Constructivism and Educational Technologies:

Building Knowledge through Engagement

Melodie M. Worthington
Boise State University
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Abstract

This paper discusses the relationship between the constructivist learning theory and the integration of educational technologies in the classroom. In constructivism, new knowledge is built through personal experience and the teacher is only one of many resources students should have access to; families, schools, communities, and other learners each play a role in the construction of new knowledge. The initial question raised is whether or not technology fits in well with constructivism, as the theory was developed decades before today’s digital technologies were available. The articles cited describe the benefits of integrating technology into constructivist classrooms and positively answer the initial question. Examples of this beneficial relationship are included from peer-reviewed research, as well as an example from the author’s own personal experience. Constructivism takes the focus off the teacher and fosters Student-Centered Learning Environments (SCLEs). The importance of basing technology integration upon foundational educational philosophies is stressed. The results of integrating educational technologies purposefully and thoughtfully into constructivist classrooms are engaged learners who build knowledge personally and retain it.
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The constructivist learning theory was developed decades ago and it is still commonly used today. Belief that knowledge is built through exploratory experiences is a key foundation of constructivism. Educational technologies have been increasing in popularity and use, with new technologies being made available on a very frequent basis. Would a learning theory like constructivism, which did not have recent digital technologies available as it was being defined years ago, lend itself to technology integration in today’s educational settings? Would the integration of educational technologies compromise the theory, or would they enhance the implementation of the theory in the classroom? This paper examines the belief that educational technologies fit well within the constructivist learning theory and help make the conscientious and responsible use of the theory even more effective in the classroom, resulting in engaged learners.

Discussion

The definition of educational technology changes with the times. In the not so distant past, technologies like overhead projectors, ditto machines, or even chalk boards were considered the cutting edge of technology in education. However, for the purpose of this paper, educational technology will be referred to in the digital sense: Educational technology integration is a process where computers and other technologies are used to support teaching and learning (Raihan & Han, 2012).

The effective use of any educational technology includes the prerequisite foundation of thought, planning, and purpose found in the educator’s choice of learning theory in his or her
instructional presentation. The haphazard tossing of technology into the classroom mix in no way guarantees an enhanced educational experience for the learners; in fact, confusion and a distinct lack of connection between the content and learning goals are more likely to occur. Gilakjani, Long, and Ismail (2013), state “using technology in the classroom by itself is not effective unless teachers have a theory to model their instruction with” (p. 49). Agreeing with that viewpoint, Hickey (2014) proposes “learning philosophies are a fundamental but oft-overlooked consideration for teachers, who would do well to choose a particular model and apply complementary approaches” (p. 16).

Too often teachers assume the inclusion of technology is the same thing as the integration of technology. In reality, integration of technology implies a conscious decision to meet certain educational goals with that technology, based upon a foundation of tested and true learning theories. Hickey goes on to state that technology does not necessarily improve learning outcomes and should be applied carefully; applying technology according to an educational philosophy is important if it is to be effective (p. 19). In fact, the consistent integration of technology into the classroom may actually cause the teacher to approach instruction more frequently with a constructivist educational philosophy.

Teachers should consider creating intellectually powerful and technology rich environments. Considering that technology is a tool that supports your teaching, engage students in activities that the students perceive to support their learning remembering that learning is the most important outcome…Teachers are likely to grow in their own process of teaching and learning; they start to develop constructivist-compatible philosophical beliefs that cause them to reexamine their instructional practices. They begin to link their beliefs about education to their instructional practices. As a result, they are more likely to
find ways to effectively integrate technology into their classrooms in meaningful ways.

(Keengwe, Onchwari, & Agamba, 2013).

As the focus of this paper is how the constructivist learning theory and digital educational technologies can work effectively together, a deeper look into this relationship is warranted.

**Constructivist Classroom**

Constructivism, as defined by Keengwe et al., (2013), is an educational theory that stresses activity-based teaching and learning in which students form their own representations of knowledge. Early constructivist theorists include Piaget, Bruner, and Goodman (Ertmer & Newby, 1993). Piaget’s notion of constructivism assumes that learners must build their own knowledge, both individually and collectively. However, it is important to note that it is not the learner’s responsibility alone. “The role of the family, the school, the teacher, the community, and other learners is to provide the setting, pose the challenges, and offer the support that will encourage active construction of knowledge” (Keengwe et al., 2013).

How then is knowledge built using Piaget’s foundational definition? According to Ertmer and Newby (1993), constructivists believe knowledge of the world stems from experience and how we interpret it, unlike cognitivists and behaviorists who believe that knowledge is mind-independent and can be “mapped” onto a learner. In other words, humans create meaning as opposed to acquiring it. That doesn’t necessarily mean that in constructivist classrooms teachers should never tell students anything directly and just allow them to build their knowledge for themselves. “Constructivism assumes that all knowledge is constructed from the learner’s previous knowledge, regardless of how one is taught. Thus, even listening to a lecture involves active attempts to construct new knowledge” (“Constructivism,” 2015).
Maintaining the focus on engaging the student is even more effective than listening to a teacher-centered lecture, however. Constructivism typically brings the focus of the classroom from the teacher to the student, which makes it foundational in student-centered learning environments (SCLEs). As described by Land, Hannafin, and Oliver (2012), SCLEs are grounded in constructivism, where meaning is personally rather than universally determined. “Pedagogically, SCLEs favor rich, authentic learning contexts over isolated, decontextualized knowledge and skill, student-centered, goal-directed inquiry over externally directed instruction, and supporting personal perspectives over canonical perspectives” (Land et al., 2012, pp. 4-5). When the focus is on the student, rather than the teacher, instruction becomes more relevant and meaningful to the student. This results in the content being learned more effectively and retained for a longer period of time, lending great credence to the use of SCLEs in today’s classrooms.

Within a SCLE or any other constructivist learning environment, learning also demands questioning and decision-making. When a learner comes across something new or different, he must reconcile it to what he already knows through his own experiences, perhaps changing what he believed or discounting the new information (Raihan & Han, 2012). If the learner finds the new information valid, then he must do something with it. “Constructivist teachers encourage students to constantly assess how the activity is helping them gain understanding. By questioning themselves and their strategies, students in the constructivist classroom ideally become ‘expert learners’” (Raihan & Han, 2012, p. 20). This ideal should be the goal of any responsible educator, no matter the content area.

**Relationship between Constructivism and Technology**

The basic tenant of constructivism is that the learner constructs his or her own knowledge; the teacher cannot supply it entirely, though the teacher can be one of many
resources (p. 50). “Constructivist learning environments are intended to provide multiple paths for students to explore with teachers performing the role of a guide, mentor or facilitator” (Keengwe et al., 2013). Thus, as already mentioned, a constructivist classroom is one which is centered on the student, rather than on the teacher. The students learn through experience. Within the constructivist theory, “we all conceive of the external reality somewhat differently, based on our unique set of experiences with the world and our beliefs about them” (Jonassen, 1991, p. 10).

What better way to expand students’ experiences then by using technology? It can bring the world to the students’ fingertips and allow them to manipulate information in an engaging manner. “There is a close relationship between technology and constructivism, the implementation of each one benefiting the other” (Gilakjani et al., 2013, p. 49). Technology can be a very effective tool to bring additional and increasingly relative experiences to students. Traditional seatwork is replaced by the use of computers as learning tools, as described in the following quote from Gilakjani et al. (2013, p. 51):

Instead of the static teacher-centered environment where the students act as receivers of information from a single source, the classroom becomes an active setting full of meaningful activity where the student is made responsible for his or her learning. The students are engaged in meaningful activities such as problem-based learning projects, browsing the Internet in search of information for a report, or the preparation of presentation assignments. Software and hardware become tools used by the students to create a product to be presented to teachers and fellow students so that they may review, learn, or critique in a collaborative manner.
Teachers should be encouraged to integrate digital technologies to engage students in the building of new knowledge, facilitating and strengthening the learning. By interacting with learning materials and various digital technologies, a learner is better able to develop a deeper level of understanding than a lecture alone could provide. The integration of educational technologies into a constructivist classroom goes hand-in-hand with interactions between students and peers, students with teachers and other resources, and learning-based activities (Keengwe et al., 2013). These technologies are the common denominator between them all.

**Examples.** A general example of how educational technology can fit well within the constructivist classroom is e-learning. E-learning is a learner-centered approach that enhances learning through the use of computer and communication technology, such as personal computers, mobile phones, the Internet, digital televisions, email, and collaborative software (Keengwe et al., 2013). According to Keengwe et al. (2013), e-learning students learn material between 30-50% faster and retain 30% more than do students during traditional lecture methods, as the e-learning fosters greater student collaboration, interaction and greater student/teacher contact. Student learning is more complete as it is built through the enhanced methods which the technologies provide.

A more specific example of e-learning is offered by Virtual Enterprises International. As described in the NMC Horizon Report, 2014 K-12 Edition, high school students are connected with the world of business and entrepreneurship via an in-school, global business simulation. This simulation offers students the chance to build 21st century skills in areas including communication, problem-solving, technology, and personal finance, along with project-based and collaborative learning. “This experiential learning model engages students by replicating all the functions of real business in both structure and practice. Teacher-facilitators and business
mentors guide students as they create and manage all facets of their virtual business from product
development to marketing in a range of firms” (Johnson, Adams Becker, Estrada & Freeman, 2014, p. 20). Johnson et al. (2014) describe how students are guided, yet individually develop personal knowledge through their own research, development of a product, and experiences with levels of success or failure determined during the product’s presentation and marketing.

Another example involves a study of 60 third grade students in Mexico. Garcia and Pacheco (2013) found that applying constructivist theory to math content in the classroom resulted in improved learning.

Children began to communicate by considering the suggestions or posing questions to their teammates through the interactive platform. Cooperative work awakened concern for the learning of others. Children with better abilities serve as a direct guide for less able children while solving verbal problems and even while using the platform (Discussion and Conclusions section, para. 5).

**Final Example.** This final example is from my own experience. My son, Ryan, is a third year music education major at a private university out of state. Over his spring break he was relating a recent experience he had with an assignment in his upper level music theory course. The students were asked to compose an original 20th Century-style piece, incorporating various music theory components they had been learning over the last two or three semesters. There were guidelines from the professor as far as length, minimum number of components required, etc. but the 20th Century aspects and performance medium were left entirely up to the students. The only other requirement was that the composition had to evoke some sort of emotion from the audience, as the composition would be performed by each student composer in front of the professor and the rest of the class. Some students wrote their composition for solo
piano or as a duet for wind instruments; my son chose to write for solo flugel horn, accompanied by synthesized instruments and sounds which he put together using a digital audio workstation and MIDI sequencer software application called “Logic Pro X” by Apple.

In this composition assignment, Ryan applied prior knowledge from his own experiences as a musician and from the music theory coursework. He was able to build a deeper understanding of 20th Century music by creating his own work (constructing knowledge through personal experience). Before he began this compositional experience, his opinion of 20th Century-style music was limited to his general understanding of the atonalism of the time period, which typically is difficult for most people to enjoy. During the process he built an appreciation for the music style and learned how to compose music using serialism and the 12-tone music writing method.

Ryan’s composition depicted the moments leading up to the eruption of Mount St. Helen’s in 1980. His compositional theme moved freely, repeating the 12 notes he had chosen to use throughout the piece. He used the Logic Pro X software to add timpani rolls and bass ostinato to depict the crescendos of earthquakes, including some other effects such as bird song to lend reality to his programmatic composition. Since his compositional focus was the moments leading up to the famous eruption, the crescendos build until everything abruptly stops at just that point. After he had performed his composition on his flugel horn accompanied by the underlying instrumentation and effects he had created with the software, the reaction of the professor and his classmates was extremely positive. He had successfully produced the emotional reaction he desired from his audience with his composition and performance.

Ryan’s face lit up when he was describing to me how his composition had come together. His excitement was apparent as he listed several different compositional aspects he used, such as
cadences, rhythms, dynamics, special effects he included via the software, as well as unusual sounds he purposefully created on his flugel horn during the performance of his composition. As I was listening to him describe what he had learned as he had put everything together, aided by the Logic Pro X software, I knew I was witnessing the results of constructivism and technology working together. As Gilakjani et al. (2013) state, learning environments combining technology and constructivism are “the contexts in which knowledge-building tools and the means to create and manipulate artifacts of understanding are provided through which learners work together and support each other as they use a variety of tools and learning resources” (p. 49). The learning environment provided in this instance by Ryan’s professor included technological tools and a setting where the students felt comfortable performing their compositions and supporting each other’s efforts. Ryan’s learning became personal, relative, and something he will not soon forget. He constructed a deeper knowledge of the content by investigating the 20th Century music style, experimenting with the 12 tone method, and creating his own composition using the Logic Pro X software and music notation software which successfully met the overarching educational goals the professor set forth.

Conclusions

There is little doubt that today’s educational technologies can be effectively integrated into a constructivist classroom with students of various ages. What is also obvious is that this integration enhances the learning being built by the students as they assimilate the new knowledge they are gaining with previous knowledge they have already acquired. Could the early constructivism theorists possibly have imagined how today’s digital technologies are currently enhancing student learning? Probably not, but the foundation laid in their theorizing is still applicable today and worth integrating into today’s classrooms, no matter the content area.
As educators we must evaluate the goals of our instruction and purposefully choose the learning theory which best fits our students, the content, and our instructional style. Centering the classroom around the student, and using constructivist principles enhanced by digital educational technologies, will result in engaged learners who retain the personally attained and relevant new knowledge for a very long time.
References


