2002

The constructivist-based approach : the better choice for learning

Consuella Eugene
University of Northern Iowa

The constructivist-based approach : the better choice for learning

Abstract

With the integration of technology in the classroom, the constructivist-based approach encourages students to utilize their minds in a scholastic and a creative manner. Students are encouraged to learn via creativity, experience, experimentation, and teamwork. Teachers are able to organize information around conceptual clusters of problems and questions as opposed to learning facts in isolation. This approach is based upon the idea that students construct their own knowledge, rather than reproducing someone else's knowledge.

The advantages of the constructivist-based approach will be clearly noted and described by this researcher exploring the learning environments for students, students learning, student involvement, evaluation of students, technology integration, and the impact of educational technology. This researcher will also offer suggestions for preparing and planning for technology in a constructivist environment.

The Constructivist-Based Approach: The Better Choice for Learning

A Graduate Research Paper

Submitted to the

Division of Educational Technology

Department of Curriculum and Instruction

In Partial Fulfillment

Of the Requirements for the Degree

Master of Arts

UNIVERSITY OF NORTHERN IOWA

By

Consuella Eugene

June 2002

This research paper by: Consuella Eugene

Titled: The Constructivist Based Approach: The Better Choice for Learning

has been approved as meeting the research requirement for the Degree of Master of Arts.

July 29, 2002
Date Approved

Sharon E. Smaldino
Graduate Faculty Reader

Aug. 21, 2002
Date Approved

J. Ana Donaldson
Graduate Faculty Reader

Aug. 22, 2002
Date Approved

Rick Traw
Head, Department of Curriculum And Instruction

Introduction

With the integration of technology in the classroom, the constructivist-based approach encourages students to utilize their minds in a scholastic and a creative manner. Students are encouraged to learn via creativity, experience, experimentation, and teamwork. The shift from an industrial-based society to a knowledge-based society does alter the traditional aims of education in our society because it "changes the fundamental process and values added to each step in producing a product or service, the so called value chain of work" (Trilling & Hood, 1995, p.5).

The constructivist-based approach has more advantages than the traditional approach in integrating technology into the classroom because teachers are able to organize information around conceptual clusters of problems and questions as opposed to learning facts in isolation. This approach is based upon the idea that students construct their own knowledge, rather than reproducing someone else's knowledge. The informational-based approach is direct instruction, where the teacher directly instructs the students on the skill or content that is to be learned and provides practice until the learning was internalized. However, when a distinction between training (direct learning by transmitting knowledge) and teaching (facilitated learning by hands-on experience) exists, it can be observed how direct instruction can have limited value.

When utilizing the constructivist-based approach, students are more inclined to become actively involved in the classroom and activities by sharing ideas, asking questions, and discussing concepts via collaborative environments, which encourage a basis for knowledge construction. In addition, the constructivist-based approach also helps students become further acclimated with progressive technological advances by allowing students to absorb more in less time.

The advantages of the constructivist-based approach will be clearly noted and described by this researcher exploring the learning environments for students, students learning, student involvement, evaluation of students, technology integration, and the impact of educational technology. This researcher will also offer suggestions for preparing and planning for technology in a constructivist environment, while keeping in mind the various learning styles within the learning environment.

Methodology

This researcher chose the constructivist-based approach as her topic based on her experiences in teaching with various learning styles; finding the need to integrate real world situations to lessons in order for students to learn and grasp a range of concepts. This researcher is not a teacher, but has taught various classes for university summer programs and has tutored and mentored many students within the last three years. Surprisingly, in every situation, students had a harder time understanding the content via traditional teaching style, such as lectures or direct instruction. As soon as this researcher delivered the information using meaningful, real life scenarios, the students were able to picture the situation in their minds more figuratively, and then construct their own reasoning and methods for finding answers and analyzing circumstances.

The way students learn and how teachers instruct is a priority to this researcher since in a constructivist environment technology is usually integrated in lessons and used to build the real life simulations needed to reach students and to encourage a different type of thinking. This researcher's focus is educational technology and understanding the impact of a constructivist-based approach. Because of the technology trend and its role in education, she believes in the benefits of technology integration.

Searching for information on this topic was an involved task. The constructivist-based approach of teaching has recently been more accepted and researched by many within the last several years. In searching, this researcher, discovered resources that compared and contrasted the traditional teaching methods and constructivist-based approach, evaluated students and teachers thoughts, described performance and outcomes of a constructivist-based approach, and presented various learning styles of students. This researcher also targeted articles, journals and magazines that focused on educational technology and the integration of technology in various aspects of the education environment.

Analysis and Discussion

Learning Environment for Students

It has been determined that context is essential in teaching students and encouraging students to learn. "Students or participants need to be able to speak and debate their ideas without fear of retribution from any source and should be encouraged to explore and research topics that may not be an explicit part of the curriculum or agenda" (Palloff & Pratt, 1999, p.20). Teachers are able to facilitate student learning by allowing students to express ideas and analysis critical information without the fear of being wrong. This positive atmosphere allows students the freedom to expand their knowledge and build on prior knowledge.

The constructivist-based approach aids in environmental learning by making the transfer of knowledge from one context to another easier and more successful. The constructivist-based approach within a context, allows teachers to portray, examine and explain real world situations, which increases the desire of the student to learn. "Educators must invite students to experience the world's richness, empower them to ask their own questions and seek their own answers, and challenge them to understand the world's complexities" (Brooks & Brooks, 1993, p.5). This combination of context and the constructivist-based approach allows room for clarification of real world problems and "critical thinking and doing in the knowledge age" (Trilling &

Hood, p.9) that, allows students to learn how to analyze and understand what they are experiencing.

The constructive-based approach, supplies teachers with enough information to provoke multiple learning approaches for diverse learning styles and multiple ways of expressing understanding. Constructivism allows teachers to better understand that there are a number of intelligence levels and that people learn in various ways. Many behaviors that are beneficial for informational learning have the opposite effect in the constructivist-based learning environment. This is because students lead learning. They know themselves better than anyone and are more likely to present a lesson that relates to them in the most effective manner. Educators have traditionally focused on information that is relevant to learning and have drilled the information into the minds of the students. A constructivist views learning as the activity in context. "The situation as a whole must be examined and understood in order to understand the learning" (Duffy & Cunningham, 1997, p.171).

Constructivist learning will better serve teachers because they are encouraged to continuously alter their perspectives and practices for teaching in order to reap the gains of a constructivist-based environment. New challenges to problem solving solutions will lead to a heightened engagement level by the student. Due to this change, learning materials used and selected by the teacher are important when "designing challenges

where learners can collaborate on creating solutions to problems students care about" (Trilling & Hood, p.16).

"Teachers learn to elicit and use students' existing ideas as a basis for helping them construct new, more reasoned, more accurate or more disciplined understandings" (Reynolds, 1999, p. 1) because teachers guide students through manipulation and exploration of an environment created to guide students' knowledge constructions. Participation is equivocal to learning and doing with activities that force a teacher to become more of a facilitator and to develop a culture of invitation and value for students in the classroom via intellectual tasks because conceptual clusters are reflecting, building, inquiring, talking, writing and learning through project centered activities. The classroom becomes a context through which students "think, question, revise understandings and learn something about an informative concept the teacher set out to teach" (Reynolds, 1999, p.1). Teachers direct students through manipulation and exploration of an environment created to guide students' knowledge constructions that build on existing knowledge.

Student Learning

After a context or concept is conceived, construction must take place. Here, teachers use "visceral and virtual modeling activities, which provide strong external supports for the internal model-making going on inside students heads" (Trilling & Hood, p.10). As people build mental models and assimilate new

experiences, they confront experiences that do not quite fit, or hold important misconceptions about the world as necessary bridges to more accurate models. The construction of mental models aid in assimilating new experiences, accommodating changes to our models for those experiences that do not necessarily fit or coincide and holding important misconceptions about the world as motivators, and creating bridges for reaching more accurate and precise models. Design, simulation, and building activities are essential to learning because "they match the constructive, modeling, and designing aspects of how we learn, and they also prepare us for the models we will use to accomplish our future knowledge work" (Trilling & Hood, p.10).

If students learn by actually doing rather than by being told how to do it, then they will need to engage in higher level thinking activities such as problem analysis, information gathering, synthesis, abstraction and reflection. A lecture-learning environment is hardly the best place where these activities can occur. Through the researcher's experience, lectures are inherently an informational teaching method where knowledge is conversed by one expert to a group of students gathered together in one place in order to passively listen and retain what is taught. A lecturer can model problem-solving approaches but it is not until students have to do it for themselves that valuable transferable learning will take place. Lecturing is very useful for imparting the core or foundational

knowledge but it cannot develop the student's own abilities to use information in unfamiliar environments or make meaning.

As Fardouly (1998) states: "lecturing does not provide opportunities for students to engage in a continuing dialogue with the lecturer where their conceptions can be shaped through feedback. Nor does it allow students to actively apply are experiment with their conceptions or reflect on experiences and feedback" (p.2). During a lecture, there is no room for students to express their ideas or to be creative because the instructor is constantly feeding students information that they are expected to subsequently regurgitate.

Lecturing keeps the teacher dependent on one way of teaching and allows teachers from approaching systematic reform with little background knowledge on the topic that is to be taught, especially topics that constantly change. The paradigm shift, lecturer to facilitator, supplies teachers with a since of empowerment because they have a stake in the structural change and responsibility. If educators are to prepare students in today's world to communicate, "we must help them comprehend and communicate through both traditional and emerging technologies of communication" (Considine & Haley, 1992, p.12).

Student Involvement

In the constructivist approach, students are more inclined to become actively involved in the classroom and activities by sharing ideas, asking questions, and discussing concepts via

collaborative environments. This encourages knowledge construction for long-lasting learning. With this approach, students voice their prior knowledge in the classroom or during the activity in order to extend and improve the new knowledge acquisition. "This encourages students to continue to examine and build on their knowledge" (Moussiaux & Norman, 1997, p.4). It is better for students to work in groups to solve problems because they are given the opportunity to voice their opinions and ideas, and then receive and report feedback. It is more effective when students work in groups because they acquire more information, analyze ideas, and demonstrate and communicate their understanding of various concepts.

A constructivist approach allows student responses to activate lessons and alter instructional strategies and content. Students "form rules through reflection on their interaction with objects and ideas. When they encounter an object, idea or relationship that does not make sense to them, they either interpret what they see to conform to their rules or they adjust their rules to better account for the new information" (Sprague & Dede, 1999, p.3). The knowledge construction for students is formed because the constructivist teachers are encouraging the students' inquiries by "asking thoughtful and open-ended questions and encouraging students to ask questions of each other" (Sprague & Dede, p.4). This process of reflection allows students to connect with each other and provides a richer

learning experience. Palloff and Pratt (1999), state "this process, then, is historical; it takes stock of our shared history and records it as we progress though the course but the reflective process does not end with history taking. It is also looking ahead as to how this process will affect the learner in the future" (pg. 139). Since there is usually no right answer, students are motivated to discuss with one another and the teacher, while gaining the opportunity to present their ideas, listen to, and reflect on the ideas of others.

This type of learning is "a modification of the person's world by an interaction process within which a person attains new insights or changes old ones" (Buther, 1998, p.1). Students are allowed to tackle problems full of meaning because of their real-life happenings and interactions. In solving these problems, students are encouraged to explore possibilities, invent alternative solutions, collaborate with other students or external experts, try out ideas and hypotheses, revise their thinking, and then present the best solution they can derive. This method works better than the traditional method because students are not simply learning the tasks and rules for how to get an answer right using the teacher's procedures, but they are challenged to critically think, invent solutions, and create a knowledge thinking process.

The constructivist approach also is a catalyst for a higher level thinking among students. As students learn by

experimentation and development of ideas and theories, they must also justify, defend, and prove their ideas and concepts. This concept challenges students and causes them to experiment and provide proof before determining their conclusion. With this type of thinking, students will carry these problem-solving skills over into their careers and lives. It will cause them to be well rounded and to be successful in their field of study. The amount of information retained by students, because of the rigorous process and determination of proof and justification, will be much greater as opposed to a rehearsed textbook response. Students will have more information committed to memory and will also be able to readily apply what information they have. With this in mind, this higher level of thinking will give students an increased level of confidence performance. This is advantageous in our competitive, commercial, and capitalist society. With this confidence, students will be more apt to compete with both foreign and domestic peers.

Evaluation of Students

When a student takes standardized tests and learns textbook answers, there is limited room for contingency factors, ingenuity, or creativity. The researcher has observed that written and standardized tests are not necessarily the most accurate way of measuring the information learned and ascertained by students. A student that just sits in a class and listens to a lecture will more than likely retain less information than a

student who has hands-on experience, open class discussions, and interactive dialogue with teachers and other students. With the constructivist-base approach, teachers encourage the integration of technology in the classroom. Because the teacher and other students are encouraged to respect students' ideas, the constructivist teaches students to be independent thinkers and, even more importantly, problem solvers. Instead of being dependent on teachers to answer all questions and solve all problems, the students are encouraged to be independent and to analyze and assess their situations and engage in problem solving on their own. When students have the freedom to think independently, they develop their own intellectual identity, which helps to give them confidence and that confidence, encourages them to develop capabilities to solve problems.

Integrating Technology into Learning Environments

The format of the constructivist approach when integrating technology in the classroom is key to student technological progress. Yet, even with that knowledge, many teachers are still reticent and uncomfortable with determining how a variety of technology-based experiences can expand and enhance what is happening in their classrooms. As seen today with online classes and universities such as the University of Phoenix, information is being learned, processed, and applied much faster and in greater quantities than ever before. Many colleges and

universities around the country are now offering degrees in e-commerce and various kinds of Internet business.

The researcher has experienced a university that is set up in what resembles a constructivist format. Students of this Internet-supported university read their material and interacted through cyber-conversations by sharing and analyzing the thoughts and reflections of their fellow classmates through synchronized and asynchronized postings and evaluations.

There are scholastic requirements, but there are not many standardized tests nor any lectures by professors or challenging midterms. The challenge comes when students discipline themselves, learn to critically think, learn all the material, interact with their fellow classmates, analyze statements and thoughts of their fellow classmates, explain, discuss, prove, and defend their own thoughts, ideas and concepts.

Technology integration within an Internet-enhanced university may not simply include technology, but also traditional and contemporary means of education such as team and group work. Professors may place teamwork and class participation as requirements for a good grade in the class discussions, class project, and class interactions. This type of team interaction forces the student to branch out of his/her normal realm of cooperation and derive new and creative ways for completing assignments. In addition, students must conduct their own surveys and searches in order to justify and defend their

thoughts and concepts. Through the researcher's own discussion with fellow classmates, the researcher learned that students of Internet-enhanced learning environments embrace this challenge. Many students prefer this particular system of learning over the traditional college setting and learn and retain more information since they are not being fed information, but rather searching for their own contents and contexts.

With the phenomenon of today's online learning students must learn to operate and function in this type of learning structure. Instructor support should accommodate and adequately equip students to function in this type of environment. Just as many major universities have shifted to Internet classes, our nation's K-12 schools must prepare for new innovations and advances in technology. They must enhance, upgrade, and improve their systems and curriculums to accommodate and integrate technology through a constructivist approach.

Dr. Healy (1998), stated "the best results from all technology use for children come accompanied by a skilled adult "coach who adds language, empathy, and flexibility"(p.247). It is imperative to develop the appropriate learning environment for the use of technology. It is important that teachers and parents play an active role in developing a plan that will be useful in guiding students through the learning process because students can easily go off track and find themselves lost in cyberspace.

Impact of Educational Technology

Computer-based instruction (CBI) "individualizes the educational process to accommodate the needs, interests, proclivities, current knowledge and learning styles of the students" (Schacter, 1999, p.4). Research on technology and the impact of student learning is in its infancy and the educational field is beginning to see foundational work emerge. When CBI was implemented it determined that students absorbed more information in less time. In a study, learners who used CBI scored in the 64th percentile on tests of achievement when compared to learners in controlled conditions without computers, who scored in the 50th percentile (Kulik, 1994, p.4). To assess the effect of computer-based learning across all learning domains and all ages of learners, Sivin-Kachala (1998) reviewed 219 research studies from 1990 to 1997. From his analysis, he found "students attitudes toward learning and their own self-concept improved consistently when computers were used for instruction"(p.5). He also found that a "student in technology rich environments experienced positive effects on achievement in all major subject areas"(p.5). His review of all domains and ages of learners determined an increased achievement level for preschool through higher education students.

A group of 950 fifth grade students and a group of 290 teachers from West Virginia participated in the Basic Skills/Computer Education program during 1991 through 1992 to

demonstrate the impact of the West Virginia integrated learning system on learners' achievement. This system concentrated on teaching spelling, vocabulary, reading and mathematics. From this study, Mann, Shakeshaft, Becker, Kottkamp (1999) found that "half of the teachers in the sample thought that technology had helped a lot with West Virginia's instructional goals and objectives"(p.6). Mann, et al. also reported "consistent student access to the technology, positive attitudes towards the technology (by both teachers and students), and teacher training in the technology led to the greatest student achievement gains"(p.6). Students' test scores on the test instrument (Stanford 9) rose because of this program.

Students who have continued access to technology such as, computer-assisted instruction, design and programming technology, and software that teaches higher order thinking have shown "gains on standardized test and have demonstrated a positive attitude toward learning" (Mann, Shakeshaft, Becker, Kottkamp, 1999, p.5).

Preparing and Planning for Technology

"The technical function depends on the instructor first becoming comfortable and proficient with the technology being used and then being able to transfer that level of comfort to the learners" (Palloff and Pratt, 1999, p.73). It is important that teachers have the proper training in order to facilitate learning and to construct a framework within the classroom, which will encourage students to explore the course material without

restriction. The instructor should design the curriculum to include assignments and guidelines for the group to discuss and gently facilitate the flow of the course and the outcome. Learning with the use of technology creates an awareness of the impact of technology on the learning process.

Context is important in teaching students and in encouraging students to learn. Teachers are able to effectively separate the environmental conditions for learning such as objects, people, symbols, and relationship within the learning environment. "Students are participants that need to be able to speak and debate their ideas without fear of retribution from any source and should be encouraged to explore and research topics that may not be an explicit part of the curriculum or agenda" (Palloff & Pratt, 1999, p.20). With this in mind, when analyzing the environment the instructional designer should remember the three factors of the learning environment, which are knowledge, environment, and involvement skills.

When dealing with the content (knowledge), the instructor needs to be provided ample information to allow his/her guidance, model behavior, and acclimatize to learning preferences. Once the focus is on the environment, the instructor requires tools to transfer the subject matter to the learners, i.e. computers and software, sufficient classroom space, courseware for example lesson plans, and training aids. The instructor must be provide detailed information about the students because the instructor

must be acquainted with the learners and the affective tools that will help the students succeed in the learning environment.

Preparing the right environment can become difficult for the instructor. Teachers must choose the way in which technology can best fit into a particular instructional environment. The instructor must match the instruction and learning task to a certain computer-based tool to complete the task. It is critical for the student to understand that the teacher values the technology-based activity and that is an integral part of the curriculum and the learning process.

In order to achieve the best results for integrating technology, students should demonstrate using their knowledge attained by authentic application and written assessment. "The challenge of cognitive learning is that it does not take into account the fact that all students do not learn well in a structured environment" (Fardouly, 1999, p.12). Students have the aptitude and ability to learn, retain, and apply information successfully, but not possess a learning style that fares well in a structured, rigid, or disciplined environment. Many will experience better academic grades, become more excited about learning, and thus become further interested in school if they are placed in an environment that is accommodating to their learning style.

Learning Styles

According to Reynolds, (1999) there are two basic learning styles. One learning style is acclimated to organized, structured; disciplined learning and these learners are commonly called stringers. "This individual feels the most comfortable when they start at the very bottom of a subject and learn every detail of that particular level of learning before they work their way up to the top of the subject or discipline that they are learning" (Reynolds, 1999, p.6). They memorize and apply the information that is given and seek to utilize this information once they are finished with the various levels of learning. These students usually function very well in the traditional classroom because of the rigid, disciplined, bottom-up type teaching styles of most institutions.

The second style is that of one who "learns by gathering information about a subject and learning the basic principles of a subject before they begin to learn the details of the subject" (Reynolds, 1999, p.6). This individual will gather information, conduct surveys, tests, and use different resources and hands-on experience in order to gather information and learn the subject or discipline, which they are studying. This individual, known as a grouper, does not always do well in the traditional school settings because of the disciplined, rigid, structured learning environment.

This student will use some of the traditional means to learn but will also learn from other students and therefore will develop a level of respect for the intelligence of his/her peers.

With the constructivist-style and approach to technology integration, both individuals will be comfortable and accommodated. The stringer will be accommodated because of his/her inclination to gather information and to prove and defend ideas, concepts, and thoughts. The grouper will perform extremely well because of the facilitated instructional style of the constructivist setting. Both students will retain more information and become more excited and enthusiastic about learning. All students will also become well acclimated with the various forms of technology because of the hands-on experience they will gain by utilizing the equipment and interacting with their fellow classmates.

Recommendations and Conclusion

The constructivist-approach is student-based but it is not without structure. The students must actively participate, show progress, and demonstrate learning. The teacher has the role of a moderator and an academic guide, rather than the main source of information. Many times the teacher learns right along with the students and is more receptive to suggestions from the students.

As stated earlier, in preparing and planning for the constructivist-based approach, teachers should have the proper training in order to facilitate guidance and a constructed framework for the learning environment. The teacher should also design the curriculum to include assignments and guidelines for the group to discuss and gently facilitate the flow of the course and the outcome. When integrating technology the teacher must correctly match the instruction and learning task to a certain computer-based tool. This will help ensure the success of this approach, while guaranteeing that students are learning the content. At an advanced stage, students will be able to apply the newly acquired knowledge effectively to various situations.

One of the best features about the constructivist approach is that it involves students in real-life possibilities. Students will face situations that will occur in life, such as the interaction of people of different ethnicities and cultures. They will deal with technology and personnel while gaining an understanding of how to utilize and function successful with

these tools. With the constructivist approach, students are allowed and encouraged to hypothesize and explore the realities and possibilities of the world that surrounds them. This causes students to be better prepared mentally, socially, and academically to enter the competitive world in which we live. As a result, students will have confidence, be better prepared to be a life long learner, and have a basis for continued technological expertise.

References

Brooks, J.G., & Brooks, M.G. (1993). The case for constructivist classrooms. Alexandria, VA: Association for Supervision and Curriculum Development.

Buther, D, (1999). An overview of learning theory with an emphasis on problem based learning [on-line]. Available: http://www.usd.edu/knorum/learningpapers/pbl.html

Clark, D. (2001). Instructional system design: Implementation Phase [on-line]. Available: http://www.nwlink.com/~donclark/hrd/sat5.html

Considine, D.M., & Haley, G. (1992). Visual messages: Integrating imagery into instruction. Englewood, CO: Teacher Ideas Press

Duffy, T., & Cunningham, D. (1996). "Constructivism: Implications for the design and delivery of instruction." In David H. Janassen (ed). Handbook of Research for Educational Communications and Technology (pp. 170-198). New York: Simon & Schuster Macmillan.

Fardouly, N. (1999). Instructivist versus constructivist learning. [on-line]. Available: http://www.fbe.unsw.edu.au/teach-with-web/analysis/inst-const.htm

Healy, J.M. (1998). Failure to connect: How computers affect our children's minds and what we can do about it. New York: Simon & Schuster.

Kulik, J.A. (1994). Meta-analytic studies of findings on computer-based instruction. In E.L. Baker, and H.F. O'Neil, Jr. (Eds.). Technology assessment in Education and Training. Hillsdale, NJ: Lawrence Erlbaum.

Mann, D., Shakeshaft, C., Becker, J., & Kottkamp, R. (1999). West Virginis's Basic Skills/Computer Education Program: An Analysis of Student Achievement. Santa Monica, CA: Milken Family Foundation, 5.

Moussiaux, S., & Norman, J. (1997). Constructivist Teaching Practices: Perceptions of teachers and students. (pp.661-687). Paper presented at the conference of AETS, Pennsylvania.

Palloff, R.M., & Pratt, K (1999). Building Learning communities in cyberspace: effective Strategies for the online classroom. San Francisco, CA: Jossey-Bass.

Reynolds, D. H. (1999). What does the teacher do? Constructivist pedagogies and prospective teachers beliefs about the role of a teacher. Teaching and Teacher Education, 16, 21-32.

Schacter, J. (1999). The impact of education technology on student achievement. Milken Exchange on education technology, 3.

Sivin-Kachala, J. (1998). *Report on the effectiveness of technology in schools*, 1990 -1997. Software Publisher's Association. Santa Monica.

Sprague, D., Dede, C. (1999). If I teach this way, am I doing my job? Constructivism in the classroom. [on-line]. Available: http://www.iste.org/L&L/archive/vol27/no1/feature/

Trilling, B., & Hood,P. (1999). Learning, technology, and education reform in the knowledge age or "we're wired, webbed, and windowed, now what?" Educational Technology, 5(2), 5-17.