

Emerging Theories of Learning and the Role of Technology

Shannon Doak

Boise State University

Abstract

This paper discusses the changes in the world created by technology which leads to the discussion of the changes within the current student population and the role technology has played. It then covers how the changes being made in society have affected the requirements for graduates entering into the work force. These requirements bring into light the fact that technology integration can play a large role in changing our learning environments to better support the development of higher-level thinking skills needed by the 21st century. This leads to the discussion of emerging learning theories. Situated Cognition, Distributed Cognition and Socially-Shared Cognition are discussed in regards to the creation of learning environments which support higher-level learning skills.

Emerging Theories of Learning and the Role of Technology

Introduction

The world is changing and the requirements for people entering into this world are different than they have been in the past. This paper will look at what this major change is, what these new requirements are and the impact they have had on the theories about learning.

Why new theories are emerging and what technology can do to help

Many reasons could exist for a new theory to be developed. Perhaps an older theory doesn't quite answer questions about learners or maybe the old theory leaves out an explanation for cognition within the brain. For the purpose of this paper though, the author has chosen to discuss reasons connected to a change in the world that is having an effect on nearly every aspect of society. This aspect is technology (Fouts, 2000).

What is happening to make educators think that a change is needed?

The main reasons educators would believe that change is needed are that they can see a change in the current student population, and they can also see a change in the requirements of our new world. Students are facing an entirely different world than the generations before (Fouts, 2000). This generation of students differs in many ways, but one thing which stands out is that they have more access to technology than previous generations (Eugene, et al, 2004). For example research has found that quite a few first grade aged students use a computer on a weekly basis during the summer

holidays. Researchers have also found that by the year 1999, a surprisingly large percentage (97%) of kindergarteners had access to computers at home or school. Statistically, even lower income students that might not have access to technology at home find a way to make use of it, by either going to a library, their school, or to a friend's house (Eugene, et al, 2004). These statistics clearly show that technology plays a very important role in students' lives. It also helps to clarify why educators believe a change is needed in the way teaching and learning occurs. If students are so engrossed in the use of technology outside of the classroom, they obviously value it. It would then be logical to say that if technology were integrated into the classroom the learning environment would be more relevant to the current student population. Why are children of today becoming so engrossed in the use of technology at such an early age?

The world we live in has become a technical world. Nearly all aspects of society have been influenced by technology (Fouts, 2000). According to *Research on computers and education: Past, present and future*,

The fact that virtually all segments of society have changed dramatically by information technologies and will continue to change in the future cannot be ignored. Schools must be a part of these changes and research should proceed with the assumption that technology is and will continue to be a growing element within the schools (Fouts, 2000, p. 33).

This is the main reason the student population is so interested in the use of technology. It is impossible to grow up in a world that has become technological in nature and not be influenced by it.

As stated above the world we live in has been changed dramatically by information technologies. What does this mean for young adults entering into the workplace of the 21st century? What are the requirements of this century and how can the integration of technology help? The requirements of the 21st century are dramatically different than those of previous times. In fact, core subject knowledge is no longer enough, students need higher-level learning skills. The demands of the 21st century require young adults to be able to “use their knowledge and skills—by thinking critically, applying knowledge to new situations, analyzing information, comprehending new ideas, communicating, collaborating, solving problems, making decisions” (Honey, et al, 2003, p. 9). Not only does the 21st century demand these high-learning skills, they are needed to be successful in this ever changing world that we live in. Authors of *Computers in the classroom: The impact of technology on student learning state:*

The world in which we live is increasingly sophisticated, multifaceted and nuanced. People need high-level learning skills to respond, learn and adjust to ever-changing circumstances. As the world grows increasingly complex success and prosperity will be linked to people’s

ability to think, act, adapt and communicate creatively (Stratham & Torell, 1996, p. 24).

In order to prepare students for the demands of this new century change in the way teaching and learning occurs must take place. Learning environments must become more authentic, by giving students the opportunities to use higher order thinking and problem solving skills connected to real world applications (Fouts, 2000). It is this need along with the change in the current student population that has led to the rethinking of learning theories and the revamping of learning environments. These new theories whose foundations are based on older educational theories are vastly different in their methods of teaching and learning.

What can technology do to help?

Technology integration, if done properly, can do many things to help in the process of creating more authentic learning environments and more. Many of the studies report, if the learning environment is technologically rich, it can increase self-esteem and enthusiasm for learning (Fouts, 2000). This can lead to more positive attitudes for learning, as well as lower absentee and dropout rates. In fact, one study proved that having a more technologically rich learning environment eventually lead to a higher rate in college attendance and scholarships (Stratham & Torell, 1996). This is great news for today's students if they are lucky enough to have learning environments that are rich in technology. Studies show that technologically

rich learning environments provide for better development of life skills.

These skills include organizational, problem solving, inquiry, and collaboration skills. The learning environment is improved by providing more cooperative learning and reduced competition (Stratham & Torell, 1996).

Research also has shown that technology integration increases the chance of interaction within the learning environment (Keengwe, et al, 2008).

"Because many new technologies are interactive, it is now easier to create environments in which students can learn by doing, receive feedback, and continually refine their understanding and build new knowledge" (Fouts, 2000, p. 11). It is these new environments, which have so much interaction between the participants in the learning community, that emerging theories on learning support and try to create.

Emerging theories that support the use of technology and help to create more authentic learning environments

Situated Cognition

Situated Cognition is a learning theory which supports the idea that learning occurs only when situated within a specific context. It believes that learning takes place in a learning community or community of practice, where the learners take an active role in the learning community. It involves a process of interaction between the learners within the community, the tools available within the specific situation and the physical world. It is within this active participation, this interaction (whether with tools, artifacts

or other people), where knowledge is located. Therefore knowing evolves as the learners participate and interact within the new situation. Cognition is linked to the action the learners in the community take, whether it is physical in nature or a reflective process within the learners themselves (Myers & Wilson, 2000). Wilson and Meyers put it this way, "the development of knowledge and competence, like the development of language, involves continued knowledge-using activity in authentic situations" (Myers & Wilson, 2000, p. 71). Situated Cognition also takes into account the culture of the community at large and "treats culture as a powerful mediator of learning and practices, both for students and teachers (Myers & Wilson, 2000, p. 83)." Basically, a program based on this theory will not be successful if the larger communities, outside the learning environment, culture is not considered, as it can define what may be possible within the learning environment (Myers & Wilson, 2000). The main points to remember about situated cognition for the purpose of this paper are that "knowing, learning and cognition are social constructions, expressed in actions of people interacting within communities" (Myers & Wilson, 2000, p. 59). Therefore without action there is no learning.

So what is the role of technology within this emerging theory of learning? As stated above action needs to take place in order for cognition to occur. This action must take place within a community of practice or learning community. This action often involves interaction between tools

and or artifacts that are situated in the community (Myers & Wilson, 2000). These tools and or artifacts are invaluable parts to the learning system. Without these parts the interactions that they produce, assist or motivate, may not occur. Therefore technology in this learning theory is a piece of the learning environment that helps to bring about cognition. Myers and Wilson (2000) state, "These tools and constructed environments constitute the mediums, forms, or worlds through which cognition takes place. Problem solving involves reasoning about purposes in relationship to the resources and tools which a situation affords" (p. 71).

It is quite clear that the learners who are placed into this type of learning environment would be using their "knowledge and skills—by thinking critically, applying knowledge to new situations, analyzing information, comprehending new ideas, communicating, collaborating, solving problems, making decisions" (Honey, et al, 2003, p. 9) This learning theory supports the very skills needed by the 21st century.

Distributed Cognition

In Distributed Cognition the student is afforded more power. In other words it is a student centered approach to learning where the learners participate in a systematically designed learning environment that supports interaction amongst its participants. Distributed cognition describes a construction of knowledge that takes place in a natural environment which is synergistically connected to the cognitive actions taken by the participants in

the learning environment. (Bell & Winn, 2000) This theory promotes learning in a community of learners or a system where interaction takes place. It is through this interaction where cognition occurs. Distributed Cognition requires sharing of cognitive activity among the parts and participants of this system, which can be other people or artifacts such as devices, technologies or media. These participants distribute their cognition among other learners and physical or digital artifacts by externally representing their knowledge. Artifacts can help to scaffold new capabilities as well as off-load a certain amount of cognitive work thus reducing the cognitive load of the learners and helping to augment their capabilities. At times, by using these artifacts, a little bit of the information might stick with the user, this is known as cognitive residue. It is through interaction with other members and artifacts that progresses learning. Therefore communication among all participants is paramount in importance (Bell & Winn, 2000).

The role of technology within this theory is an invaluable part of the system in which the learners are interacting. This interaction can either help to distribute their knowledge, off-load certain amounts of cognitive work making the cognitive load less and or help to scaffold new capabilities (Bell & Winn, 2000). In this theory technology (artifacts and or tools) can be used to help extend human capabilities. An example of this might be the use of manipulatives in the early development of basic addition skills (Bell & Winn, 2000). The problem might be too complex for the child to solve, but with

the use of the manipulative, they can visually represent their thinking and use the tool to help them solve the problem. Another example of this is taken from a case study that was conducted using robotics to produce solving problem skills. In this case study, students were placed into small collaborative groups and were asked to construct a robot, using Lego Mindstorm for schools kits, which would perform various tasks. The groups were introduced to a tool known as a flowchart. They used these flowcharts to map the programming instructions they would give the robot to complete the given task. This allowed them to off-load some of the cognitive work to the flowchart and then through its use, they were able to solve harder problems (Chambers, et al, 2007). The above example shows that cognition takes place because of the cognitive abilities of the learner plus the augmentation of these capabilities by the use of the external technology (Bell & Winn, 2000).

This learning theory supports the very skills needed by the 21st century. Learners who are placed in to a learning environment based on this theory would be using their “knowledge and skills—by thinking critically, applying knowledge to new situations, analyzing information, comprehending new ideas, communicating, collaborating, solving problems, making decisions” (Honey, et al, 2003, p. 9)

Socially Shared Cognition

In Socially-Shared Cognition learners are participants in a community where the cognition is shared between the participants, the artifacts and tools they are using and the social institutions in which the learning occurs (Brown & Cole, 2000). The learners of this community are required to be active participants in order for cognition to occur (Bell & Winn, 2000). In this theory, cognition is also distributed, as sharing implies both that the learners are experiencing something together and that the learning which occurs is being divided and distributed between the participants in the learning community (Bell & Winn, 2000). These ideas of sharing are relevant to this theory because no two learners can ever experience a situation in the exact same way as another learner. Brown and Cole put this way,

To say that cognition is socially shared is to say that it is distributed (among artifacts as well as people) and that it is situated in time and space. Because it is distributed, and its assembly requires the active engagement of those involved, it is to some extent constructed (Brown & Cole, 2000, p. 198).

The role of technology in this theory is similar to that of the other two theories thus far discussed. Technology plays a part in this theory by being something which helps to share the cognition in the community of learning. In one example a computer and the games the children play on it, are at the heart of the system. The participants make use of the games as the core

activities for the learning of new skills. While the games are regular off the shelf type of games for computers, they are changed by a make believe activity system. In this system there are specific tasks set for the children to accomplish, many of which involve communicating with others in the learning community, either orally or in written format (Brown & Cole, 2000).

This learning theory also supports the skills needed by the 21st century. Learners who are placed in to a learning environment based on this theory would also be using their “knowledge and skills—by thinking critically, applying knowledge to new situations, analyzing information, comprehending new ideas, communicating, collaborating, solving problems, making decisions” (Honey, et al, 2003, p. 9) The use of this learning theory could help to prepare our students for their lives in this new world.

Shared aspects of these learning theories

All of the above emerging theories share many of the same aspects. One strong aspect is they all suggest that learning occurs best in a community of learning or practice. The word community implies that the people within it are taking an active part in the process of learning. They all support communication amongst the learners and interaction with others, artifacts, and tools in order to assist cognition. In these theories technology plays an integral part, either by helping to assist the learning of new skill by providing scaffolding or by off-loading some cognitive work to make the

learning process easier. These technologies may also help to maintain the vital interaction amongst the learners within the community. It is this interactive environment where the students are learning by doing, communicating and receiving feedback which helps to bring about the skills desired by the 21st century. All of the above mentioned theories help to create a learning environment which allows participants to “use their knowledge and skills—by thinking critically, applying knowledge to new situations, analyzing information, comprehending new ideas, communicating, collaborating, solving problems, making decisions” (Honey, Mandinach, & McMillan, 2003, p. 9)

Conclusion

Technology has made a huge impact on people’s lives. This impact has affected every aspect of society. It has also had an impact on the current student population. It has made our world increasingly complex which has changed the requirements for people entering into the work force. This change has made it necessary to create learning environments which support higher level thinking skill development. Technology integration has also been shown to help create more authentic learning environments where the students are more motivated to attend, have a greater chance of communication and collaboration and have more opportunities to use higher order thinking and problem solving skills connected to real world applications

(Fouts, 2000) This has led some to believe that new theories in learning needed to be developed that would help to support the creation of such learning environments. The three emerging theories discussed in this paper all possess the ability to support the creation of such learning environments. They all support the idea that learning is through action. They all support that cognition happens through communication and collaboration with others. They all support the use of technology to help in the creation of such learning environments. It is through these new theories that learning environments, which support the development of these higher-level learning skills, can be created.

References

- Bell, P., & Winn, W. (2000). Distributed cognitions, by nature and by design. In D. Jonassen, & L. S. M., *Thoretical Foundations of Learning Environment* (pp. 123-145). New Jersey: Lawrence Erlbaum Associates, Inc.
- Brown, K., & Cole, M. (2000). Socially Shared Cognition: System Design and the Organization of Collaborative Research. In D. Jonassen, & L. S. M.,

Theoretical Foundations of Learning Environment (pp. 197-214). New Jersey: Lawrence Erlbaum Associates, Inc.

Chambers, J. M., Carbonaro, M., & Rex, M. Scaffolding Knowledge Construction through Robotic Technology: A Middle School Case Study . *Electronic Journal for the Integration of Technology in Education* , 6, 55-70.

Eugene, H., Rod, P., & Patrick, S. (2004). *Toward a new golden age in American education: How the Internet, the law and today's students are revolutionizing expectations*. Department of Education.

Fouts, J. T. (2000). *Research on computers and education: Past, present and future*. Bill and Melinda Gates Foundation.

Honey, M., Mandinach, E., & McMillan, K. C. (2003). *A retrospective on twenty years of education technology policy*. Education Development Center, Center for Children and Technology, U.S. Department of Education, Office of Educational Technology.

Keengwe, J., Onchwari, G., & Wachira, P. (2008). The use of computer tools to support meaningful learning. *AACE Journal* , 16 (1), 77-92.

Myers, K. M., & Wilson, B. G. (2000). Situated Cognition in Theoretical and Practical Context. In D. Jonassen, & L. S. M., *Theoretical Foundations of Learning Environments* (pp. 57-88). New Jersey: Lawrence Erlbaum Associates, Inc.

Stratham, D. S., & Torell, C. R. (1996). *Computers in the classroom: The impact of technology on student learning*. Boise, ID: Army Research Institute. .