

Constructivism is a learning theory found in psychology which explains how people might acquire knowledge and learn. It therefore has direct application to education. The theory suggests that humans construct knowledge and meaning from their experiences. Constructivism is not a specific pedagogy. Piaget's theory of Constructivist learning has had wide ranging impact on learning theories and teaching methods in education and is an underlying theme of many education reform movements. Research support for constructivist teaching techniques has been mixed, with some research supporting these techniques and other research contradicting those results.

In the classroom, the constructivist view of learning can point towards a number of different teaching practices. In the most general sense, it usually means encouraging students to use active techniques (experiments, real-world problem solving) to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing. The teacher makes sure she understands the students' preexisting conceptions, and guides the activity to address them and then build on them.

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." This gives them ever-broadening tools to keep learning. With a well-planned classroom environment, the students learn HOW TO LEARN.

Constructivism and Technology: Strategies for Increasing Student Learning Outcomes

Introduction

Constructivism is a theory about knowledge and learning (Fosnot, 1996). It requires a learner-centered classroom where knowledge and the creation of knowledge is interactive, where different viewpoints exist, and where all student questions are valued (Brooks & Brooks, 1993). In a constructivist classroom, the importance of context related to the learning process is emphasized. In addition, the importance of "authentic activity" is promoted, which is an experience of personal relevance to students (Lebow, 1993). Constructivist classrooms are very different from traditional classrooms. To highlight the differences, Brooks & Brooks (1993) did a comparative analysis of constructivist and traditional classrooms. Below are a few examples of the differences from their research:

<u>Constructivist Classroom</u>	<u>Traditional Classroom</u>
Students collaborate on tasks.	Students primarily work alone.
Student input is highly valued in the teaching-learning process.	Adherence to the established curriculum is highly valued.
Students are treated as thinkers with the ability to construct new	Students are treated as empty vessels into which information is

knowledge.	poured by the teacher.
Teachers partner with students in the classroom.	Teachers are the experts, disseminating information to students.
Teachers seek students' feedback in order to better understand student learning.	Teachers seek the "correct" answer to validate student learning.
Assessment of student learning is integral to the teaching-learning process.	Assessment of student learning is separate from teaching.

Based on the differences between constructivist and traditional classrooms, it is clear that students are more actively engaged and have greater ownership of their learning in constructivist classrooms. They share ideas, ask questions, discuss concepts, and revise their ideas when necessary. The constructivist classroom setting is very collaborative, which contributes to enhanced learning outcomes (Jonassen, 1996). According to Wilson (1996), a constructivist classroom requires that students take responsibility for their own learning. Therefore, students think about what they need to learn, are able to manage their own learning activities, and utilize metacognitive skills. Strommen & Lincoln (1992) suggest that the core premise of constructivism is that students actively construct their own knowledge by connecting new information to preexisting knowledge, which helps them to make sense of the world. In constructivist classrooms, students have the opportunity "to take personal responsibility, exercise initiative, and be in control in the instructional setting through a variety of learning experiences" (Snyder, Bolin, & Zumwalt, 1992, p. 415). Constructivist practitioners encourage student responses to guide lessons, shift instructional strategies, and make curricular improvements. These practitioners have contributed to a fundamental change in our understanding of the teaching-learning process. A constructivist framework changes the role of both the teacher and student. It gives new status to the student as an active constructor within the learning environment instead of being a passive recipient of knowledge from the teacher. Also, the teacher becomes a partner with the student in the intellectual discovery process (Brooks & Brooks, 1993). Furthermore, constructivist approaches to teaching accommodate individual differences in learning styles. Teaching practices based on constructivism are flexible enough to meet different learning needs. For example, the integration of technology into a constructivist classroom allows for individualized learning.

Complementary Relationship Between Constructivism and Technology

There exists a complementary relationship between constructivist practice and technology. Like constructivism, technology has transformed the teaching-learning process. It has been used in

many classrooms to foster meaningful learning experiences (Jonassen, Peck, & Wilson, 1999). Several studies have investigated the role of technology in enhancing the teaching-learning process in constructivist classrooms (e.g., Black & McClintock, 1995; Brush & Saye, 2000; Collins, 1991; Duffy & Cunningham, 1996; Richards, 1998). Duffy & Cunningham (1996) have suggested that constructivist methods exploit educational technologies for the greatest impact on learning outcomes. They state:

Technology is seen as an integral part of the cognitive activity...This view of distributed cognition significantly impacts how we think of the role of technology in education and training, the focus is not on the individual in isolation and what he or she knows, but on the activity in the environment. It is the activity- focused and contextualized- that is central... The process of construction is directed towards creating a world that makes sense to us, that is adequate for our everyday functioning (p. 187-188).

According to Collins (1991), technology rich classrooms contribute to the following changes:

1. A shift from large group to small group instruction.
2. Teacher facilitation occurs rather than lecture.
3. Teachers have more time to work with weaker students.
4. Students are more actively engaged in the classroom and participate in decision making.
5. There is more collaboration in the classroom.
6. There is more autonomy and individualized instruction

The availability of technology may lead teachers to incorporate constructivist practices in their classroom. Rakes, et.al. (1999) found that the amount of technology available, the level of technology skills of the teachers, and the use of technology were directly related to use of constructivist methods in the classroom. They state, "technology can provide the vehicle for accomplishing constructivist teaching practices" (p. 3). Technology complements constructivism by providing ongoing information and tools for student creativity and development, which contributes significantly to an increase in student learning outcomes. It serves as a powerful tool for constructivism's fundamental principle that students learn by doing. Constructivist practice is made easier with technology because it promotes collaborative, interactive and student-centered learning. The use of technology in the classroom also has a positive effect on student attitudes because they feel more successful, are motivated to learn and have better self-confidence (Dwyer, et al, 1991). In today's digital economy, the ability to access, adapt, and create knowledge using technology is critical to a student's success.

Applying a constructivist approach in a classroom using technology creates more learning opportunities. For example, online activities provide students with unlimited access to information and tools for creativity and development. This challenges students to be self-motivated, interactive, and committed to critical thinking. Constructivist practices and technology allow students to present their ideas to a broader and diverse audience beyond their individual classroom. The term techno-constructivist has been used to describe teachers who integrate technology into the curriculum, so that it not only complements instruction but helps to redefine it (McKenzie, 2000).

Assessment of Student Learning Outcomes

The effectiveness of constructivist methods and technology on student learning outcomes is dependent on how the technology is integrated into the instruction and the assessment of the learning outcomes. Technology offers teachers a range of tools to collect and analyze data in order to inform their practice. With the increase in accountability, teachers are now having to systematically use data in the decision making process (Delisio, 2003). More importantly, teachers are expected to show how they use assessment data to make changes in their teaching practice in an effort to increase student learning outcomes. Students need criteria, feedback, and opportunities for reflection in order to maximize learning outcomes. In traditional classrooms, assessment activity usually comes at the end of a unit and focuses on grading and accountability, which doesn't serve students' need for feedback throughout the learning process (Gifford and O'Connor, 1991). Jonassen (1991) offers the following observations regarding appropriate assessment from a constructivist perspective:

1. Assessment must be outcome based and student centered.
2. Assessment strategies should be linked to instructional outcomes.
3. "Grades" should be contracted when required.
4. There should be non-graded options and portfolio assessment.
5. In addition to teacher assessment, there should be self and peer assessment.
6. Performance standards should be established.
7. A grading process should be developed that includes meaningful feedback to students on a regular basis.
8. Assessment should be context dependent.

Strategies for Increasing Student Learning Outcomes

Constructivist instructional design models embrace cooperative learning, project-based or problem-based learning, and reciprocal learning (Hannafin, et.al., 1999; Jonassen, 1991; Spiro, 1992). Educators interested in developing a constructivist classroom would benefit from Jonassen's (1991) "Constructivist Learning Environment" model, which is widely used to design constructivist classrooms. In his model, Jonassen identifies a number of strategies that can be used to promote an increase in student learning outcomes. These strategies are as follows:

1. Create real world environments that employ the context in which learning is relevant;
2. Focus on realistic approaches to solving real-world problems;
3. The instructor is a coach and analyzer of the strategies used to solve these problems;
4. Stress conceptual interrelatedness, providing multiple representations or perspectives on the content;
5. Instructional goals and objectives should be negotiated and not imposed;
6. Evaluation should serve as a self-analysis tool;

7. Provide tools and environments that help learners interpret the multiple perspectives of the world, and
8. Learning should be internally controlled and mediated by the learner.

Below are strategies for increasing student learning outcomes in a constructivist classroom utilizing technology:

1. Coordinate technology implementation efforts with core learning goals;
2. Teachers should collaborate to design a curriculum that involves students in meaningful learning activities using technology when appropriate;
3. Conduct a technology needs assessment;
4. Develop a technology strategic plan;
5. Create an instructional technology budget;
6. Offer technology training opportunities for teachers/faculty;
7. Establish a technology committee;
8. Expand instructional technology support staff;
9. Provide technology support across the curriculum;
10. Increase accessibility to computers and technology;
11. Engage in ongoing assessment of technology and constructivist methods.

Conclusion

Constructivist theory provides valuable insight for educators who want to use technology to increase student learning outcomes. The utilization of technology in constructivist classrooms enables students to be more responsible for and active in the learning process, which contributes to an increase in learning outcomes. Constructivist practice allows teachers to individualize learning for each student, while using technology tools to enhance the learning process. Taken together, constructivist practice and technology offer compelling evidence of the benefits of educational innovation on student learning outcomes.

Some useful links:

www.thirteen.org/edonline/concept2class/index.html

www.thirteen.org/edonline/concept2class/constructivism/demonstration.html

www.sydney.edu.au/education_social_work/learning_teaching/ict/theory/constructivism.shtml

<https://sites.google.com/a/boisestate.edu/edtechtheories/the-impact-of-technology-on-constructivist-pedagogies-1>

www.saskschoolboards.ca/old/ResearchAndDevelopment/ResearchReports/Instruction/97-07.htm

www.slideshare.net/mlegan31/constructivism-in-the-classroom4