Technology and Constructivism in the Classroom

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Abstract

Technology has had a major impact on our society. We have the ability to access more information and more ways of retrieving information than was dreamed possible even a few years ago. To fully benefit from the promise of technology for education, both teaching and learning are evolving to prepare students to acquire, analyze, and communicate information in the ways demanded by their global future. This paper will examine the interrelationship between constructivism and technology as well as highlight the advantages of using both to reshape the 21st century classroom.

Introduction

Technology can assist educators in creating a constructivist learning environment. A complementary relationship appears to exist between computer technologies and constructivism, the implementation of each one benefiting the other. Technology offers a tremendous amount of information, tools for creativity and development, and various environments and avenues for communication. Constructivism changes the role of the teacher so that teachers help students build knowledge rather than reproduce knowledge. Research supports the idea that using technology in the classroom allows for a more student-centered, constructivist learning environment (Strommen & Lincoln, 1992). Constructivism is all about inquiry, exploration, autonomy, and personal expressions of knowledge and creativity. As a result, constructivist approaches to learning and teaching are becoming more widely accepted in school settings because they shift instruction from passive to active learning and to authentic tasks. Technology tools are good for such expressions since they allow for exploration and highly creative and individualized self-expression (Burns, Burniske, & Dimock, 1999).

Constructivism – An overview of the learning theory

Constructivism is a theory -- based on observation and scientific study -- about how people learn. Constructivism, derived mainly from the works of Piaget (1970), Bruner (1962, 1979), Vygotsky (1962, 1978), and Papert (1980, 1983), is both a philosophical and psychological approach based on social cognitivism that assumes that persons, behaviors and environments interact in reciprocal fashion (Schunk, 2000). Constructivism is student-centered; it proposes that learning environments should support different views or interpretations of reality, knowledge construction, context-rich, experience-based activities. The focus is on knowledge construction, not knowledge reproduction (Nanjappa & Grant, 2003). It is a belief that one constructs knowledge from one's experiences, and that experience is used to interpret objects and events.
The key concept of constructivism is that learning is an active process of creating, rather than acquiring, knowledge (Burns, Burniske, & Dimock, 1999). Constructivism describes a learner-centered environment where knowledge and the making of knowledge is interactive, inductive, and collaborative, where multiple perspectives are represented, and where questions are valued (Brooks & Brooks, 1993).

In a classroom setting, the constructivist view of learning can resemble a number of different teaching approaches. In the most cases, it means encouraging students to use active techniques such as, experiments, and real-world type problem solving to construct more knowledge and then to reflect on and discuss what they are doing and how their understanding is changing. The teacher makes sure she understands the students' previous knowledge, and guides the activity to address them and then build on them.

The chart below compares the traditional classroom to the constructivist one.

<table>
<thead>
<tr>
<th></th>
<th>Traditional Classroom</th>
<th>Constructivist Classroom</th>
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<tbody>
<tr>
<td>Curriculum begins with the parts of the whole. Emphasizes basic skills.</td>
<td>Curriculum emphasizes big concepts, beginning with the whole and expanding to include the parts.</td>
<td></td>
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<tr>
<td>Strict adherence to fixed curriculum is highly valued.</td>
<td>Pursuit of student questions and interests is valued.</td>
<td></td>
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<tr>
<td>Materials are primarily textbooks and workbooks.</td>
<td>Materials include primary sources of material and manipulative materials.</td>
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<tr>
<td>Learning is based on repetition.</td>
<td>Learning is interactive, building on what the student already knows.</td>
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<tr>
<td>Teachers disseminate information to students; students are recipients of knowledge.</td>
<td>Teachers have a dialogue with students, helping students construct their own knowledge.</td>
<td></td>
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<tr>
<td>Teacher's role is directive, rooted in authority.</td>
<td>Teacher's role is interactive, rooted in negotiation.</td>
<td></td>
</tr>
<tr>
<td>Assessment is through testing, correct answers.</td>
<td>Assessment includes student works, observations, and points of view, as well as tests. Process is as important as product.</td>
<td></td>
</tr>
<tr>
<td>Knowledge is seen as inert.</td>
<td>Knowledge is seen as dynamic, ever changing with our experiences.</td>
<td></td>
</tr>
<tr>
<td>Students work primarily alone.</td>
<td>Students work primarily in groups.</td>
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</tbody>
</table>

Why use a Constructivism approach in the classroom?

Constructivist approaches are similar to the way we learn.

According to research in education, constructivism reflects the way students learn. Students learn by doing, by interacting with others and through authentic (real world) tools and experiences (Burns, Burniske, & Dimock, 1999). Experience is paramount to learning, not only as a premise for what has been learned but a basis for what will be learned. Constructivists believe that "learners construct their own reality or at least interpret it based upon their perceptions of experiences, so an individual's knowledge is a function of one's prior experiences, mental structures, and beliefs that are used to interpret objects and events" (Mergel, 1998). Students learn through experience and how they make sense of that experience. By making the learner's experience the starting point for learning, educators will help to "develop active, self-aware learners who have a capacity and freedom to frame their own purposes" (Tennant & Pogson, 1999).

Constructivism makes accommodations for individual differences.

Learning is not the same for every individual. Teaching practices based on constructivism are flexible and varied and therefore accommodate different learning needs. Students have content structured only to a moderate degree so they can contextualize the content in ways that stimulates them and helps them to learn (Burns, Burniske, & Dimock, 1999). Constructivist teachers encourage students to constantly analyze how a lesson is helping them gain understanding. By questioning themselves and their strategies, students in the constructivist classroom ideally become "expert learners." This gives them their own set of tools to keep learning while accommodating individual differences in the way they may learn. With a well-planned classroom environment, the students learn "how to learn". When students continuously reflect on their experiences, students find their ideas gaining in complexity and power, and they develop increasingly strong abilities to integrate new information. One of the teacher's main roles becomes to encourage this learning and reflection process.

Constructivist approaches prepare learners for the workplace of their future

The shift in the workplace to information jobs that demand skills in analysis and synthesis of information requires changes in both how and what our future workers learn. The evidence is compelling that the current and future health of our country’s economy will depend directly on how broadly and deeply Americans reach a new level of literacy that includes strong academic skills, thinking, reasoning, teamwork skills, and proficiency in using technology. To be prepared to enter our globally competitive market, students must not only be able to memorize facts, they must know “how and why” (Burns, Burniske, & Dimock, 1999). The workplace of the future will require students to use higher order thinking skills, take risks and come up with new ideas. In order to encourage students to discover new ideas, we need to create learning environments that encourage and support failure. Students must be provided with challenging questions to
tackle that don't have obvious answers. The evidence is compelling that the current and future health of America’s 21st Century Economy depends directly on how broadly and deeply Americans reach a new level of literacy that includes strong academic skills, thinking, reasoning, teamwork skills, and proficiency in using technology. Constructivist approaches along with using technology help implement these changes by emphasizing both the process and the product of learning (Burns, Burniske, & Dimock, 1999). A context is created in which learners are able to explore new ideas and experiences (process). Within this context, a teacher's role in providing information decreases and is replaced by a "strengthened role in extracting and supporting students' own thinking" to come up with a final solution or product.

How Technology can Enhance Learning and Teaching Based on a Constructivist approach

Constructivism blends a learning process where each student gains their own knowledge by using the teacher as a facilitator. The focus of both constructivism and technology are then on the creation of learning environments. Hannafin and Hill (2002) depict these learning environments as contexts: in which “knowledge-building tools and the means to create and manipulate artifacts of understanding are provided, not one in which concepts are explicitly taught… a place where learners collaborate and support each other as they use a variety of technological tools and learning resources in their pursuit of learning goals and problem-solving activities”. The availability of educational technology promotes the use of collaborative learning, problem-based learning, higher order thinking skills, active use of a wide range of educational resources, and emphasizes student creativity. (Rakes et al., 1999) surveyed 435 K-12 teachers regarding the use of educational technology, and their use of constructivist teaching strategies. They found that "as the amount of technology, the use of technology, and technology skills level increase, the use of constructivist practices in the classroom appears to increase.

As a teacher, the best way to plan lessons for the students is to create it with the idea that allows each student to solve problems while the teacher oversees and encourages higher level thinking. Students should be exposed to data and other resources and then share and learn from their different experiences. The classroom should be an open environment where idea sharing and learning experiences are encouraged. Some ideas for classroom applications of constructivism for the teacher include having students working together and helping each other to answer one another's questions. Another strategy includes designating one student as the "expert" on a subject and having them teach the class. Students should be encouraged to work in groups or pairs and research topics which they must then present to the class.

Constructivist classrooms that use technology support independent work as well as collaboration among students. Classrooms designed like this provide students opportunities to connect prior learning and share different experiences. Students have access to a variety of tools and resources; technology goes hand in hand with this type of constructivist learning environment. Technology gives today’s student instant access to information and makes it possible to exchange information between individuals; it allows instant access to databases and online information services, and provides access to multimedia such as interactive audio and video. Technology also allows for the repurposing of pre-existing educational materials across media formats: print, static illustrations, still and digital photographs, digital audio, still and motion video, still and
motion film, animations, computer graphics, and hypermedia can all be accessed and combined in novel ways (Strommen & Lincoln, 1992). Technologies, primarily computers, help build knowledge bases, which will “engage the learners more and result in more meaningful and transferable knowledge. Students function as designers, using the technology as a tool for analyzing the world, accessing information, interpreting and organizing their personal knowledge, and representing what they know to others”. Technological tools such as spreadsheets, databases, expert systems, video conferencing and others can be used by students to analyze subject matter, develop representative mental models, and transcribe them into knowledge bases (Jonassen, 1994; Jonassen & Carr, 2000; Jonassen & Reeves, 1996).

Students can create their own understanding by using technology tools for individualized learning, or as a device to share their ideas with other classmates. Individual understanding and experiences should be shared and compared to courses of study. By bringing to light students' individual understandings, teachers can determine the impact of students' prior knowledge and further their education through new experience (Southwest Educational Development Laboratory, 2010). Students can use the technology as tools for analyzing the world, accessing information, interpreting and organizing personal knowledge, and representing what they know to others. These tools are intended to engage and facilitate cognitive processing. Cognitive tools are both mental and computational devices that support, guide, and extend the thinking processes of their users (Rakes, Flowers, & Casey 2006). Technology used in this way allows students and teachers to easily create student-centered learning environments that support different views or interpretations of reality, knowledge construction, context-rich, experience-based activities which tie into the core of the constructivist theory.

Technology can also be used advantageously in a constructivist classroom to assist active experiences—gather data and resources, conversing with colleagues, and encourage cooperative learning and student collaboration. If they are allowed to converse, most students like to talk about their computer work and share their strategies. Classroom activities should be structured so that the technology encourages collaboration and builds on students desire to communicate and share their understanding. It takes planning and intervention to build successful cooperative groups with or without technology, but groups that use technology as teamwork tools have a better start toward a collaborative constructivist learning environment (Southwest Educational Development Laboratory, 2010).

Technology and Constructivism in the Classroom: A Real-World Example

There is no blueprint for a constructivist, technology driven classroom, and teaching practices based on constructivism are diverse and flexible. The educational goal of this example lesson is to teach students the difference between mammals and reptiles. The teacher in the traditional classroom would start by determining which facts the students are required to learn, and then
design an outline to transfer those facts from the teacher to the student. The teacher would
determine what the students knew about the subject and then would present information to
students using lecture, dittos, videos, or topic outlines. The classroom discussion would be
focused on reinforcing the factual information. For assessment the students would be given a
paper test to evaluate the facts they were taught.

The constructivist teacher would compose the same lesson by employing more student-centered
activities. A web quest to a zoo would take place. Prior to the web quest the teacher would
present the students with their topic and generate a class discussion to determine student’s prior
knowledge on the subject. During the web quest students would be required to observe the
different aspects of the animal’s environment, their appearance, their habitat, how they move,
and what they eat. After the students are finished with the web quest they will break into small
groups and describe and talk about the differences between mammals and reptiles. The teacher
will be walking around during these small group instructions acting as a facilitator. For
assessment students will work in small groups on a problem solving task. Students would be
required to classify various mammals and reptiles into appropriate groups based on different
criteria that they observed.

Conclusion

Constructivist views maintain that learning is the active process of constructing rather than
passively acquiring knowledge and instruction is the process of supporting the knowledge
constructed by the learners rather than the mere communication of knowledge (Nanjappa &
Grant, 2003). Within this constructivist context environment, technology can play an integral
part in the learning environment. By integrating technology with constructivist methods, such as
problem-based learning and project-based learning, learners are more responsible for and active in
the learning process.

The challenge for teachers today is to prepare the students of tomorrow. This preparation must
include learning the process of thinking and problem solving in the real world. In order to thrive
in a global economy, students will need digital age proficiencies. It is important for the
educational system to make parallel changes in order to fulfill its mission in society, namely the
preparation of students for the world beyond the classroom. The constructivist approach in
combination with the latest technology affords an effective model to reach these learning goals.
References


