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Factors affecting use of technology by educators

Jean Lange Bengfort
University of Northern Iowa

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Factors affecting use of technology by educators

Abstract

Technology in some form has been found in schools beginning with the printing press in the 15th century. The late 19th century brought about motion pictures followed by radio, photography, television, and videotape (Simonson & Thompson, 1990). But recently, many dramatic technological devices have become available. Powerful computers are now priced low enough for purchase in both the home and schools, as well as telecommunication devices, videodiscs, CD ROM, hypermedia, and networking systems. The microcomputer and related technologies hold promise as the medium of the future. Technology has affected the way business is transacted, medical problems are analyzed, and products are produced. Its' growing presence has been touted as the means to restructure schools and transform the educational process (Olson, 1992). However, we have not seen the expected impact of technology on our nation's schools. The evidence seems to indicate that the majority of educators are not comfortable with the implementation of technology in their classrooms. Therefore, it is the intent of this research to examine factors that may contribute to this lack of usage.

FACTORS AFFECTING USE

OF TECHNOLOGY BY EDUCATORS

A Research Paper

Submitted

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

Jean Lange Bengfort

University of Northern Iowa

July 1993

This Research Paper by Jean Bengfort

Entitled: Factors Affecting Use of Technology By Educators

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

Sharon E. Smaldino

July 20, 1993

Date Approved   Director of Research Paper

Sharon E. Smaldino

July 20, 1993

Date Approved   Graduate Faculty Advisor

Leigh E. Zeitz

July 21, 1993

Date Approved   Graduate Faculty Reader

Peggy Ishler

July 21, 1993

Date Approved   Head, Department of Curriculum
            and Instruction

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CHAPTER I

Introduction

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comfortable with the implementation of technology in their
classrooms. Therefore, it is the intent of this research to
examine factors that may contribute to this lack of usage.

Recent Data

McCoy (1989) reports that there are nearly 1.5 million
computers in American schools today. It is estimated that

between 1978-1988, schools spent $2 billion on technology purchases. A 1989 *USA Today* article states there has been an explosive growth of microcomputers in the nation's classrooms from slightly more than 15 percent in the early 1980's to nearly 95 percent today. The student per computer ratio has been reduced from nearly 125:1 to 20:1 (Nuccio, 1990; Olson, 1992).

Microcomputers have also emerged on the personal front. In January 1991, the Electronic Industry Association (EIA) estimated that 28% of U.S. households owned a personal computer (Dupagne & Krendl, 1992).

However, while microcomputers are becoming more available and technological advances are being made, their use in education lags behind computer usage in business and industry. In 1989, an article in *Business Week* claimed, "After a decade of enthusiasm, there's still no consensus about the role, value or effectiveness of computers in schools. Well-thought-out goals are still lacking....Initial fervor has given way to benign neglect" (Shao, Carey, and Ehrlich, 1989, p.108). According to an OTA report, not all students use computers and those who do use them, spend an average of little more than an hour a week on them, or only 4 percent of their instructional time (Olson, 1992). Additionally, a NAEP Survey of 24,000 students nationwide found that 10 percent or fewer used a computer in school more than once a week (McCoy, 1989).

Inadequate Training

To what do we attribute this lack of usage? Perhaps too much attention has been focused on students and training them to become computer literate and the needs of the teachers who are training the students have been overlooked. Unless students are taught by teachers who are skillful at integrating technology into the curriculum, computers will not achieve optimum results (Hirschuhl, 1990). Educators at all levels have been expected to assume the role of computer instructor and therefore advance the computer literacy in the schools but possibly have not been prepared for such a role for various reasons.

Cicchelli and Baecher (1989) note that teachers vary in the quality of their expertise, interest, and acceptance of new technologies, as well as a basic fear of computers. McCoy (1989) suggests that the major reason that teachers do not use computers is that they are not comfortable with the computers themselves because of inadequate training.

Hardware and Software

Additional concerns addressed in the literature include a lack of hardware and software (Dupagne & Krendl, 1992). Lack of funds has inhibited districts from making these

investments. In some districts, poor planning has been the problem as the purchase of hardware has preceded decisions on how to use it.

Software has also undergone major changes. The pace of technology development has been so rapid, it has been nearly impossible to get comfortable with a given computer or application before a new one is announced. Consequently, educational software has seen changes in format, quality, and the amount available.

Role of the Principal

Research done by Linn and Fischer (1984) indicates that the principal plays a key role in the implementation of microcomputers in schools. As the instructional leader, principals are instrumental in creating effective schools that may include the use of technology. Furthermore, whether the principal shows a positive attitude towards computers might affect teachers' instructional uses of computers.

Time

Teachers also report that they have not had enough time to carry out computer activities in the classroom (Novak & Knowles, 1991). The curriculum has undergone major changes in the past decade such as outcome based education, mastery learning, whole language, new national math standards, and cooperative learning that require educators to learn new

teaching strategies. Today's educators are being challenged to revamp their curriculum as they incorporate these new approaches that require additional time on their part. Learning to implement technology is an additional burden on already over-committed teachers.

Teacher Attitudes

Finally, levels of computer literacy and the attitudes held by educators have been shown to affect personal use and adoption of computers for use in the classroom (Hignite & Echternacht, 1992). A number of researchers have concluded that not all teachers have the personality and attitudinal profiles necessary in order to use the computer effectively in an instructional situation (Katz, 1992). These researchers have been investigating the personality profile of a successful computer-using teacher.

Statement of Problem

The literature seems to indicate that there are several theories which might explain whether educators become successful technology users in their classrooms. If we will be able to educate our youth to become computer literate, we must address the problem of computer literate educators. It is the intent of this research to further examine teacher usage of technology concerning the issues of teacher training, adequate hardware and software, role of the

principal, time to implement technology, and teacher
attitudes.

Definition of Terms

Authoring software - A method of using a simplified
  programming language to create computer based instruction.

CD ROM - Compact disc-read only memory. This technology uses
  laser technology to store and retrieve vast amounts of data
  for use as input by computer systems.

Computer-assisted instruction (CAI) - The application of
  computer technology to solve an instructional problem.

Computer-based instruction (CBI) - Instruction delivered
  primarily via computer.

Computer-managed instruction (CMI) - Application of computer
  technology to monitor, track, and report on student and
  lesson performance.

Cooperative Learning - Classroom approach whereby students
  work together in small teams and share goals, divide a
  task, share resources, assume different roles, and receive
  rewards based on their group performance.

CPU - Central processing unit. The brain of the computer
  system.

Expert systems - An operationalization of artificial
  intelligence that uses a computer to simulate human
  brainpower.

Hardware – Computer equipment including processing units, disc drives, and printers.

Hypermedia – The creation of interactive multi-media learning environments which may include a combination of data from CD-ROM, laser disc, and scanners.

Intelligent tutors – Software programs that incorporate artificial intelligence.

Laser disc (Videodisc) – A record like surface containing digital data. Originally developed to store and replay video, this technology has demonstrated great potential for storing other forms of data as well.

Mastery Learning – Philosophy that contends that students should demonstrate proficiency in one area before moving on to other areas. In mastery learning contexts, students often work with concepts, information, or skills until they perform the desired behaviors with 80% to 90% accuracy.

Microcomputer – A small personal computer system designed for use by one person at a time, rather than multiple users. Components usually include a keyboard, through which the student communicates to the computer; a central processing unit (CPU), in which processing takes place; a monitor, through which the computer communicates to the student; and one or more diskette drives, used for data storage.

Networking systems – Two or more computers are connected to one another through pathways on a local area network.

Scanners - Device through which an image may be imported
into the computer.

Software - The languages, programs, and data that make use
of computer hardware. *Hardware* includes the physical
devices; *software* encompasses many types of information
that apply the hardware to produce results.

Telecommunications - Transfer of data from one computer to
another via communications media such as telephone lines.

CHAPTER II

<u>Review of Literature</u>

This review of literature reveals evidence that several factors have an effect on the successful implementation of technology by educators. The issues of teacher training, adequate hardware and software, role of the principal, time to implement technology, and teacher attitudes will be each be addressed separately regarding their impact on technology implementation in our nation's schools.

<u>Inadequate Training</u>

One reason often cited as being of major importance in successful implementation of technology into schools is training for the teachers. According to Benjamin, Byrant, & Mack (1990), the key for optimal computer instruction lies with the classroom teacher. Teachers should be the primary role models for their students in regard to computer usage. Therefore, the teacher should acquire and regularly update knowledge of, and skills in the use of, the computer. This includes participation in workshops provided through the district or building staff development as well as external offerings.

Congress's Office of Technology Assessment recently completed a report, "*Power On! New Tools for Teaching and*

Learning" detailing the use of computers in schools. They also concluded that teachers need both training and education if technology is to take hold in schools (Hirschbuhl, 1990). According to this report, the vast majority of teachers today have had little or no training in the use of new technology which limits a school's potential to use technology effectively. They also report that only a third of K-12 teachers have had even 10 hours of computer training and much of it has focused on learning about computers, not on how to teach with them. (Olson 1992).

Unfortunately, many teachers also report that what technology training they have had, has been ineffective. Another survey sponsored by *Instructor* magazine in 1991 reported that 88 percent of readers responding indicated that they have taken a computer course, but 60 percent found that the typical inservice course was unsatisfactory. Teachers were asked to state their needs concerning technology less than 50 percent of the time when technology inservice was being planned (Clemente, 1991). Consequently, inservice has often been designed without input from the teachers for whom it was intended, resulting in ineffective sessions. Teachers experience frustration over these poorly designed, irrelevant, and inadequate inservices concerning the use of computers. This frustration grows as they try to integrate this new piece of technology into their already well-honed lessons (Nuccio, 1990).

Scrogan (1989) reports on factors that contribute to
effective computer inservice. He finds that there should be
an appropriate balance between lecture and guided practice.
Detailed curriculum guides and lesson plans are a visible
component of inservice. Clear and relevant objectives are
important so teachers feel that they have a clear
understanding of what they will learn. Lesson-related
materials and handouts free teachers from extensive
notetaking and reliance on computer manuals. The inservice
lessons should be linked to instruction so teachers can go
back and use the materials and activities with their
students. There should be peer interaction which allows for
communication among participants and the trainer should have
ways to deal with participants of differing levels of prior
knowledge and anxiety. Finally, the impact of training is
much stronger when followed up (Scrogan, 1990).

Other training difficulties also become evident in the
literature. A seven-member technology study team which spent
29 days compiling data for an educational technology plan for
Clark County, Las Vegas, Nevada, found that staff development
was by far the most cited difficulty in making full use of
technology in the classroom. They found three major areas of
concern: adequate time was not allocated for training;
training resources such as facilities, instructors,
materials, equipment, and funding were insufficient,
inappropriate, or nonexistent; and follow-up sessions to

training were inadequate or nonexistent (Rotondo, 1990).
Allocation of time, resources, and follow-up are therefore
important considerations for anyone involved in the planning
of technology training.

The lack of appropriate training for program
implementation is also an impediment to successful operation
of CBI (computer-based instructional programs). Too often
Educational Consultants go into schools to plan or to deliver
the workshops and find that the people most responsible for
the success of the system-the principal and teachers-have
played no part in the decision-making. Neither do they have
any idea that the system requires much time and work to use
it successfully. Staff training has wide ranging
implications for the scope and sequence of any CBI (computer-
based instruction) and should be one of the major
considerations in program planning. To be successful,
groundwork must be laid, growth nurtured, and staff
development on-going (Robinson, 1992).

Other literature focuses on successful computer-using
teachers in order to make recommendations for inservice and
training. When this data is analyzed, it suggests that most
of these teachers have received some training and support. A
national survey which was federally funded through the Center
for Technology in Education (CTE) at Bank Street College of
Education in New York City was distributed to 1,200 computer-
using teachers. Six hundred teachers (with 75 percent having

more than 13 years of teaching experience and representing a wide range of subject areas in grades 4-12) responded. Most of these teachers indicated that they have spent an average of five to six years mastering computer-based practices and approaches. Most (73 percent) have used computers in their teaching for five years or more, with some using the technology for more than nine years. Ninety percent of these teachers say that they were to some degree self-taught and close to 80 percent attended conferences and workshops on their own time. About 60 percent have taken inservice courses offered by their district and/or at school. They also have gotten information from software catalogs, computer education magazines, and general computer magazines. They have attended conferences related to computer education and more than 80 percent have computers at home for their use (Brady, 1991).

Most(77 percent) of these teachers also report that they have continued access to on-site support and advice. This includes help from other teachers, from a school computer coordinator, or from another consultant. Additionally, almost half (42 percent) of their teaching colleagues at school were also using computers for instruction (Brady, 1991). Information such as that cited by Brady should be valuable to administrators, coordinators, and teachers when planning for future technology integration.

Nuccio (1990) of St. Mary's College provides several
recommendations for the integration of computer hardware and
software into the classroom. He states that any
technological solution is reliant on the support of teachers.
The most promising tool in the world is useless if the
teachers, those who will implement it in the curriculum, are
uncomfortable using it. Teachers and administrators have
varying levels of expertise in the use of the computer, and
many classroom teachers feel uncomfortable in planning
computer-aided lessons. If integration of computers within
the regular curriculum is to become a reality, it will become
necessary to implement staff development programs that
provide educators with the appropriate knowledge and skills.
In fact, the needs for training and education are more
extensive and complex than anyone imagined when computers
first were introduced in schools. He goes on to recommend
that inservice training should include adequate hands-on
practice on a regular basis, teacher incentives such as their
own classroom computers, extra pay or release time for
training, and peer-coaching or cross-classroom sharing of
knowledge and skills. Having teachers train other teachers
is also recommended (Benjamin, Byrant, Mack, 1990). The
knowledge teachers need is not knowledge *about* technology;
teachers need to know *how to teach* more effectively while
using this technology. Training should not only focus on the
technology, but also emphasize how teachers can use it to

assist what they now do more efficiently as well as open up new options for instruction (Nuccio, 1990).

Only three states require teacher inservice in the area of technology while an additional fifteen recommend this type of training. Although most teachers want to use computers in their instruction, many are hesitant to become involved (Nuccio, 1990).

Are future teachers being prepared in technology usage? In 1987, only eighteen states required preservice training in technology while an additional seven states recommended inclusion of technology training during preservice education of teachers (Nuccio, 1990). This has resulted in many teachers emerging from teacher education programs unprepared to teach using computers.

Teacher preparation programs should include an introduction to the computer, its operation, and potential uses in the classroom. Field experiences with computers - actively using them for instructional purposes which are theory-based, practical and realistic, and opportunities for substantially enhancing practice are sorely needed (Novak & Knowles, 1991).

Since many undergraduate education programs don't have the ability to completely train future teachers in technology use, education students increasingly must step off campus and into K - 12 schools to get more hands-on training. Some colleges recommend or require preservice teachers to have at

least one student-teaching placement in a setting that uses computers in the classroom as a teaching tool (Bruder, 1990).

Implications of Hardware

Insufficient access to computers, inadequate supplies of quality software, and pauper technology budgets all contribute to limiting a school's potential to use technology effectively (Scrogan, 1990). Olson (1992) states that the vast majority of schools still do not have enough computers to make them a central element of instruction. She goes on to say that individual states, districts, schools, and teachers are exploring uses of technology on their own, often with no clear direction or purpose. Additionally, funds tend to be limited or flow without agreement on how technology should be used. Districts which buy computer hardware before developing an instructional plan are likely to widen the gap between the promise of computers in education and the reality of their use in the classroom (Linn & Fischer, 1984).

Rather than buying machines and then deciding how to use them experts suggest schools should identify their most pressing needs or problems and ask how technology can make a difference (Olson, 1992). Direction can be provided through the development of a long range plan to serve as a guide in purchasing hardware.

Zammit (1992) and researchers at the Bank Street College's Center for Technology and Education also found that access to technology was a critical factor for success (Brady, 1991). It was found that access got more and more difficult as more teachers became interested in using computers.

The major technological changes that have taken place in a relatively short period of time are another obstacle concerning hardware. These changes have been overwhelming to many teachers and threaten to overload what teachers need to know. Hardware has evolved from the typical 8 bit, 16K-64K machine found in schools in the early 1980's to machines with expansion to several megabytes today. Color monitors are common along with L.C.D. projection units, telecommunications capabilities, videodiscs, and networking systems (Nuccio, 1990).

Teachers need to see computer hardware as providing a myriad of tools to use to help students learn. The key is to focus teacher preparation not solely on the technology, but to emphasize how teachers can use it to assist what they now do more efficiently as well as open up new options for instruction (Nuccio, 1990).

Implications of Software

Availability of sound software packages and information about new developments add to the problem. The best software

takes years to develop and requires much evaluation and revision resulting in higher costs (Linn & Fischer, 1984). As with hardware, funding shortages prevent adequate supplies of quality software.

Software selection is also a problem. It is often difficult for schools to find out about new products. Schools may select software because it is inexpensive or free rather than because it is the best. Many teachers have not developed the ability to browse through educational software and select software which will meet their needs. Frequently, the only source of information about software is a salesperson for a particular product (Linn & Fischer, 1984).

The future for software products is promising, however. A 1987 report from the Office of Technology Assessment notes that there are more than 10,000 stand-alone instructional programs from more than 900 software companies. Additionally, several larger software manufacturers offer integrated learning systems that cover large segments of the elementary and secondary school curricula (Nuccio, 1990).

It is reported that commercial products developed since 1985 enjoy a 80 percent recommendation rate by software reviewing agencies (Nuccio, 1990). Critics agree that the current software is good and getting better. Additionally, dramatic advances in computer software such as expert systems, intelligent tutors, and authoring software are

beginning to evidence themselves and will help educators learn to teach with the computer.

Role of the Principal

Interviews with principals show that most favor instructional uses of computers. School administrators must support and encourage teachers if programs are to be truly effective. They should provide opportunities for the use of technology and encourage the staff in its use whenever possible.

In schools where technology implementation proceeds from top, down, the impetus for adopting new technology comes from senior administrators or school principals (Bishop-Clark & Grant, 1991). Principals' policies for implementing and supporting computers affect teachers' instructional uses of them. Many principals give teachers release time to attend computer workshops or conferences. They encourage teachers' computer-related interest and activities. They also place much of the responsibility for expanding the school computer program on teachers. They do not coerce teachers into using micros, but instead provide subtle encouragement. They delegate responsibility to committed teachers or to someone in the school's central office to manage the details of their computer implementation policies (Shavelson, Winkler, Stasz & Robyn, 1983).

Another aspect in which principals affect implementation is in their control of funds. As previously stated, almost all principals favor instructional use of microcomputers. From what meager discretionary funds they have at their disposal, they allocate or support departmental allocation of a respectable percentage to computer goals (Shavelson, Winkler, Stasz & Robyn, 1983). Principals commit resources to projects, organize the implementation, and ensure that teachers and staff adopt the technology as intended (Bishop-Clark & Grant, 1990).

The principal's role is one of an instructional leader. The effective teaching research clearly demonstrates the key role of the principal in creating a school-wide atmosphere that promotes learning. This is also true with integrating computers (Nuccio, 1990). Principals show highly positive attitudes toward the implementation of computers in schools. Interestingly, their attitudes may be more favorable than those of teachers (Dupagne & Krendl, 1992).

In 1983, very few principals owned a computer or knew how to use one for instruction, administrative tasks, or even recreation, despite professed interest in and commitment to computer literacy (Shavelson, Winkler, Stasz, Robyn, 1983). Principals should be role models in the use of the computer. They should also regularly update their own computer skills via educational offerings (Benjamin, Byrant & Mack, 1990). The Office of Technology Assessment reports that there is an

immediate need for administrative training in the vision and value of instructional technologies.

A review of research by Dupagne & Krendl (1992) stresses that support from administrators consistently predicts successful integration of computers into the instructional process. The infrastructure to support and maintain computer implementation by individual teachers is often missing and it is critical that the administrator develops such an infrastructure.

Additionally, in a study by Cicchelli and Baecher published in 1989, teachers were concerned about the leadership style of the principal, his or her commitment to computers, expectations for teachers to perform, and the availability of resources.

Time

Time associated with computer usage can be addressed from two aspects; time for teachers to learn about technology and acquire the skills necessary to use it in their classrooms; and secondly, time to use the technology with students when today's ever-changing curriculum is already overcrowded.

It is the responsibility of the teacher on a daily basis to take the time necessary to make sure each lesson taught is well-planned. Learning about new technology and how to incorporate it into the curriculum is an additional burden.

The time required for teachers to develop their own computer
skills is often underestimated. In a survey that summarizes
what top technology teachers have learned, Brady (1991)
states that teachers see lack of time to develop computer-
based lessons as a major barrier. She also found that
researchers concluded that it takes time to become an expert
in anything. Since teachers have to master the technology
themselves and then figure out how to teach with it, it is
unlikely
that the process can be made to happen quickly. As with many
accomplished technology teachers, the process may take five
or six years.

Nuccio (1990) states that the key may be not to focus
solely on the technology, but to emphasize how teachers can
use it to assist what they do now more efficiently as well as
open up new options for instruction. These advances in
technology will provide opportunities for teachers to
institute more cooperative methods of learning among
students. Team projects that are not limited to students in
an individual class or the resources of those school
districts will become feasible through telecommunications.
Integration of computers into everyday use will occur only
when teachers understand how to teach with the computer.

In a study by Novak and Knowles (1991), data from
beginning teachers about their computer usage was collected.
It was found that beginning teachers are surprised by the

amount of time teaching requires and are often overwhelmed by all they need to do. The teachers felt constrained by time-time to plan for the computer; time to identify, locate, and preview software; and time to allow the students to use the computer during the school day.

Teacher Attitudes

The final factor which will be addressed in reference to computer usage is the teacher's attitude. The attitude of the educator towards computers has been found to be significant. This computer attitude tends to be broken down in studies into computer anxiety and computer interest. In the last two decades, reports have indicated that teachers have somewhat ambivalent attitudes towards computer technology. As one looks back, Dupagne & Krendl (1992) cite earlier research by Lichtman from 1979 which found that educators exhibited less favorable attitudes toward computers than did the general public and majority of teachers (55 percent) perceived computer technology as a dehumanizing tool. Additionally, they go on to cite research by Stevens in 1980 in which he surveyed 657 K-12 teachers and reported that they were strongly supportive of computer literacy in the secondary schools. However, 90% of them responded that they did not consider themselves qualified to teach computer literacy courses, and nearly 40% felt anxiety not only when

around computers, but also when others were talking about computers.

As we look at more recent research, Katz (1992) has been researching the personality profile of a successful computer-using teacher. Offir and Katz concluded in a 1990 study that teachers who, by their very nature, are risk-takers in their personal and professional lives are more likely to have positive computer-oriented attitudes than teachers who are cautious and have a fear of taking risks.

Hignite & Echternacht (1992) cite significant correlations between computer attitudes and computer literacy have been found among educators. However, in a study completed in 1992, the relationship between computer attitudes and computer literacy was found to be neither direct nor simple. They concluded that an individual's computer attitude and level of computer literacy may be comprised of multiple related attitudinal variables with correlations existing between and among these variables.

Research by Bishop-Clark & Grant (1991) focused on categorizing types of resistance to change. These could be classified as: 1) people-determined resistance which reflects the belief that there are elements inherent in human nature or in one's personality which make one resist change; 2) technology-determined resistance steming from poor quality of the technology, whether it might be hardware, software, training materials, or procedures; and

3)environment-determined resistance which can be traced to characteristics of the environment. They go on to offer suggestions for helping these various types of people accept technology. Bishop-Clark & Grant also stress the importance of encouraging positive attitudes and identifying key persons within a particular school who tend to drive technology adoption.

Recent research also indicates that people are becoming more accustomed to computers. According to other research by Dupagne and Krendl (1992) teachers in recent years have been enthusiastic about and have expressed positive attitudes toward the implementation of microcomputers in the classroom and curriculum. Additionally, the level of enthusiasm about computer use increases with the individual teacher's level of computer experience.

Dupagne & Krendl (1992) also find that knowledge of computers and computer experience has a positive impact on teachers' attitudes. Teachers who had no professional experience with computers were less knowledgeable about the application of computers in the classroom. They conclude that having a knowledge of computers influences teachers' attitudes toward computers and computer use.

Dupagne and Krendl (1992) also conclude from a review of research that the more willing teachers are to use computers in the classroom, the more favorable their attitudes are towards computers and vice versa. The more

proficient teachers are in computer use, the more predisposed they are to use them.

Teachers who use or own computers are more likely to exhibit favorable attitudes toward computer use in the classroom. Educators with previous computers skills tend to show lower levels of anxiety toward computers than do other educators. Thus, the literature suggests that computer experience fosters positive attitudes toward the use of computers. Training may stimulate teachers' computer use and consequently foster favorable attitudes toward computers (Dupagne & Krendl, 1992).

CHAPTER III

SUMMARY AND CONCLUSIONS

As schools prepare students for the 21st century, the
effective use of technology will be a necessary part of the
educational process. Even though microcomputers and related
technologies are becoming more available, reports indicate
usage lags behind what we would desire. Improving the
technology skills of students and teachers must become a
priority in our nation's schools. Continuing advances in the
technology field will make it imperative that educators at
all levels be not only familiar with, but efficient in the
use of technology of all kinds such as CD-ROM, laser discs,
scanners, telecommunications and microcomputers as these
pieces of hardware become common in the workplace and
schools.

In summary, this review of recent literature has
revealed several factors which seem to have an impact on
computer utilization. The factor that seems to have the
greatest impact is the amount of inservice or training that
is available to educators. Four major points surface in
terms of training. First, educators cannot be expected to
learn about computers and related technologies on their own.
They need training and education in the use of technology in
order to be able to incorporate its use into the curriculum.
Furthermore, any training must not only focus on learning

about computers, but also on how to teach with them. Another important consideration in reference to teacher training is follow-up. Once teachers return to their classrooms, follow-up sessions should be scheduled to continue to hone skills or classroom visitations by a technology coordinator can also be an effective means to provide assistance. Finally, the skills of future teachers can be improved through the inclusion of technology training during the preservice education of teachers.

The literature also reveals that limited access to computer hardware affects computer utilization in the classroom. Money must continue to be allocated to purchase additional hardware as well as update equipment. Secondly, districts are often functioning without a computer plan to provide clear direction or purpose. Consequently, they tend to purchase hardware before they have a plan of implementation for its use. Finally, major advances in technology in a short period of time have also hindered educators as they attempt to be knowledgeable about the software and hardware which they will be using. Persons in leadership roles must be kept abreast of these changes so that the information can be passed on to teachers and students alike.

In addition to hardware, available software affects computer usage. Educators often do not have quality software at their disposal because of cost or are not knowledgeable

about evaluating software packages for possible purchase. Thus, software purchases are often limited or software is of poor quality.

Principals play a key role in the implementation of microcomputers in schools. They set high expectations and promote a rich environment that incorporates the use of technology. Principals also control funds for the purchase of hardware and software which determines the level of computer access. Finally, the principal is viewed as an instructional leader, therefore a leader in modeling the use of technology.

Another factor that affects computer usage by educators is a lack of time. There are two important considerations. First, it takes time for teachers to learn about technology and secondly, there is a shortage of time to use the technology with students. Technology leaders should emphasize the use of the computer as a teaching tool where its use is integrated into the curriculum and how teachers can use it to assist them in what they already do. Educational technology should not be treated as a separate discipline, but appropriate roles for the use of computers within their content domains should be determined (Kinnaman, 1990).

Finally, a person's attitude towards computer technology has also been found to be significant. Studies have shown that educators tend to show less favorable attitudes towards

computers than the general public. However, it has also been found that as computer experience increases, a person's level of enthusiasm towards technology also improves.

These five factors that have been discussed in this review of literature have had and will continue to have an impact on the regularity and degree of computer use by educators. Schools must plan for training, budget for technology hardware and software purchases, and train the principals and those persons in leadership roles. They must also be sensitive and patient as time becomes a factor in implementation. Last of all, the more experience that educators have with technology, the more positive their attitudes will become towards it. If these areas of concern are addressed, we can expect to see an increase in computer usage by educators as they accept the challenge to integrate new technologies into our schools and prepare our students for the workplace of the 21st century.

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