & Kalina, 2009; Ultanir, 2012).

The theory of constructivism is not without critics. One main criticism is that in a traditional view of knowledge, the learner looks for a match between knowledge and reality (Bodner, 1986). This view contends that there is a reality and the learner has to use it to make meaning of their knowledge. In a constructivist viewpoint, there is no reality. Learners use their prior knowledge to create a reality. This is an example of solipsism. Every individual is free to construct his or her own world in whatever way they like (Fox, 2001; von Glasersfeld, 1988). Critics argue that there is more than one pole of human experiences. Learning is an active process in so much as the learner acts upon the world but also the learner is acted upon (Fox, 2001). The learner acts and reacts. Some critics argue that in constructivism, especially radical constructivism there is no such thing as true knowledge which can lead to self-refutation. A learner in radical constructivism has no way in which to demonstrate by cognitive arguments which truth is the correct truth (Quale, 2012). Constructivists are criticized for having an ontological view of learning. Constructivists believe that the ontology of learners is the sum of their own sensed attitudes, volitions, emotions, and perceptions of what the world is like for them at any one time (Fox, 2001; Quale, 2012). These are only a few criticisms of this very complex theory. Most of these criticisms are of a very extreme and radical version of constructivism.

In a classroom that uses one-to-one computing, the students are constantly constructing new knowledge. They are designing and creating products such as websites and power points. Students work collaboratively with each other and are in a constant state of questioning as they search for answers and analyze information from the internet. Using one-to-one computing in the classroom changes the focus of the classroom from an I teach environment to an I learn environment, effectively making the teacher a facilitator or guide. This is a huge part of a constructivist learning environment. Another example of the match between constructivism and a classroom with one-to-one computing is that "it empowers students to search and acquire information, critically evaluate information, creatively synthesize information, and generate innovative ideas and products as well as craft solutions to problems" (Spires, Wiebe, Young, Hollebrands, & Lee, 2009, p. 7). Students are able to construct knowledge with their devices and are able to be hands-on learners as is emphasized in a constructivst learning model.

"Technology in the classroom enables students to shift from being consumers of knowledge to creators of knowledge" (Prettyman, Ward, Jauk, & Awad, 2012, p. 13), which is the basic premise of constructivism theory. Incorporating aspects of both cognitive and social constructivist models into a classroom environment creates an ideal learning space. This is seen with the use of technology as it connects students to each other and to a world that is theirs to explore.

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