

A RESEARCH AGENDA FOR TECHNOLOGY AND THE SCHOOLS: PAST AND PRESENT

Mr. Brijesh Kumar Singh Patel

Assistant Professor

Mata Jiyo Devi College of Education, Hissar

ABSTRACT

Computers and related technologies are now in almost every school across the nation. State reform efforts include the integration of technology in curriculum standards and sometimes make technology skills a separate standard for students to achieve. As the focus on technology expands, policy makers and tax payers are asking researchers in educational practice to provide the data for thoughtful decision making on the use of technology for learning. At this time the decision-making is often hampered by the lack of adequate research, although there is considerable work from previous years to guide future study.

INTRODUCTION

In recent years there have been numerous calls for extended research activities in the area of technology, learning, and schools. These calls have come from a variety of organizations, including the President Committee of Advisors on Science and Technology the National Science Foundation the National Research Council private charitable foundations and research institutes such as the RAND Corporation. There is a general concurrence among professional educators and others that there is insufficient empirical evidence on the value of computers and related technologies to student learning.

Over the past several decades technology has been used in a variety of ways for a variety of purposes. Researchers have employed varying research methods in an attempt to understand the role that technology can and does play in the education of children. Consequently, there are a number of differing lines of research that have been conducted, and many of the lines of inquiry may overlap with others. This has resulted in a large amount of research, but so varied in method and treatment that at times is difficult to categorize. There are areas for which there is little, if any, information available, meaning that there is much that we do not yet know about the effect of this technology on student learning. Because there are a variety of ways in which technology

has been used in the past and a variety of ways it is being used today in education it is important to consider each line of research individually in an attempt to sort out the status of what is known and what research is yet to teach us. As new technologies have emerged they have often times replaced or have been used concurrently with earlier technologies, thus dramatically changing the nature of the way the technology has been used in the classrooms. Computers and related technologies have been used as tutors, surrogates and supplemental teachers of the regular curriculum, as tools for the purpose of transforming the classroom, as delivery modes for distance education, and for educational management applications, including improved planning, data analysis, communication and personal productivity.

THE COMPUTER AS TUTOR AND SURROGATE TEACHER

One of the earliest uses of computers in classrooms was to teach the traditional curriculum and basic skills, often operating as a means to deliver instruction, sometimes as a supplement to the teachers' classroom instruction, and sometimes in lieu of the teachers' instruction. Much of the software focused on basic skills and knowledge in the various content areas, used programmed instruction and drill and practice, and was often based on behaviorism and reductionism for its instructional design. As time progressed, the software and usage changed and the line between the computer as a tutorial and the computer as a tool became blurred. For example, as word processors became more sophisticated and available, the computer was often used to produce student writing. Other types of programs, such as Logo, soon further blurred the line between tutor and tool. With the change of usage came questions about how best to evaluate the effect of The technology on student learning, but in most instances, the researchers relied on standardized test scores or other traditional measures of achievement.

It is important to note that not all of the computer usage in schools during these decades was focused on the teaching of basic skills and content based on behavior theory. Those educators who envisioned a more student centered curriculum and learning environment did attempt to employ the computers in different ways. For example, there were efforts in some science classrooms to use the computers to provide simulations and modeling of problems to aid instruction and to foster a deeper understanding of method and content (Stratford, 1997). Attempts were made to eliminate the preprogrammed nature of the instruction and to incorporate "intelligent tutoring systems" (ITS) (Goodyear, 1991; Shute & Psootka, 1996; Wegner, 1987) that used diagnostic procedures based on the knowledge of the learner at any given point. Other efforts, based on the work of Seymour Papert (1980), focused on teaching of computer programming with the belief that it could foster cognitive development. One of the most common programs was Logo for young children. It was the focus of a number of research studies for several years (e.g. Clements, 1987b; Clements & Gullo, 1984; Clements & Nastasi, 1988, Keller, 1990; see DeCorte, 1996), with evidence that a Logo programming environment fosters higher order thinking skills, develops creativity, and produces other desirable outcomes.

Sometimes these studies were included in the reviews of research (e.g. Khalili & Shashaani, 1994; Liao & Bright, 1991), and sometimes they were omitted because the use of the computer and the educational outcomes being sought did not fit the scope or criteria of the review.

TECHNOLOGY AS A TRANSFORMATIONAL AGENT AND LEARNING TOOL

In the past decade the use of the computer and related technologies has expanded from use primarily as an instructional delivery medium to technology as a transformational tool and integral part of the learning environment. In fact, many proponents of the current reform efforts see technology as a vital component of a new educational paradigm in which the curriculum, teaching methods, and student outcomes are reconceptualized (see Means, 1994). This view was adopted by the U.S. Department of Education at least as early as 1993. In *Using Technology to Support Education Reform* (United States Department of Education, 1993) it was stated: “technology supports exactly the kinds of changes in content, roles, organizational climate, and affect that are at the heart of the reform movement.”² In these settings the computer and related technologies are serving at least four distinct purposes: (1) they are used as previously to teach, drill and practice using increasingly sophisticated digital content; (2) they are used to provide simulations and real world experiences to develop cognitive thinking and to extend learning; (3) they are used to provide access to a wealth of information and enhanced communications through the internet and other related information technologies; and (4) they are used as productivity tools employing application software such as spreadsheets, data bases, and word processors, to manage information, to solve problems and to produce sophisticated products.

RESEARCH ON THE NEW LEARNING ENVIRONMENTS AND STUDENT ACHIEVEMENT

Perhaps the most pressing research question focuses on how students in the high technology new learning environments perform on the new assessments of student learning when compared to students in the more traditional or non-high technology classrooms. There is a wide belief among technology proponents that the transformation of the classrooms facilitated by the use of technology will produce positive learning results not assessed fully by traditional standardized tests. Consequently, there is reluctance to use the traditional standardized tests to evaluate the impact of the technology on student learning.

There have been a few attempts to conduct research in this new and difficult area. A case in point is the research conducted by Stevenson (1998) in Beaufort, South Carolina. His evaluation of the Anytime, Anywhere Learning program in the Beaufort County School District showed a positive relationship between laptop computer usage and academic achievement using standardized test scores, and this relationship was strongest among free and reduced lunch children. These are

encouraging findings, but, as Stevenson points out, the findings must be accepted with caution because of the nonexperimental nature of the program. While these and other such findings are encouraging, they generally do not meet the standard of “rigorous empirical testing.” Instead, the evaluation reflects the real world in which educational researchers attempt to conduct their research, rather than the controlled atmosphere of a laboratory setting.

COMPUTERS, NEW LEARNING ENVIRONMENTS, AND TECHNOLOGICAL LITERACY

There are many people who advocate increasing technology in the schools because of the need for our children to be technologically literate for success in the Twenty-First Century, and that this literacy is best achieved in classrooms where the technology is an integral part of the environment and where it is used as a daily tool for learning and solving real-world problems. Much of the general public supports increasing technology in the schools for this reason. An interesting finding emerged from a program evaluation in Washington State (Fouts & Stuen, 1999). When 50 parents were interviewed, the reasons given for believing in the importance of increased technology in the schools focused almost exclusive on the ideas that “technology is the wave of the future” and that “these kids will need technological skills to get good jobs when they get out into the real world.” Even when pressed on the topic, only two of the fifty parents (a medical doctor and a mother who was herself an elementary teacher who used technology in her classroom) could articulate the importance of computers and technology for helping to reform education and change the nature of classroom activities, teaching and learning

CONCLUSIONS

Policy makers and educators who ask the broad question, “What does the research say about the effectiveness of computers in schools?” are faced with the problem of asking a question that has many potential answers. The answer depends, in part, on whether or not a particular line of research has been addressed by researchers over a period of time long enough to produce a substantial body of findings. Given the wide range of uses of the computers and technology in the schools and the different purposes to which they are employed, when combined, these lines of research have presented a substantial challenge to researchers

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