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The role educational technology plays in student achievement and teacher preparation

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Abstract

The role of technology in the classroom, as a tool for improving student achievement, has received much attention in education today. Teacher preparation programs are making efforts to produce computer literate and competent users of educational technology. This author focuses on the role of educational technology, including the Internet. Consideration is also given to changes in teacher preparation that integrate new technologies into methods courses, as areas that could potentially lead to improved achievement levels for all students.

THE ROLE EDUCATIONAL TECHNOLOGY PLAYS
IN STUDENT ACHIEVEMENT
AND TEACHER PREPARATION

A Graduate Review
Submitted to the
Division of Educational Technology
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Master of Arts
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by
Overton Howard Bean

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Table of Contents

Abstract.....	iv
Introduction.....	1
Methodology.....	2
Discussion and Analysis.....	3
Conclusion.....	12
References.....	14

Abstract

The role of technology in the classroom, as a tool for improving student achievement, has received much attention in education today. Teacher preparation programs are making efforts to produce computer literate and competent users of educational technology. This author focuses on the role of educational technology, including the Internet. Consideration is also given to changes in teacher preparation that integrate new technologies into methods courses, as areas that could potentially lead to improved achievement levels for all students.

Introduction

Computers have become as common as a dictionary or thesaurus in the classrooms across America today. According to Vice President Gore “Every child in America deserves a 21st Century education and access to a 21st Century technology” (cited in Educational Technology Programs, n.d.). During a recent educational tour, U.S. Secretary of Education, Rod Paige, (2002) stated, “By harnessing technology, we can expand access to learning and close the achievement gap in America” (cited in No Child Left Behind, n.d.). Chaika, (1999) wrote, “To adequately prepare students for the future, educators say, they must be able to use 21st Century methods of teaching in the classrooms of the 21st century” (pg. 4). The ratio of students to computers in 1989 was 22:1; in 1995 the ratio dropped to 12:1. Educational technology has become one of the six top issues in schools today (Plotnick, 1996). Not only has student access to instructional computers grown, but the ratio of students to Internet connected computers has fallen from 20 students per computer in 1998 to 5.6 students per computer in 2002 (Ansell and Park, 2003).

Local school budgets have been hard pressed to keep pace with the demands of purchasing the latest technology. In the past ten years there has been a movement for reform of the public education system in the United States, and at the heart of almost every proposal has been the inclusion of educational technology as a major component of the implementation plan (Plotnick, 1996). The 1995 publication by the Congressional Office of Technology Assessment, entitled *Teachers And Technology: Making a Connection* (1995), suggested that even though technology can not be considered the answer to all of the ills of education today, it is the use of technology as an essential

teaching tool that will allow teachers to become more efficient in the classroom. The challenge now becomes enhancing the technological skills of students, teachers and administration. Schools no longer can simply rely on providing hardware and software to teachers in hopes of seeing increased student achievement. Teachers need adequate time and appropriate technology training to facilitate curriculum changes that affect a change in student learning (Merrill, 2002). Pre-service teacher training is beginning to include an educational technology component that includes curriculum design as well as hardware and software proficiency (Beckett, Chisholm & Wetzel, 2003).

This review will discuss recent literature and studies that explore the capabilities of educational technology in terms of student achievement and the strategies being developed to improve teacher preparation for use of technology in the classroom. Educational technology is a term widely used in education, but is often used to mean different things. "Educational technology properly refers to a particular approach to achieving the ends of education" (Ely, 1997, pg. 1). Seels and Richey (1994) define the term, instructional technology, to mean: "The theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning" (pg. 1). For the purpose of this review, educational technology will be used to encompass the hardware, software, and the systematic process that result in the creation of a learning environment for the student and teacher.

Methodology

Information for this paper comes from a variety of sources including materials recommended by university professors, publications available at the University of Northern Iowa library, and articles found in professional publications subscribed to by

the local school district. Online resources included the EBSCO database of professional journals and ERIC. Descriptors for the online searches included, “educational technology”, “technology and teacher preparation”, and “instructional design.” Additional websites were included in the review based upon the recommendation of university professors in the graduate program, local school district technology coordinator and district curriculum director.

Articles chosen for this paper were based upon the relationship of the material to the topic. Several of the authors included in this review have been required reading for students in this graduate program by University of Northern Iowa professors or cited as resources in other publications. Current information on the topic of educational technology and teacher preparation established a framework for this review. Finally, literature addressing the use of educational technology in our current school settings and the concerns that educators have with providing worthwhile instruction became the focus for information being considered.

Discussion and Analysis

Much has been made of the ability of educational technology to inspire, motivate, and in general improve the learning of students. Educators must be wary of the use of technology for technology’s sake. When analyzing the role technology plays in education today, a multitude of variables must be considered. Money spent on educational hardware and software is just the tip of the iceberg. The fiscal budget for 2000 increased spending for educational technology by 1.2 billion over the 1999 spending levels as indicated by a CNN news release (2000). Beckett, Chisholm & Wetzel (2003) indicated that consideration must also be given to teacher training in the use of both hardware and

software as well as the ability of the teacher to infuse the new technology in the curriculum. Because the number of variables is difficult to control, “technology programs are often among the first victims of the budget knife” (McCabe & Skinner, 2003, pg. 50). The design of the curriculum that uses educational technology is becoming as important as the technology itself. Teacher resistance to the utilization of new technology can be attributed to inadequate teacher training, support and planning (Feist, 2003). A recent study conducted by a San Francisco-based research laboratory concluded that student achievement or lack thereof may be linked to districts putting a lot of money into educational technology before devising practical plans for how to use such technology (McCabe & Skinner, 2003). The report went on to emphasize that technology alone cannot raise student achievement, but technology use should be supported by other improvement efforts, such as technical support, teacher technology training, and long term planning (McCabe & Skinner, 2003).

A recent study by Herrington & Oliver (2000) looked into the design of an educational technology plan that would address the use of both educational technology and traditional learning plans. The study was designed to determine the effectiveness of a situated learning environment, coupled with multimedia software, to create an authentic learning experience for students. Pairs of students were given the task of being new teachers who are to present a report to the school staff on assessment strategies. The pairs of students worked on the report using a multimedia program and had access to their professor for assistance. The reports were to be evaluated on the effectiveness of the argument, the proposal’s practicality, the degree to which the arguments were supported and the presentation skills of the student pairs. The findings of the study indicated that the

collaborative aspect of the assignment provided numerous learning environment advantages including articulation and reflection with a partner.

Recently, there appears to be a shift from school learning to real-life learning. School learning is the content information that students are exposed to in the classroom, while real-life learning is the knowledge gained from life experiences. The following anecdote points out the discrepancies of the two forms of learning. A driver, with a physics degree, finds himself bogged down in a sandy rut. The driver then attempts to dig the car out of the sand instead of partially deflating the tires (Herrington & Oliver, 2000). This underlines how many times learners have not been able to make the connection between facts learned and real-life situations that can be solved by knowledge of those facts. Herrington & Oliver proposed the following:

Useable knowledge is best gained in learning environments that feature the following design elements: provide authentic contexts for knowledge to be used, provide authentic activities, provide access to expert performances and modeling, provide multiple roles and perspectives, support collaboration, promote reflection, promote articulation of tacit knowledge to become explicit, provide coaching and scaffolding and provide authentic assessment of learning tasks (pp. 25-26).

Students who participated in the study were positive in their feedback about authentic learning and the use of collaboration between partners, which allowed for “scaffolding” from one level of understanding to another. Scaffolding refers to the transfer of knowledge from one level of understanding to another. The teacher or partner serves as a mentor for providing information, clues and encouragement in an effort to help the learner discover relationships in the concepts being studied (Canning, 2001). The use of

authentic learning based upon situated learning appeared to be successful, not solely because of technology, but because of the design of instruction that included technology (Herrington & Oliver, 2000).

Another case study, which investigated the effectiveness of educational technology, took place in a rural Nebraska school. The study lasted for three years with students in grades first through third tested in reading and math for achievement (Isernhagen, 1999). The study showed that students who tested below the 50th percentile in standardized tests prior to the use of technology increased in math and reading achievement over the three-year period of the study. The school district's philosophy was that technology could improve student achievement and change the way teachers presented material to the students. The data supported their philosophical approach. Studies have further indicated that by creating positive learning environments through the use of educational technology, the integration of technology is a more cost effective program than hiring more teachers or reducing class sizes in the traditional classroom (Chaika, 1999).

Not only can educational technology be effective in the regular classroom, but that same technology can be utilized to help special needs students enjoy the power of learning. Special needs students are many times thought to be less capable than they are. However, the use of computers and instructional software can empower special needs students to gain control of their own learning (Ryba, Selby, & Nolan, 1995). The number of disabled students taking part in regular classrooms has increased by ten percent in the last five years. The types of students vary widely, but over half of those identified, have a learning disability (McCann, 1998). Not only can technology be effective in the student's

personal learning, but that very same technology can help the student develop improved social skills. Although students may have experienced failure in conventional learning environments, computers provide an opportunity for special needs students to achieve (Ryba, Selby, & Nolan, 1995).

A study was conducted by the University of Cincinnati on the use of handheld computers in a sixth grade classroom. The study was to monitor the transition of students from an inclusive classroom into a junior high school environment. After just two days of handheld use with limited training, the students were mastering techniques of the technology not previously introduced. A daily record was kept by students that traced usage of all students, including those with disabilities, which indicated use of the handheld for recording daily assignments and assignment completion between 2.2 and 3.9 days a week. Students identified with special needs were the strongest users of the technology, indicating a daily use and a preference for handheld computers. Students with disabilities were sometimes viewed by their peers as experts in this technology and shared their knowledge with the class (Bauer & Ulrich, 2002).

Ryba, Shelba, & Nolan (1995) noted special needs students can learn more from one another, rather than working alone, even when working with a computer. Students who seldom communicated with others would talk to partners and work cooperatively to solve problems using a computer. That sharing of knowledge also takes place when teachers get involved with using technology and then demonstrating their skills to the students. Technology has been applied in a variety of disciplines for special needs students. Visually impaired students are provided with "reading" opportunities by simply accessing stories on audio CD's thus allowing for full inclusion in typical language

classes. Other special needs students are being helped in science by curriculum that emphasizes hands on experiences to discover the knowledge for themselves. Computers, digital cameras, and multi-media programs allow students to access their own information and create a presentation that demonstrates their understanding of basic science principles. Technology has become a critical element in the success of the students in the class (Milone, 2000).

Other studies are being conducted to investigate the use of the Internet as an effective learning tool. The Internet or World Wide Web is a unique medium that is being used as an educational tool today (Thornburg, 1996). As we journey further into the age of the super highway, learners will be expected to become sophisticated consumers of information (Land & Greene, 2000). Thornburg (1996) cited previous studies conducted by Henry Becker on Internet use by teachers and found that the use of the web for informational access accounted for the third largest classroom use of technology after word processing and the use of CD-ROM based materials. Once again the direction for information gathering and processing begins with the teacher and lesson design. "When learners use personal goals, questions, or theories as the basis for investigation, their decisions are characterized by a connection of both broad ideas and current information" (Land & Greene, 2000, p.46). Land and Greene concluded that learning was more successful when students accessed relevant knowledge from a domain that could be used for meaningful integration of new information. In short, students need to make a connection to personal experiences in order to be able to transfer new information to learned information, while using technology as the resource tool.

Thornburg (1996) divided the uniqueness of the Internet as an educational tool into six characteristics:

1. Communication is on demand, meaning it is available via computer to multiple users at anytime.
2. The web is an interaction medium.
3. The web supports multiple expressive modes, such as sound, text, and graphics that can be viewed and reviewed at the users discretion.
4. The web supports representational choice by the user to view content in text format only or in full graphical mode.
5. The web is a non-conserved medium, meaning a multitude of users can view or even copy documents from one basic source.
6. Barriers to publishing on the web are low, allowing for virtually anyone to create and post information on the Internet.

The unique nature of the Internet coupled with the increased growth of internet accessible classrooms and schools has created opportunities for classroom teachers to alter their daily activities in an attempt to do a better job of what they had already been doing (Ansell & Park, 2003). According to Cuban (1986), the use of machines, in this case computers, by teachers is a result of looking for versatile, reliable, and efficient means to an end, that end being the education of the students.

The Internet can also be used as a distance-learning tool. Many schools do not have the resources necessary to provide every learning experience possible first hand, so they are finding that distance learning can provide a degree of learner satisfaction (Collins, 2001). A recent survey conducted by the Pew Internet and American Life

Project, Levin and Arafeh (2002) cited that which indicated that three in five children under the age of 18 and 78% of children from 12-17 use the Internet, with the most common activity being homework. The findings also showed that students used the Internet to help complete homework, communicate on-line with fellow classmates about assignments, projects and upcoming tests. Students also described the use of the Internet as a virtual textbook, tutor, study group, guidance counselor and virtual notebook (Levin & Arafeh, 2002). The use of the Internet as an educational resource is only limited by the imaginations of the developer of instruction or the user.

With the use of educational technology, comes the burden of designing effective instruction. Instructional technology has been shown to have an impact on learning as previously illustrated by a variety of studies, but who will be given the obligation of creating effective uses for the technology? Much of the instructional technology violates the fundamental principles of effective instruction. Instructional technology must do more than present information; this technology must demonstrate a skill and allow the learner an opportunity to apply the new skill with guidance and feedback (Merrill, 2002).

Teachers are now expected to take on a different role from their predecessors. Teachers must now find new ways to present information to students, create an engaging learning environment using educational technology, and generate learning opportunities for all students in their classroom (Herr, 2000). Teachers are no longer the sole provider of information to the student but a facilitator of student learning.

In 2000, the Center for Applied Research in Educational Technology (CARET), reviewed research that measured the effectiveness of the use of technology in schools. They found a correlation between prepared teachers with a knowledge base of

instructional design and the effectiveness of the integration of technology into the curriculum. Concerns of effective integration from a teacher point of view includes effective student learning, appropriate professional development, adequate technical support and sufficient quantities of hardware and software (Cradler, Freeman, Cradler, & McNabb, 2002). As teachers and administrators become more familiar with educational technology, positive trends will continue to grow. Greater numbers of teachers are using computers for daily planning and teaching, and the use of Internet instruction in the classroom is also on the rise (Ansell & Park, 2003). If teachers are to be effective facilitators of educational technology, they must be provided with adequate training and ample opportunities to interact with the technology and colleagues who are presently using the same tools. “Instructional technology alone will not affect a change in learning” (Merrill, 2002, p.16).

A majority of teachers report feeling inadequately trained to use technology resources, in particular, computer-based technologies (Congressional Office of Technology, 1995). Although technology use in teacher preparation is increasing, preservice education could help student teachers learn to integrate technology tools into their respective curricular areas. Student teachers cited lack of technology being modeled in the classroom as a reason for feelings of inadequacy (Bielefeldt, 2001). To combat the feeling of inadequacy in using technology in the classroom, Arizona State University has implemented a program to pair pre-service teachers with in-service mentors for training in the use of technology in the classroom. A study was started to evaluate the program. The results of the study indicated that many classroom teachers needed help in developing appropriate classroom materials, which integrate technology, and teachers

discovered that using technology for educational purposes could be an enriching and meaningful learning experience (Beckett, Chisholm & Wetzel, 2003). The success of educational technology programs can be found in three essential factors:

1. The software was selected with careful consideration to the classroom instruction. Technology is just one of many tools that is at the disposal of the classroom teacher.
2. Teachers have previously received adequate training and technical support in the use of the software.
3. Students have ready access to current software and reliable Internet ready computers (Chaika, 1999).

Studies continue to be conducted that indicate the positive effects of educational technology on the learning process for today's students. Bielefeldt (2001) conducted a survey of institutions who were successful in helping new teachers use technology effectively in the classroom. The survey results supported the theory that infusion of technology into teacher preparation requires a balanced combination of facilities, coursework, professional development of faculty, and student field experiences. As more teachers are trained to use educational technology correctly, the number of successful programs should grow in accordance with that training.

Conclusion and Recommendations

In this researcher's opinion, educational technology has and will continue to enhance the learning of all students. But how educators choose to use the technology will ultimately determine to what extent the learning will be achieved. With all this focus upon strengthening education in America and the passing of the "No Child Left Behind"

bill, educators and lay-people have been looking to educational technology as an answer to the problem. It is much more likely that teachers will be the variable that generates positive results when considering the role of technology in education. With better training for teachers and adequate supplies of reliable computers for students to use the number of schools that find success using educational technology will grow.

Further studies will need to be conducted and better teacher preparation will need to take place to help teachers facilitate the use of the latest technological advancements. Practical application of technology in the classroom appears to be one area that both the teacher and student would like to see increased. Colleges and universities need to be attuned to the needs of the classroom teacher by providing a balance of theory and practical knowledge in training teachers to use and implement technology into their own classrooms. Teachers must also consider the needs and concerns of their students when developing activities that utilize technology. Many students can be “turned off” by applying technology in ways that are not relevant to the students’ educational and social needs at the time. With increased professional development opportunities in the use of educational technology, the potential for enhancing student learning is boundless.

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