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Computers in Education:
A Constructivist Model in Distance Learning

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Abstract

Computers and the Internet have the potential to revolutionize the content, audience, and delivery of distance learning. Previous studies have indicated that distance learning is inappropriate for many young or unmotivated students. Others have shown that computers and the Internet do not add any benefits to traditional forms of distance learning, such as television, videocassettes, and correspondence courses. However, when the unique assets of computers and the Internet are used, more recent studies have shown that distance learning can be implemented in a wide range of circumstances. Virtual schools can offer comprehensive, interactive, and social environments where people around the world can communicate and learn effectively. However, educators will need to learn to effectively integrate new technology into the curriculum to create this virtual learning environment. When this is achieved, students of all ages will be able to benefit from distance learning.

Computers in Education:

A Constructivist Model in Distance Learning

In the past, technology has had a limited role in education. Since the 1980s, schools have used computers much like Skinner's "teaching machines." Students have used programs aimed at teaching different skills, such as phonics, math facts, and vocabulary. However, educators did not have a clear understanding of how computers could be integrated into teaching core subjects or how to evaluate the effectiveness of computerized instruction in the curriculum. As a result, computer usage has been viewed as an extra-curricular activity, used as a reward for finishing work quickly or for good behavior, or not used at all (Rodrigues, 1997).

In a similar fashion, distance learning has had a limited impact on education. Institutions have used correspondence courses by mail, public television, pre-recorded videocassettes, telephone networks, and CD-ROMs for remote teaching (Eddy, Burnett, Spaulding, & Murphy, 1997; Sedlak & Cartwright, 1997). Their audience has generally been adults who want to further their education but cannot or do not want to attend a college or university. Reasons can range from scheduling conflicts caused by work to uneasy feelings about returning to a classroom. However, such courses are unappealing to students who enjoy learning in a social environment where they can interact with other students and their teachers.

When distance learning leverages the unique capabilities of advanced technology, such as computers and the Internet, educational institutions are able to reach a broader audience and provide a richer learning experience for their students (Attali, Dyson, & Burda, 1997). The Internet can facilitate distribution of information, communication between students and teachers, and constructivist learning that other forms of distance have not been able to achieve. Web sites, newsgroups, listservs, E-mail, chat rooms, and video conferencing are Internet components beneficial in the educational system of virtual schools.

Web Sites

Many educational institutions have Web sites for their faculty, students, and the general public to use (e.g. Biola University, California Department of Education, Lennox School District). Institutions post general descriptions of programs, calendars, course catalogs, and important announcements. They may include an area where teachers can find curriculum guides and lesson plans. Teachers may have locations where students can find lecture notes or assignments or publish their work. The school can use the Web site as a flexible and widespread resource and publishing tool for the educational community (Leu, 1997).

Other Web sites such as S.C.O.R.E., the MAD Scientist Network, and Ask an Expert answer students' questions and archive questions and answers on their Web sites by categories. Students can peruse the site as a resource or ask questions about school work, homework, or any topic of interest. Questions are forwarded to experts in the subject who volunteer to write responses. Professionals, such as scientists, mathematicians, and historians, from around the world comprise the group of experts (Leu, 1997; Marks, 1997). Students learn they can gain knowledge from a variety of sources outside the classroom. In addition, since they are consulting with experts, students may have more of an opportunity to study the subject in greater depth than they would under the guidance of their classroom teacher. These experts can become resources for classroom teachers as well.

Web sites can also be used as a forum to publish the results of collaborative projects in which students are involved. For example, Monarch Watch includes several experiments classrooms can perform with Monarch butterflies and their migration patterns and records the findings on their Web site. It also includes resources on Monarch butterflies and information on research projects scientists are doing on Monarch butterflies. Students participating in the program also have the opportunity to consult with the scientists (Leu, 1997). Web sites providing science experiments, such as Monarch Watch, allow students to analyze and synthesize data from many geographical regions so they may construct

more global hypotheses and conclusions. The resources included on the Web site can be a starting point for interested students to research the topic in depth.

Junnarkar (1997) refers to similar programs of the National Science Foundation. These programs focus their attention on science projects that take advantage of the Internet's unique abilities of involving real-time data and collaborative efforts. One Internet site, the NASA Goddard Space Flight Center, allows students to view eruptions of solar flares and examine and analyze data scientists have collected and recorded on solar flare activity. Rather than reading about solar flares in a textbook, students can watch video clips of the sun, download information about radiation emissions, and research topics related to solar phenomenon.

Web sites not specifically oriented toward education can also have educational value. Discovery Travel documents the travels of photojournalists to different countries. Gilster (1997) recounts an on-line adventure Jim Malusa took in Australia. As Malusa bicycled across the Australian Outback with a laptop computer and digital camera, he sent reports and photos to his office using a modem and pay phone. Gilster and others following his adventure could e-mail him and ask him questions. Gilster asserts that these types of Web sites "have the sense of immediacy that appeals to young people. A 6th grader in a class studying Australia would have found this project very engaging – particularly the opportunity to communicate with experts across the world" (p. 7). This type of on-line experience can serve as motivation for further study. An entire class or individual could also search the Internet for other sites and the library for books dealing with Australia to learn more about its culture and people.

In an interview with O'Neil (1996), Clifford Stoll voices some concerns he has about Web based learning. First, he states that children love getting on the Internet because they do not have to work, they just passively watch things happen. He believes that worthwhile learning needs to be hard work. Salomon (1997) draws similarities between busy forms of television like MTV and the Internet and warns against the haphazard use of technologies.

However, he further states that thoughtful application of the Internet and multimedia can be instrumental in students' learning. "It is only when the study of history is turned into a narrative-like web of connected themes (a story) that the single event or date becomes meaningful. The denser the web of connections, the richer the meaningfulness of the single item. Coming to comprehend something means networking – creating a network or web" (p. 380). Educators need to carefully evaluate the instructional value of the Web sites and programs they include in their curriculum.

Stoll also fears that the Internet will hinder teacher-student interaction. Since students will learn that they can find good information from the computer, they will not need to listen to their teachers (O'Neil, 1997). Even with extensive use of the Internet, students will still rely on teachers to help them find information they need and want. For many, the Internet is not an easy place to navigate. It contains a vast collection of information and requires an experienced person to find sites on specific topics. Students will need teachers to teach them how to use the technology as well as how to evaluate the validity of the information they find and effectively communicate their findings with others (Leu, 1997).

Newsgroups, Listservs, E-mail, and Chat Rooms

Newsgroups, listservs, e-mail, and chat rooms are forms of text-only communication. Graphics and sound files can be sent to others through these forms of media; however, they need to be translated by computer programs before they can be used. Newsgroups (public forums), listservs (semi-private forums on the Web or by E-mail), and chat rooms (real time forums) are best for group discussions. A benefit of newsgroups and listservs is that participants do not need to be on-line at the same time. Participants in chat rooms must be on-line at the same time, but the conversation between members is more natural. E-mail is best for private discussions between a few people.

Lynes (1997) includes her fourth grade students in National Geographic Kids Network math and science units. This cross-age program includes units on pet ownership, weather, acid rain, recycling, water quality, solar energy, and nutrition. The participants distribute their results to everyone in the program by e-mail. Each classroom then uses the data provided to draw their own conclusions. Lynes finds that her students' problem solving, reasoning, critical thinking, and communication skills develop naturally through the program. Her students critically evaluate the results they collect and attempt to explain anomalies. They are careful to ensure that the results they collect are accurate and that they do not make common mistakes like reporting temperatures in degrees Fahrenheit instead of Celsius.

In southeastern New Hampshire, twelve districts comprise a consortium that operates listservs to run three cross-age programs, Batnet, Birdnet, and Treenet. Lonergan (1997) finds that her third graders profit from the science projects because they make science more relevant to them. They explore natural phenomena the way scientists do, by collecting real data and consulting with colleagues. Her students not only use e-mail to interact with other students, but also with environmental and government agencies and scientists. Her students also use skills in geography, reading, writing, and math far above grade level, but since it is in the context of a real-life situation, her students are motivated to

learn them. These projects help students understand what scientific research is and how it can benefit society. In these programs, students learn that the interpretation of data can lead to many conclusions, and that all of them can be valid.

In an interview with O'Neil (1996), Clifford Stoll states that he does not feel comfortable with students participating in joint research projects. He states that teachers, not other students across a network, should be teaching their students. His lack of teaching experience at elementary and secondary levels may be the reason he assumes that teachers take a passive role in cooperative learning activities. However, conscientious teachers will be monitoring their students' work and learning throughout the learning process from data collection to the presentation of findings. Teachers will be teaching or guiding their students in constructing methods of data collection and analysis when necessary. The process is similar to science experiments students conduct in a traditional classroom; however, in this situation, the data is collected from a variety of sources they can arrive at more valid conclusions.

Desktop video conferencing

In the San Francisco Bay Area, Pacific Bell provides a few demonstration sites that video conference via computer. Two participating teachers use this technology to share class sessions and guest speakers with each other. They find that their students feel connected, even though they live in different counties (Aerenson & Watts, 1997). Quesada (1997) finds that video conferencing can also be beneficial in conducting parent-teacher conferences with working parents, sharing ideas to design lesson plans, giving feedback on students' writing projects, and encouraging professionals to share their careers and knowledge with students from their workplace.

Although there are educational benefits in using this technology, it has its drawbacks. Schools should be wary of the installation and maintenance costs even though they may currently receive a grant to offset these initial costs. Faster 56 Kbps modems make video conferencing over regular phone lines possible; however, schools may have much higher telephone bills.

Video conferencing has its limitations. Both parties must possess video conferencing capabilities and all parties must be available at the same time. Scheduling video conferences may become a problem and cause interruptions if teachers do not plan well in advance. Standard Internet access, Web access, newsgroups, and E-mail, is adequate technology for most situations.

On-line Courses

On-line courses can include any combination of the components discussed previously as well as computer software. Teachers interested in teaching on-line should realize that teaching in a traditional lecture method on the Internet will not engage many students (O'Neil, 1996). Better results occur when students are actively engaged in projects, simulations, role-playing, and collaborative investigations (Berman & Tinker, 1997; Pelton, 1996). Active learning is a beneficial motivational and instructional tool in a traditional school setting as well; however, the physical absence of a teacher in a virtual school accentuates the necessity for active learning.

Although virtual schools may challenge teachers to learn new teaching methods, teaching courses on-line has many advantages. First, excellent teachers are potentially available to anyone on the Internet at any time. Second, courses unavailable at traditional schools due to low enrollment or lack of qualified teachers in the area can be taught on the Internet to a wider audience. Third, teachers can monitor their students' progress carefully. Fourth, students can learn in a comfortable environment where they feel unthreatened.

Gilster (1997) states that a school's best teachers can be available to everyone on the Internet at any time. Students who wish to go to class at 3 a.m. can do so. Students who are too ill to attend a traditional school can learn at home as their health improves. Teachers can provide their instruction and feedback on-line whenever they wish as well. Virtual schools allow both teachers and students flexibility in their schedules to teach and learn when they wish. If an unforeseen emergency occurs, teachers or students can take care of it without missing class. Although there may be times when teachers may want to set up a chat room or video conference, most instructional activities can rely on Web sites, newsgroups, listservs, and E-mail.

Classes such as specialized courses in advanced mathematics, literature, or technology that might only attract a few students in a school become possible to implement when twenty or thirty students district-, state-, country-, or even world-wide wish to enroll in

the class (Berman & Tinker, 1997). This expanded curriculum allows students access to knowledge and opportunities they would not be offered in a traditional setting and could allow students to explore their interests in more depth. Also, while students are learning content, they are also learning about the cultures and lives of their classmates as they share and learn from one another.

Courses taught in languages other than English can expand bilingual students' curriculum by offering more content area courses in their native languages on-line (Berman & Tinker, 1997). Bilingual education consistently has a deficit in bilingual teachers. If bilingual teachers could teach on-line, they could offer courses to students from all over the country. They can service those who are not receiving bilingual services when their district does not have teachers who speak their language or because there are too few students who speak the language.

Teachers can use the Internet as a teaching, communication, and assessment tool in the classroom. They can direct students to Web sites that support the lesson they are teaching. They can E-mail newsletters, messages, homework assignments, and progress reports to students and parents. They can also collect homework assignments, monitor their students' progress on daily assignments, and even take attendance over the Internet (Candelori, 1997).

Finally, on-line classes may encourage some students to participate in class discussions more often than they would be willing to in traditional classroom settings (Berman & Tinker, 1997). Some students who feel inhibited in a classroom or who respond more slowly may benefit from the methods of communication where quality of the response, not speed, is the issue. Also, since they are learning in a more familiar environment (i.e. their home), they may feel more at ease to share their ideas with their teachers and classmates.

Cautions of On-line Courses

Despite the attractive advantages of virtual classrooms, some students may not do well in this type of environment. Students who rely on intimate relationships and learning in a social environment may have great difficulty if all instruction is delivered by a virtual school. Students, especially very young children, may not develop the interpersonal skills they need to function in society. Also, finding teachers that can effectively teach over the Internet and funding programs may be extremely difficult.

Eddy et al. (1997) state that face-to-face communication is much richer than any form of electronic communication. Immediate responses, non-verbal communication, and group dynamics are very important in delivering a message. Electronic communication only expresses the written aspect. Although video conferencing may solve some communication difficulties, it is limited by several factors that have been discussed above.

Eddy, et al. caution that distance learning may also inhibit the rapport teachers develop with their students. When students are unable to have direct contact with their teacher, a trusting relationship may not develop. Students may not feel they can talk freely with their teacher in writing on-line. Even if they do share with the teacher, and the topic is a sad or distressing event, a distant teacher cannot put a hand on a shoulder, give a hand a squeeze, or hug the hurting student. The teacher can only use words to express acceptance and comfort to the student. Empathy is best expressed in person.

Those cautious about virtual classrooms are also concerned about the socialization of students. Attali, et al. (1997) state that education on the Internet could have disastrous effects on the socialization of students. They wonder how students will learn to live in society if they no longer learn at school with other students. Students may not develop the same interpersonal skills on-line as they would in a traditional classroom; however, they may develop other important communication skills. For example, students need to learn to communicate effectively in writing to a larger audience. They will need to be able to converse with people of diverse backgrounds and cultures. Although these experiences

are not the same as face-to-face contact, students still require interpersonal skills to participate in the culture of the Internet.

Harrington-Lueker (1997) is concerned that schools will not have enough teachers who can effectively teach on the Internet since it requires many technical skills. She states that school districts will need to provide ample professional development courses so that teachers will have the skills to design and teach on-line courses. Teachers may also need more time for preparation since they may need to design and develop Internet-based teaching resources as well as plan the course.

As with any new program in education, money is always an issue. Grants, such as the nationwide \$425 million allocated for programs preparing teachers and students to use the Internet recently announced by Vice-President Al Gore (Reuters, 1997), may decrease schools' financial burden to initiate these programs; however, schools will need continued monetary support for teacher training, hardware, software, and maintenance as educational programs are tested and expanded.

A Constructivist Model

“Technology has the power to teach, to motivate, to captivate, and to transform an ordinary classroom into a training ground for the next generation of artists, entrepreneurs, and government leaders” (California Department of Education, 1996, p. 1). The Internet is instrumental in giving students real-world experiences that will stimulate their thinking and refine their problem solving, reasoning, critical thinking, and communication skills. Teachers can guide their students through experiences and give them the skills they need in order to begin a life-long process of learning.

Teaching through real-world experiences and multimedia are more enjoyable for students and take advantage of students’ natural curiosity to learn independently (Gilstrap, 1997). Students would rather learn from conversations with experts, the Internet, or a multimedia encyclopedia with bright colored pictures, animation, and sound rather than an old black-and-white encyclopedia or a textbook because the former gives them richer experiences they can relate to and build upon.

Using the Internet, students can truly construct knowledge using a variety of sources (Gilster, 1997). They can visit sites from around the world, E-mail experts, ask questions on newsgroups or listservs, download graphics from Web pages and binary newsgroups, and evaluate the credibility of the sources of information. After analyzing their information, they can synthesize what they have learned into a report or presentation.

However, students should not be taught to use the Internet for its own sake. Students should be engaged in an authentic task that helps them develop, refine, and test their own hypotheses and ideas (Middleton, Flores, & Knaupp, 1997; Rodrigues, 1997). As students discover new ideas and principles, they can incorporate them in their schemas of knowledge. The authentic task gives them the framework in which to organize their insights.

Finally, computers and the Internet are only tools for instruction and learning (Dwyer, 1996; McDaniel & Umekubo, 1997). They help teachers teach but cannot replace them.

Therefore, teachers must learn how to use these tools effectively in their classrooms. Computers are not merely classroom management devices that occupy students who finish their work quickly. They are a valuable tool teachers can use to engage students in learning. As Education Secretary Richard stated, “one of the most exciting aspects of American education today is developing this important link between education and technology” (as cited in Reuters, 1997).

On the surface, Internet virtual schools appear extremely attractive. Students have more flexibility on courses they can take and when and how they learn. Both younger and older students may be motivated by the multimedia and interactive aspects of new technologies. In addition, the non-threatening atmosphere of learning at home can encourage discussion between students, teachers, and experts. These discussions may prompt students to research topics of interest using the vast quantities of information on the Internet. These aspects are conducive to a constructivist environment where students construct their own meaning.

However attractive virtual schools might look, educators should not be quick to abandon traditional schools. Although the multimedia aspects may peak students' interest, there are questions as to whether the student is really learning or just being entertained. Some students may learn better without the flashy graphics and colorful screens. Also, many students learn best in a social environment. In these situations, computers may hinder learning.

One thing should be clear. Technology, such as computers and the Internet, is a tool for teachers to use. In the virtual school, computers will be widely used, but teachers will continue to be actively involved in teaching their students and guiding their explorations. In other schools, computers may be used often, but the types of educational programs teachers choose will be different. These programs will be less distracting and focus on teaching and supplementing the curriculum. Web designers and software developers should keep these differences in teaching methods in mind when creating their products.

Implications

The two perspectives presented above demonstrate the unique qualities of each individual. Each person has his or her strengths and weaknesses. Effective educators construct learning experiences around their students' strengths so they can succeed. At the same time, educators address students' weaknesses gradually in an attempt to strengthen these areas in a nurturing environment. However, if students are unable to overcome these areas of weakness, teachers attempt to lessen the effects of these limitations with extra support and individualizing instruction.

With the controversial issue of using traditional or virtual instruction, elementary school teachers should choose the technique that is best suited for the learning activity. They should also be looking for signs that students may not be learning as well in certain situations. If, for example, students appear to be frustrated at the computer, this may indicate that they are unable to focus on their task and may need alternative instruction. If students appear to be enjoying working on the computer but are focusing on the animated characters on the screen rather than learning the material, alternative programs may be more appropriate for those students.

Teachers, as well as society in general, need to realize that there may never be one school or method of teaching that addresses the needs of all students. Therefore, as new teaching methods are discovered, teachers will need to be well versed in them so they will possess the tools necessary to reach the broadest range of students possible. Teachers need to commit themselves to life-long learning and be open-minded to new ideas presented at conferences, in inservices, and by their co-workers. They should be continually updating their credentials and researching new developments in education so they can best serve their students and communities.

In the same way that students have different learning styles, teachers have different teaching styles. Administrators should be sensitive to this at the junior high and high school levels and encourage teachers to use their strengths. Teachers who are strong or interested

in teaching with technology should be the instructors of virtual classrooms. Those who prefer more traditional ways should continue to teach in a traditional classroom.

Finally, schools should give students and their parents choices in their education. Junior high schools and high schools already provide this as they allow students to choose classes by topic. Technology adds a new dimension to choice by allowing students to decide how they will learn the material. Students, with the guidance of parents and school personnel, can decide what environment will be best for their education.

Educators should not use technology in a way that limits choices. They should integrate technology into the curriculum to provide more flexibility in learning environments and accommodate the needs of all students. Just as the introduction of television did not eliminate the need for radio, electronic books have not made printed books obsolete. Each form of media is still available, has its unique advantages, and gives consumers choices. In the same way, traditional and virtual classrooms will allow individuals to choose their learning environment.

Integration

Many people are resistant to the creation of virtual churches. Their reasons range from the impersonal nature of computers to the isolation of its members. Church, in their view, is a weekly scheduled event where members congregate at the same time in the same building. They sing the same hymns and listen to the same sermon. Within this structure, they receive support from and fellowship with other members. They form emotional and spiritual bonds with one another as they worship and pray together.

A virtual church, on the other hand, would allow church members to worship when and where they wanted. They may feel the need to go to church at noon on Thursday during a lunch break at work after a difficult morning. They might choose to sing different hymns or not to sing them at all. Perhaps they would rather listen to a favorite hymn or express themselves through poetry instead. They might choose from a variety of sermons one that is closest to their needs at the moment. They can stay as long as they feel the need. Perhaps they decide to E-mail one of their pastors or another church member for prayer support.

A church is not a building or a weekly schedule of events. It is made of people. We are the church. A church in China and another in the United States are both part of the same body of Christ. A virtual church could potentially reach people around the world, regardless of their geographic location, and allow its members to worship, fellowship, and prayerfully uphold each other. Worship rooms, chat rooms with a spiritual focus, could allow members to worship and fellowship in real time with one another. Newsgroups, listservs, and E-mail would allow members to communicate at times most convenient to them.

Virtual churches may also help missionaries who have left their home country to serve Christ. They may still participate with their home churches and feel their support in a more tangible way. They can send back daily or weekly reports to their sponsoring churches. Instead of sending out monthly newsletters that are mostly text with a few black and white photos, they can use video, color graphics, and sound to share daily or weekly

events. Supporting churches can then have more specific prayer requests and feel more involved in the mission field.

A virtual church is not for everyone. Those who need to be with others and give and receive physical expressions of support and caring will not thrive in a virtual church. Those who value everyone doing the same thing at the same time as a sign of unity will not have an enriching experience in a virtual church. Both types of churches have their own merits as well as limitations.

Christ says that He is with us always, and Paul reassured churches that he was with them in spirit. In the same way, members of virtual churches are with one another in spirit and can feel that connection. We can be assured that God transcends time (and technology) and will be with all members of virtual churches who are united in vision (Matthew 18:20), even though they may not be gathered together in the same building at the same time. We can be assured that nothing, not time, distance, or technology, will separate us from the love of Christ (Romans 8:38).

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