Spring 1994

Identification of Factors Leading to Successful Computer Implementation in Elementary Schools

Jeffrey A. Marsh
Grand Valley State University

Follow this and additional works at: http://scholarworks.gvsu.edu/theses
Part of the Educational Administration and Supervision Commons

Recommended Citation
http://scholarworks.gvsu.edu/theses/174

This Thesis is brought to you for free and open access by the Graduate Research and Creative Practice at ScholarWorks@GVSU. It has been accepted for inclusion in Masters Theses by an authorized administrator of ScholarWorks@GVSU. For more information, please contact scholarworks@gvsu.edu.
IDENTIFICATION OF FACTORS LEADING TO SUCCESSFUL COMPUTER IMPLEMENTATION IN ELEMENTARY SCHOOLS

Jeffrey A. Marsh

Spring/Summer, 1994

Masters Thesis

Submitted to the graduate faculty at

Grand Valley State University

in partial fulfillment of the

Masters of Education
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>2</td>
</tr>
<tr>
<td>Chapter 1: Project Proposal</td>
<td>4</td>
</tr>
<tr>
<td>Key Terms</td>
<td>4</td>
</tr>
<tr>
<td>Problem Statement</td>
<td>5</td>
</tr>
<tr>
<td>Rationale of Study</td>
<td>6</td>
</tr>
<tr>
<td>Background of Study</td>
<td>8</td>
</tr>
<tr>
<td>Statement of Purpose</td>
<td>13</td>
</tr>
<tr>
<td>Chapter 2: Survey of Literature</td>
<td>16</td>
</tr>
<tr>
<td>Chapter 3: Project Conclusions</td>
<td>47</td>
</tr>
<tr>
<td>Project Methodology</td>
<td>47</td>
</tr>
<tr>
<td>Data and Results</td>
<td>49</td>
</tr>
<tr>
<td>Conclusions</td>
<td>79</td>
</tr>
<tr>
<td>Recommendations</td>
<td>86</td>
</tr>
<tr>
<td>Further Study</td>
<td>90</td>
</tr>
<tr>
<td>Plans for Dissemination</td>
<td>91</td>
</tr>
<tr>
<td>References</td>
<td>92</td>
</tr>
<tr>
<td>Appendix A: Survey</td>
<td>101</td>
</tr>
<tr>
<td>Appendix B: Article</td>
<td>104</td>
</tr>
</tbody>
</table>
Abstract

IDENTIFICATION OF FACTORS LEADING TO SUCCESSFUL COMPUTER IMPLEMENTATION IN ELEMENTARY SCHOOLS

The purpose of this study was to review existing research and write an article about factors that lead to greater computer usage in the elementary schools.

In completion of this study, an exhaustive review of literature and research dealing with factors pertaining to successful elementary computer programs was conducted. From this review, a list of factors was created and a survey developed. A phone survey was then completed for a group of 26 district computer coordinators. The surveys were divided into schools with elementary computer models that computer coordinators ranked highly, and those which computer coordinators felt were lacking. The results of each question were then subjected to a chi-square.

Recommendations of the study are divided into two categories. All have to do with administrative activities to encourage computer use.

District administrators should:

1. Develop a technology plan,

2. Hire a full time computer coordinator, and

3. Develop a district computer information clearing-house.
School level administrators should:

1. Show visible support for program,

2. Develop school goals, including computer's place in curriculum,

3. Buy compatible computer equipment,

4. Place computers in both laboratories and classrooms,

5. Have computers available for check-out by teachers,

6. Hire a part-time school computer coordinator, and

7. Have flexible, on-going, and paid training available.
Chapter 1

Key Terms

Compatible computers: Computers that run the same software.

Computer Coordinator: A person whose responsibilities include acquisition of
computers and software, training of employees, and maintenance of
equipment.

Drill-and-practice software: Software that allows for little involvement of the user,
and can only be used in one way. These include educational games.

Hardware: Any equipment. Examples would be computers, monitors, and printers.

Integrated Learning System (ILS): A large package of software that contains
practice and testing of an entire curriculum.

Lab pack: Multiple copies of a program containing only one copy of the
documentation. Usually sold to be used in a laboratory setting.

Laptop computer: A portable computer.

Learner-driven software: Also called "tool" software. These are programs that are
flexible, and allow the user to use them in many different ways. Some example
are word processors and data-bases.

SES: Socio-Economic Status.

Site license: An agreement that allows an organization to make as many copies of a
program as they need. These programs must all be used in the confines of that
organization.

Software: The programs that are used on a computer.
Problem Statement

When computers are purchased for an elementary school, very little time is spent to ensure that they will be used with the students. Elementary administrators, media specialists, and technology coordinators need a clear guide as to which factors will increase student and teacher computer use in their schools.
**Importance and Rationale of the Study**

Computers are in the schools. In 1992, 98% of all U.S. schools reported having at least one computer (Kondracke, p. 234). The ratio of students to computers in schools was 16 to 1 in 1992 (Becker, 1993, p. 26). The purchase of computer technology for education has been a priority for many school districts in the last ten years.

Despite this, the educational use of these computers is not as positive a picture. Charles Piller (1992) states, "Counting computers means nothing. Nearly every school in America owns personal computers. But without expertise to use and maintain them, thousands lie fallow." (p. 221) Only 52.3% of all elementary students use computers at school (Kondracke, 1992, p. 236). A National Council of Teachers of Mathematics study found that, of all the elementary math teachers surveyed, only 53% feel well prepared to use computers as an integral part of their mathematics instruction. This is compared with the 90% who feel well prepared to use manipulatives (cited in Hill, 1992, p.30).

Even with the disappointing evidence of student computer use, the funding of computers and technology continues to be an area of growth. In a recent survey by the magazine *Electronic Learning*, it was found that 60.8% of all school districts planned to increase or keep constant their
expenditures on technology (Bruder, 1993, p. 20). How can an administrator ensure that these computers will be better utilized than those purchased in the past?

Research on this subject exists. However, since it is a relatively new field, it is limited and not readily available to the public. Many administrators developing computer acquisition plans have little or no experience with using technology in the classroom. They are not aware of the things in addition to computers and software that must be in place to ensure a successful program, and they do not have the time to plow through the research to find this information. Many times the recommendations of computer consultants, trained in the business world, are taken without thought, despite the fact that these experts have no experience with the unique needs of elementary schools in relation to computers.

There is a need for easily accessible information on the factors that lead to a successful educational computing program in the elementary schools. Educational dollars and opportunities are being lost.
Background of the Study

Computer use in the elementary schools is a relatively new phenomenon. Elementary computer use began in the late 1960's, but was very limited until the advent of the microcomputer in the mid 1970's (Winner, 1993, p.4). Initial acquisition of computers was usually spurred by a few very enthusiastic teachers finding creative budgeting means (Microcomputers in the Schools-Implementation in Special Education, 1983). Education experts almost immediately proclaimed the importance of this new form of teaching delivery (Peterson, 1985; Schwartz, 1985; Microcomputers in the Schools-Implementation in Special Education, 1983; A Guide to Computers in Education, 1985). The abundance of positive articles led to an explosion of computer purchasing in the mid 1980's that seems not to have subsided (Becker, 1986; 1993). Along with this increase in computer purchasing, other expenditures were being suggested. Studies as early as 1981 were explaining the importance of training and other factors that should be considered by people beginning the computer purchasing procedure (Goor & others, 1981; Brennan, 1991; Becker, 1986). Despite this, many of the efforts to implement computers into schools have been less than successful (Brennan, 1991; Becker, 1986; Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology, 1991; Wirthlin Group,
As computers are placed into the schools, it is very important to realize that implementation into elementary schools is very different than implementation into schools at the secondary level. A much larger number of teachers at the elementary school are using computers, and more students use computers on a weekly basis (Becker, 1986). Despite this, fewer elementary teachers feel comfortable with computers or are seen as experts (Becker, 1986; 1993; Hill, 1993).

The picture of computer use in today's school shows a great deal of under-utilized potential. On the positive side, 16 to 1 is the national ratio of students to computers (Becker, 1993, p.26), 98% of schools report having computers (Kondracke, 1992, p. 236), and 60.8% of all school districts plan on increasing or keeping steady their computer budget (Bruder, 1993, p. 84). Despite this only 52.3% of all students use computers at school (Kondracke, 1992, p. 236). Teachers perceive that there is a great gap in the potential for computer use and what is actually being done in their school (Wirthlin Group, 1989). Along with this, there is only a very small percentage of teachers that have received at least ten hours of computer training (Fulton, 1988). Finally, it has been noted that many classroom teachers have shown only limited interest in expanding computer based
instruction due to the lack of perceived reward or return for the required time (Brennan, 1991).

Many theories have been put forward to increase the effectiveness of educational computer implementation. Brennan states that, "the role of the teacher is considered to be the most crucial determining factor relative to the effectiveness of computer applications." (1991, p. 20) Along this line, it is felt that computer training should be an integral part of teacher preservice preparation (Oke, 1992). Although this is a justifiable goal, it is a long-term solution, and does very little to help the situation in the present. With this in mind, many researchers have been theorizing on what factors may help. The most often mentioned factor is that of teacher in-service (Becker, 1986; 1993; Brennan, 1991; Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology, 1991; Hancock & Betts, 1994; Moursund, 1989). Along with training, other factors have been mentioned. Time is needed to develop adequate computer activities (Hancock & Betts, 1994). More funding is also stated as a major factor in increasing the use of computers (Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology, 1991). Finally, it is felt that a top-down model of implementation is detrimental to computer utilization (Cohen & others, 1986).
Some studies have tried to identify important factors in computer implementation by studying those schools in which success has been achieved. A study of Tennessee school teachers found that about 60% felt that summer workshops and after school workshops had assisted them in utilizing computers in their classrooms, and 30% felt the same about training manuals (Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology, 1991). It has been reported in many studies the importance of a continuous program of flexible training sessions (Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology, 1991; Brennan, 1991; Fulton, 1988; Nichols & Frazer, 1992; Scrogen, 1989; Winner, 1993). Along with this training, districts must give teachers time to experiment with the computers (Winner, 1993). The presence of a school computer coordinator was found to be of importance (Cohen & others, 1986), and it was found that the use of learner-driven software versus drill and practice software seemed to have a positive effect on computer implementation (Microcomputers in the Schools-Implementation in Special Education, 1983). Finally, it has been reported that an administrative commitment to computer usage should be evidenced by a school's willingness to find adequate funding, time for teacher training and experimentation, and rewards for teachers who strive for excellence in computer use (Bits, Bytes,
Statement of Purpose

The purpose of this study is to review existing research, and write and disseminate an article about factors that lead to greater computer usage in the elementary schools.

More specifically, this project will consist of an exhaustive review of research dealing with factors that have been studied. Opinions of experts may also be reviewed. From this review, a list of factors will be listed and ranked in order of their seeming importance to the success of an elementary computer program. This list will then be used as a questionnaire that will be sent to a group of district computer consultants obtained from the Computer Education division of the Michigan Department of Education. These questionnaires will include a question pertaining to a ranking of the level of computer use in the elementary schools in their district. The surveys will then be divided into schools that computer coordinators feel are successful in computer implementation, and those which computer coordinators feel need work. The results of each question will then be subjected to a chi-square test. These findings will then be compiled into an article. When the article is finally written some of the discarded factors may be included at the end, explaining that research had shown this to be an important factor, but it was not highly
significant in this study.

The main goal of this study is to summarize research on factors that improve overall computer usage at the elementary level, and to disseminate this information. The objectives are as follows:

- To summarize research on factors that have been proven effective in increasing elementary computer usage.
- To discriminate between what computer specialists feel are positive factors, and those that seem to be of no help.
- To disseminate the information that is collected.

Many limitations are found in this study. The goal of this study is to report on findings of other studies, thus it is imperative that the limitations of all reviewed studies be noted. The limited, and inconsistent return of questionnaires will also be a factor. Along with these it is important to note that the final product can in no way promise results. It can only report things that have had a positive impact on computer usage in schools in the past. Due to the fact that there are many individual factors at every school, it is impossible to ensure success.

The final product of this report will take the form of an easy to understand, short article. In this article, the important factors will be listed and explained. There is currently negotiation under way to publish
this article through American Library Inc. Interest has also been expressed by the "MACUL Newsletter." Research is also being done as to disseminating the information via the Internet. Other possible avenues of publication may be educational magazines such as Elementary Principal; Michigan Elementary and Middle School Principal's Association and Educational Leadership.
Chapter 2

Survey of Literature

From the early days of the microcomputer the educational promise for this new device has been heralded as nothing less than revolutionary. In an early report to administrators about this new technology it was noted that, "Many educators feel that the microcomputer has unique capabilities for improving the quality of instruction, and public schools and school districts are acquiring microcomputers at an increasing rate."

(Winkler, Stasz, Shavelson, 1986, p. 5)

A 1983 Federal report on computer implementation into elementary special education classes described the early attempts at getting computers into the school. "Actually, initial adoptions were more often characterized by enthusiasm and initiative of a few individuals who were very interested in the potential usefulness of microcomputers in education."

(Microcomputers in the Schools-Implementation in Special Education, 1983, p. 25) The report goes on to give examples of the unique process by which computers were acquired, "Two interested teachers seek permission to use special education funds to buy a microcomputer." (Microcomputers in the Schools-Implementation in Special Education, 1983, p. 167) This
initial purchase was then supplemented. "Special Education Teachers begin selling bagels to raise funds for microcomputers." (Microcomputers in the Schools-Implementation in Special Education, 1983, p. 167) Finally, grant money is solicited. "A grant proposal is submitted to the federal government. Apple printer purchased with 'bagel funds.'" (Microcomputers in the Schools-Implementation in Special Education, 1983, p. 167) Early computer implementation was not carried out in a very orderly fashion, and the means of acquiring financial resources would best be described as creative and eclectic.

By the middle of the decade, schools that owned computers were really becoming the norm, and teachers were interested in using this new educational tool in their classrooms. Henry J. Becker (1986) made this clear in his survey of American schools, "Along with a quadrupling of the number of computers in schools in the last two years, there has been a tripling of the number of teachers supervising students in their use." (p. 30) In another survey it was found that "...there is a vast resource of personnel in the reading field who are willing to use the microcomputer for teaching reading. They have an interest and a great desire to become more skillful in microcomputer use." (Schwartz, 1985, p. 7)

Many experts began to publish even more articles decrying the
importance of computer skills for economic survival in the future world, and thus in education. Peterson (1985) explains,

Just as one aspect of an effective organization is its ability to respond to change, one index of the condition and quality of our educational system may be the way in which schools are responding to the advent of an innovation such as the microcomputer. . . . the new age of advancing technology and global competition has radically changed our concept of "basic skills"--the skills necessary for a person's economic competence. Students will need to have basic skills in the use of microcomputers in order to function successfully as citizens in our society. (p. 11)

In response to this need, Peterson (1985) requested that the Federal Government start keeping detailed statistics about computer use to assure an equal opportunity of technological exposure to all students.

The data collected on microcomputer usage in the schools . . . might include: 1) allocated time on the microcomputer broken down by grade, sex, and SES of student; 2) actual time spent per week per student broken down by the same categories of student; and 3) student engaged time on microcomputers per week. (p. 12)

Other publications explained that there were new and unexpected
needs arising because of this new teaching tool. One major need was that of adequate and useful training.

The history of computer training in education which began in the late sixties, concentrated primarily on student competencies.

Education-specific instruction has been a major omission of most computer training. Little distinction has been made between the training of teachers and computer professionals. There is now, however, increasing support for specific teacher training in educational computing, as the concern develops that teachers require an alternate instructional approach (Winner, 1983, p. 4).

Another study states,

Teachers, as well as students, must become computer literate. The return on a school district’s investment in computer hardware and software will be fully realized only if the instructional staff is able to utilize the new resources to improve the quality of instruction.

In most cases this means teachers must be given the opportunity to learn to use the computer (A Guide to Computers in Education, 1985, p. 65).

Classroom teachers were the ones using computers, not a computer specialist or laboratory assistant, and new roles were being filled by many
other teachers.

Is there a new role developing, that of a computer coordinator who is only secondarily a teacher? The answer is slowly. In over 50 percent of the cases the primary computer using teacher identified by the school's principal was a classroom teacher . . . . Only 7% of elementary computer using teachers designated themselves as Computer Coordinator . . . . It appears that for the most part, the persons most knowledgeable and most active in the use of computer using schools are regular classroom teachers (Becker, 1986, p. 30).

Just putting computers in the schools is not enough to ensure their use. This was noted as early as 1981 in a national survey of computer-using teachers. All respondents indicated some needs that were critical to the initiation and expansion of computer-based instruction. The results showed that, despite the importance of funding (it received a 92% response), many other factors were of great value. In-service training and better computer programs received a response of over 40%, while assistance in planning a program received a response of 33% (Goor & others, 1981, p. 18).

Many elementary schools failed to take into account their own uniqueness when planning their computer implementation model.
Becker's 1986 survey of American schools contains many statistics proving the uniqueness of the elementary program. "At the elementary level, about two-thirds of computer using teachers are general classroom teachers, 10 percent are special education teachers, and a smaller proportion are math specialists, reading specialists, and computer specialists." (p. 31) It seems that almost everyone in the elementary schools were using the computers, as opposed to only a specialist or laboratory assistant. Many more elementary students were also using the computers, "At a typical K-6 computer-using school, 30% of the students used computers during an average week, while at a typical high school only 21% used computers." (Becker, p. 4)

Lab use was also up in the elementary school,

In about half of the laboratories where computers were used for instruction, only one or two teachers were regular users. However, elementary school computer labs and libraries are an exception to this pattern. In a K-6 school, the typical lab is used by six teachers and the typical library containing computers is used by four teachers. (Becker, p. 9)

Despite, or possibly because of, this more varied use, elementary teachers had much less expertise with the computer. "Overall . . . 27% of
computer-using high school teachers were viewed as experts as were 21% of computer-using middle school teachers, but only 10% of computer-using elementary school teachers." (Becker, p.5) Elementary teachers were also having trouble finding a real place for the computer in their teaching arsenal. "They could use a single movie projector with a classroom, or a single overhead projector, but a single computer was a different story." (Becker, p. 30)

The years that have followed this survey have improved some of this, but there is still room for improvement. A 1993 National Council of Teachers of Mathematics study found that, of all elementary math teachers surveyed, only 53% feel well-prepared to use computers as an integral part of their mathematics instruction, as compared with the 90% who feel well-prepared to use manipulatives (cited in Hill, p. 30).

On the positive side, the number of computers used in schools has increased at a drastic rate. The amount of educational dollars spent on computers have been phenomenal. "In the last eight years, the nation has spent well over a billion dollars to help public schools compete in a technological world." (Piller, 1992, p. 218). The current ratio of students to computers is approximately 16 to 1, (Becker, 1993, p. 26) and fully 98% of all U.S. schools report having at least one computer (Kondracke, 1992,
These increases show no sign of slowing down. In a recent survey by the magazine *Electronic Learning*, it was found that 60.8% of all school districts planned to increase or keep constant their expenditures on technology in the next few years (Bruder, 1993, p. 20).

A study of census statistics found that the personal computer has made great in-roads into the culture of the United States. Findings include:

- 15% of all households report having a computer (Kominski, 1991, p. 41).

- 46% of children 3-17 reported using a computer at school or at home (Kominski, 1991, p. 44).

- 36.8% of adults reported using a computer at work (Kominski, 1991, p. 44).

- Households with school-age children were more than twice as likely as those without to have a computer (Kominski, 1991, p. 23).

The trend has also been seen in education. A National Education Association Communications Survey (1993) of computer using teachers found some positive trends in the schools:

- 9 of 10 teachers have access to computers, and

- In elementary grades computers tend to be distributed in individual
classrooms. (p. 92)

But it also found many discrepancies:

- A high technology environment is more likely for affluent and suburban schools,
- Large city schools are more technologically backward than schools in small town and rural America, and
- The most serious obstacle to technology implementation is budgetary limitations. (National Education Association Communications Survey, p. 92)

Today, just as in the past, many districts expect that buying computers is enough. "It is commonly assumed that if teachers are provided with innovative technology and receive basic training in operating computers, they will effectively integrate it into their classroom." (Niederhauser & Stoddart, 1993, p. 25)

Many experts are publicly denouncing such assumptions. "Counting computers means nothing. Nearly every school in America owns personal computers. But without expertise to use and maintain them, thousands of machines lie fallow." (Piller, 1992, p. 221). "When computers are grafted onto dismal under-funded schools that lack appropriate staff support, students and teachers rarely use them effectively." (Piller, 1992, p. 223).
"Businesses have been building electronic highways while education has been creating an electronic dirt road. And sometimes on a dirt road, it's just as easy to get out and walk." (D'Ignazio, 1993, p. 84)

Recent studies show that these expert opinions are quite accurate. Despite the high number of schools with computers, only 52.3% of all elementary students use computers at school (Kondracke, 1992, p. 236).

This discrepancy between computer availability and computer use must be in part due to the lack of preparation, training, and support of teachers.

The role of the teacher is considered to be the most crucial determining factor relative to the effectiveness of computer applications, and implementation based upon teachers' lack of understanding of both the power and limitations of software programs contribute to the lack of success. Endeavors geared toward the use of instructional technology should be founded upon teachers' acceptance and well-developed background in both the use and process of using computers for teaching and learning (Brennan, 1991, p. 20).

A survey of teachers in Tennessee found that, "Overall, teachers did not indicate they felt well informed about technology," (Bits, Bytes, and
Barriers: Tennessee Teachers' Use of Technology, 1991, p. 8) and that "they reported obstacles to more effective use of technology including lack of funding, time, and training." (Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology, 1991, p. 9)

Training of teachers is not the priority of many computer implementation programs. Only about one-third of all teachers have had ten hours or more of computer instruction, much of which was at the literacy level (Fulton, 1988, p. 9). A survey of computer using teachers explains that training in itself is not enough, this training must fit their needs,

When asked about in-service training, most teachers (2/3) said they had taken in-service workshops or courses offered by educational agencies or commercial organizations. Course content usually focused on programming, very few had learned anything about educational software other than programming languages. Even fewer had received any instruction on the uses of computers with special needs children, and none reported receiving training on how to integrate educational software into curriculum (Beyond Drill and Practice: Learner Centered Software, 1988, p. 2).

Brennan (1991) explains the importance of adequate, and useful
training. "Less than ten hours of specific versus generic applications will not contribute to program effectiveness or successful implementation, and can be considered a contributing cause of ineffective applications."

(p. 22)

A final factor mentioned to explain the discrepancy between computer availability and computer use is that most districts offer no rewards for teachers who put in the many hours of training needed to become an expert computer user. "It was noted that a majority of classroom teachers had shown no interest in expanding computer-based instruction because there was no reward system, provision for incentive, or return to the teacher for the effort." (Brennan, 1991, p. 23) Even the rare district that offers incentives, offers very little. "Provisions of incentives for microcomputer use or for participation in training programs is rare. Among districts with in-service training, the most common incentives are 'special recognition,' and release time to take in-service workshops." (Winkler, Stasz, Shavelson, 1986, p. 25)

In recognition of the fact that there is a discrepancy of use in regard to educational computers, many educators have proposed theories to help ensure classroom computer use by teachers. It is of fundamental importance to identify the factors, besides the purchase of computers, that
are crucial for the successful implementation of educational computer models.

The effectiveness of computer based instruction depends not only on software quality and hardware sophistication, but on (1) how well computer activities are integrated into other instructional activities, (2) whether there are alternative and less expensive ways that students can achieve comparable academic competencies and understanding, (3) whether it is more important that students learn those particular things rather than other skills or competencies that might not be best learned using computers (Becker, 1986, p. 3).

A survey of Tennessee teachers concluded that:

1) "There should be enough technology,"

2) "There should be ample support and time for teachers to learn how to use technology and plan for its use," and

3) "There should be a school structure and culture in which teachers are encouraged and expected to take a professional and experimental approach to their work." (Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology 1991, p. 8)

In another survey, teachers were asked what they felt were the
major barriers to a successful computer program. "The five most frequent choices were 'not enough computers'; 'software too costly in the quantity needed'; and 'not enough teacher training.' The next most often mentioned problem was 'not having enough time to develop computer-based activities." (Becker, 1986, p. 33)

A large quantity of theory deals with training of teachers. These articles fall into two categories: those dealing with in-service training, and those dealing with pre-service training.

Obviously, college programs in education must play a major role in preparing teachers for classroom computer use, but they are not doing an adequate job at the present time. Oke (1992) explains that technology is in the schools,

Yet in order to implement it we must first train our teachers how to use it. This training seems to be the largest obstacle in the way of our step into the future. We really need to slow our purchasing momentarily and let our learning catch up. Many of our schools have technology, now we really need to learn how to use it. (p. 23)

Glenn (1993) notes, "Colleges of education will make slow progress in creating technology environments for educators, widespread modeling of technology by faculty will be quite varied." (p. 19).
Oke (1992) concludes with recommendations for creating a preservice program for teacher training in classroom computer use. These include:

- A computer literacy class. Add a class to the curriculum which would give all education majors a fundamental knowledge of technology.
- Have all of the education professors model appropriate uses of technology in their classrooms.
- Place students with a supervising teacher who currently uses technology in their classroom.
- Link schools of education and K-12 teachers via telecommunications networks for support and updating of ideas and practices. (p. 24-25)

Another study suggested that a positive approach for training may involve that of a school/college partnership. Many recommendations are made pertaining to this relationship. These include:

1. The education department and/or other relevant college departments must be prepared in advance to give faculty members either additional stipends and/or load credits if they chose to participate in the project.
2. The public school must prepare its staff vis-a-vis the projected administrative and instructional impact of the forthcoming project.

3. The college must be committed to the collaborative ideal and provide financial support if necessary (Hillman & Others, 1987, p. 12).

Fulton (1988) also lists recommendations for pre-service:

Integrate technology into subject matter methods courses, place students with a supervising teacher who currently uses technology in their classroom, establish computer networks to tie beginning teachers to resources and instructors that could assist them. (p. 9)

Looking to education colleges is a very sound solution to the computer literacy problem, and many experts fall on this side of the issue, but it is a long term solution, and must be viewed as such. "While schools of education are beginning to adopt computer education requirements in pre-service teacher training, few graduates at present have adequate experiences with computers and until they do schools must offer in-service." (A Guide to Computers in Education, 1985, p. 65)

Hancock and Betts (1994) explain, "To realize any vision of smarter schooling by using technology, school districts must prepare teachers to
use technology. Adequate teacher preparation is probably the most
important determinant of success. Another essential: technology must be
put in the teachers' hands." (p. 29)

When teachers were asked what they thought would be the most
beneficial type of support toward their efforts to use computers in the
classroom, 50.8% listed summer workshops and 48.3% mentioned school-
day workshops (Bits, Bytes, and Barriers: Tennessee Teachers' Use of

It seems obvious that the current problems can only be addressed
through in-service, but what makes a good in-service program? Teachers
in one study, "expressed a need for on-going, flexible in-service training
that can be individualized. They want more than traditional one-shot
programs." (Hurst, 1994, p. 74) Hurst (1994) recommends that "this
system might include . . . homemade modules developed by teachers
already proficient in a certain area of technology." (p. 75)

Moursund (1989) purports hands-on training experiences that are
sensitive to the participant's level of computer competence, and that are
taught by credible instructors (generally peer teachers). Revenaugh
(1989) recommends frequent, small group, short session in-service.
Provided initially on a basis whereby teachers elect to participate,
voluntary rather than mandatory attendance is considered as crucial to success. Finally, Niederhauser and Stoddart (1993) explain the importance of utilizing a tool-based system, and thus these are the systems on which teachers should be trained.

This preliminary study indicates that tool-based systems have significant potential for changing the way teachers teach. They are, however, extremely difficult to put into place and require a great deal of teacher education and support. Integrated Learning Systems, on the other hand, are easy to install, simple for teachers to use, and fit right in with standard practice. Yet an ILS has limited potential for changing teacher beliefs and practice, or for upgrading instruction. (p. 31)

Theories abound, but it is of greater interest to find what has proven successful in implementing a computer model. A survey of what had actually helped teachers the most in their computer use found that 30% of teachers responded that summer workshops, after school training, and training manuals were the most helpful. Only 8% felt the district technology policy was of any service (Bits, Bytes, and Barriers: Tennessee Teachers’ Use of Technology, 1991, p. 20).

In 1990, Sheingold and Hadley published a major survey describing
teachers who had distinguished themselves as expert users of computer technology. Not surprising, "these teachers work in schools that have extensive technology as well as experience in using technology for instruction." (p. 8) It was also noted that, "these teachers use the computer as a multipurpose tool." (Sheingold and Hadley, p. 8) Time also played a role, "It takes time for these teachers to master computer-based practices and approaches—fully five to six years of teaching with computers." (Sheingold and Hadley, p. 8)

The study goes on to list important factors that contributed to the success of the computer using teachers.

What are the factors that have contributed to their achievements?

Three stand out:

First, the teachers' motivation and commitment to their students' learning and to their own development as teachers;

Second, the support and collegiality they experience in their school districts; and;

Third, access to sufficient quantities of technology.

These factors act in combination and over the long term to enable teachers to develop their expertise to use the technology in new ways. The teachers' willingness to learn and change appears to be a
critical element in this process (Sheingold & Hadley, 1990, p. 9).

Finally, it was noted that the things teachers do with computers change as they become more proficient in using the computer.

The percent of teachers who use word processors frequently increases and then levels off . . . The percent of teachers who use data-bases frequently also increases and then levels off . . . In contrast, the percent of teachers who use drill-and-practice software frequently decreases from more than 40% for those with less than two years experience, to less than 30% for those with more than nine years experience (Sheingold & Hadley, 1990, p. 18).

Honey and Henriquez (1993) conducted another study of teachers who have been described as exemplary technology-using teachers. This study found that 96% of these teachers identified themselves as self-taught in regard to computer use, even though most of them had in-service and college training, and 91% identified themselves as having access to a computer at home. (p. 8)

Winner (1983) studied the implementation of computers into an individual school. Her findings again stress the importance of training of teachers.

The key to success hinges on a strong commitment of the faculty
toward further growth and knowledge. A major difficulty toward computing integration at the elementary level is the lack of training facilities for teachers. An introductory course, or two-week summer workshop, or even specific long-term programs such as the one described here are not enough. Teachers embarking on computing instruction need continuing support and training which is responsive to their individual needs. (p. 17)

Also, "the staff needed extensive training. Consequently an in-service program was created as an alternative to the workshops run by computing professionals who have little knowledge of classroom environments. The program began as a year-long, bi-weekly series of after-school workshop sessions." (Winner, 1983, p. 10)

Even with this training program in place, "at the outset, faculty involvement was sporadic. Two or three teachers showed initial interest but progress toward a commitment to implement computers in the classroom was not forthcoming." (Winner, 1983, p. 9)

Winner (1983) also brings up something that is not often mentioned in the readings -- experimentation.

The data indicated that experimentation without prior or parallel exploration was not the most prudent method of computer
utilization, as it did not produce confident computing teachers.

Those who did not thoroughly familiarize themselves with the program content and/or the operating procedures before use in the classroom were unable to proceed without substantial assistance.

(p. 13)

She went on to mention that it is impossible to train all teachers in the same way, and teachers should never be expected to use computers in a similar manner, "Teachers' computing styles are reflective of their general teaching styles and as varied." (Winner, 1983, p. 14)

Personal and cultural traits effect the initial attitudes toward computer use, but after the beginning trepidations are overcome, individual self-confidence, ample exploratory experiences, coupled with a conviction in the importance of computers in elementary education seem to be the most promising indicators of increased computer implementation. (Winner, 1983, p. 15)

Winner concluded that, "Intelligent assistance in the early years of mastery appears to be a crucial element of continued success (p. 17). Use of the word "assistance" shows that training alone is not enough.

The importance of computer purchasing and training is echoed in another study of successful schools. "If districts acquire a sufficient
number of computers and offer training, teachers will indeed participate.

Holding in-service training at teachers' own schools encourages overall participation." (Winkler, Stasz, Shavelson, 1986, p. 41) The study concludes with the statement, "The increased availability of microcomputers is thus a necessary but not sufficient condition for increased computer use." (Winkler, Stasz, Shavelson, 1986, p. 45)

Hurst's (1994) research on successful computer training programs and found that, "The most successful programs reported were those that involved teachers and principals in the planning." (p. 74) He also believes that, "teachers should be proficient in three tools: word processing, databases, and spreadsheets. Today, I would also suggest that teachers have skills in desktop publishing, electronic communication, and integrated media (multimedia)." (Hurst, 1994, p. 74) He concludes by stating, "Technology in-services will be far more effective when teachers have access to them as needed." (Hurst, 1994, p. 75)

Many studies found that it was of extreme importance that these training sessions happen throughout the year. "Ongoing maintenance and enhancement training is a crucial element to effective application and integration of computer-based learning experiences." (Brennan, 1991, p. 80) "This in-service procedure continued throughout the school year.
utilizing both after-school time and professional development days."
(Millar, & MacLeod, 1984, p. 34) However, even though teacher in-service
programs were deemed relatively successful, teachers still mentioned this
as an area of need. (Millar, & MacLeod, 1984, p. 8)

A final study of the importance of adequate training states,
"Important factors are teacher interest and need. (And it should be noted,
teacher interest and perceived need is often a direct outgrowth of relevant
experience with computers and in-service training).” (A Guide to
Computers in Education, 1985, p. 57)

Nichols and Frazer (1992) studied an implementation model that was
on-going in Texas. They found that factors other than training were
interfering in the program’s success. "Portions of the project are not fully
implemented. Logged computer time is low at all three IBM campuses.
Some teachers still resist implementing the Teaching and Learning with
Technology instructional delivery system. One in five teachers say follow-
up training is inadequate.” (p. 3) It was also noted that,

It appears students at the Apple school are improving achievement
more than students at the IBM schools. The approach at the Apple
school relies almost exclusively on pull-out instruction in
laboratories, which has aided earlier implementation. The approach
at the IBM schools, by placing computers in the classroom as well as laboratories, requires classroom restructuring. The demands of restructuring have delayed complete implementations (Nichols & Frazer 1992, p. 3).

They concluded their study by giving a list of recommendations, including: "Teachers need to use the computers in instructional activities. Use of the computers as a reward or a discipline tool needs to be eliminated," and "The amount of follow-up training given to teachers needs to be increased." (Nichols & Frazer 1992, p. 3)

In other studies of exemplary schools it was noted that at the elementary level, word processing was used in only 3% of elementary schools nationally, versus 66% of exemplary schools surveyed. (Cohen & Others, 1986, p. 10) "In K-6 schools, laboratory computers are used for an average of 27% more time per week than are computers in either classrooms or libraries." (Becker, 1986, p. 10)

It was also noted that,

Teachers relied on friends or personal contacts to solve technical and management problems. Commercial computer magazines were consulted to identify high quality educational software. Teachers and principals approached businesses and funding agencies to adopt
or support school computer facilities. (Cohen & Others, 1986, p. 13)

Many studies have given recommendations dealing specifically with administrative policies that seem to have a positive effect on school computer use. Brennan (1991) states, "Among other ideas that would contribute to the solution are provisions for administrative support and funding, teacher incentives and rewards, and the possibility of a mini-lab configuration within a central lab facility." (p. 51)

A federal report explained the importance of shared decision-making when a computer implementation model is designed.

Both the centralized and decentralized patterns of supervision of microcomputers were found in the case studies. More important than the issue of relative merits of these approaches was the finding that the microcomputer systems being used successfully tended to depend on support from two different levels—someone acquainted with teaching concerns and another person who could provide the needed administrative support (Microcomputers in the Schools-Implementation in Special Education, 1983, p. 30).

The administrative arm of the decision-makers must be ready to use creative means to fund computers in their schools.

Because the costs of widespread computer use in schools can be
substantial, gaining necessary funding may require creative and
diligent effort. But even in times of tight budgets, experience has
demonstrated that when a district has a strong commitment to
computer education funding can usually be secured (A Guide to

It is also important to be very detailed on the amount of money that
is needed, making sure not to buy computers while ignoring all of the
added expenses that go into a successful program.

To secure the funding necessary to support the instructional uses of
computers requires development of a precise budget. Care should be
taken to include all costs associated with new expanded programs . . .

In addition to the fairly obvious expenses for hardware, software,
personnel and staff training, it is also necessary to budget for items
such as supplies, furniture, increased insurance, and service
contracts or repair work (A Guide to Computers in Education, 1985,
p. 67).

A Federal study found having a computer coordinator at the school
or district level to be an important factor. "The lack of some type of
computer coordinator for the microcomputers leads to problems that may
impede the growth and effective use . . . . The computer coordinator can
facilitate continuity within the school district and conserve dollars, time
and effort." (Microcomputers in the Schools-Implementation in Special
Education, 1983, p. 58)

In a publication directly pertaining to positive administrative
policies, Winkler, Stasz, and Shavelson (1986) explain,

This research also suggests that computer-using teachers should be
provided with centralized, routine assistance in integrating
computers into instruction. Curricular assistance is needed to help
teachers match computer-based instruction to their instructional
objectives. Teachers should be provided with computer curriculum
advisers to assist them in optimizing their own computer use.
These advisers should also assist teachers with choosing and
making optimal use of hardware and software. (p. 8)

Winkler, et al. (1986) continue on to list many other policies that
seem to have some impact. "One part of the solution is to appoint a
computer coordinator to work closely with the teachers. This person,
however, should be not only a coordinator of hardware, software, and
training, but a computer curriculum adviser as well." (p. 45).

Winkler, et al. (1986) support the idea of incentives for teachers,
explaining, "Finally, administrators should seek ways to compensate
computer using teachers. A few districts are implementing the mechanisms such as computer master teacher programs, salary credits for computer use, and summer stipends for curriculum development," (p. 9) and "ways must be found to compensate computer-using teachers to encourage the use of microcomputers for subject matter instruction. The significance of extra pay is all the more remarkable for its rarity in the school districts in our survey." (Winkler, Stasz, & Shavelson, 1986, p. 46)

They discuss the importance of incentives by explaining, "There is no doubt that the resources for such programs are scarce and that the concept of differential pay is controversial. But there is also no doubt about the exodus of trained teachers . . . . In general, however, rewards such as special recognition or even release time make little difference relative to other mechanisms of providing support." (Winkler, Stasz, & Shavelson, 1986, p. 46)

Finally, a survey of teachers in Tennessee resulted in the generation of a list of recommendations for all people who will play some role in the development and implementation of a school computer education program. It is obvious that there is not one single factor, or even one single group that will ensure a successful computer education plan. This may be the best available list of recommendations.
Technology-using teachers should:

- Serve as role models and peer tutors for others in your building and school system.
- Plan and lead in-service sessions at the building level.
- Write about personal use of and readings on educational technology for professional journals and newsletters.
- Develop local clearinghouses for hardware and software resources.

Administrators should:

- Provide sufficient quantities of appropriate hardware and software.
- Set long- and short-term goals for equipment acquisition.
- Provide time for training and planning for instructional use of technology during the regular school day.
- Provide stipends to educators for training in summer workshops.
- Foster an atmosphere of innovation, experimentation, and collegiality that encourages professional educators to go beyond traditional models of instruction.

State Policymakers should:
- Provide priority funding for hardware, software and teacher training.

- Provide for continued acquisition of hardware, maintenance and upgrading of existing hardware, and the continued acquisition of upgraded software.

- Develop and Sustain business partnerships that help support equipping, training and networking for school systems,"

(Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology 1991, p. 38)
Chapter 3

Project Methodology

Today, schools in the United States own a large number of computers. In 1992 it was reported that the ratio of students to computers in American schools was 16 to 1 (Becker, 1993, p. 26).

Unfortunately, when computers are purchased for an elementary school, very little time is spent to ensure that they will be used effectively with the students. Charles Piller (1992) states, "Counting computers means nothing. Nearly every school in America owns personal computers. But without expertise to use and maintain them, thousands lie fallow." (p. 221) In fact, only 52.3% of all elementary students use computers at school (Kondracke, 1992, p. 236). Elementary administrators, media specialists, and technology coordinators need a clear guide as to what factors will increase student and teacher computer use in their schools.

How can an administrator ensure that new computers will be better utilized than those purchased in the past? Research on this subject is limited and not readily available to the public. Many administrators have little or no experience with using technology in the classroom. They are not aware of factors less tangible than computers and software which must be in place to ensure a successful program, and they lack the time to
research this information. There is a need for easily accessible information on the factors that lead to a successful educational computing program in the elementary schools. This study was conducted in direct response to this need.

In completion of this study, an exhaustive review of literature and research dealing with factors pertaining to successful elementary computer programs was conducted. From this review, a list of factors was created, and a survey developed (See Appendix A). A phone survey was then attempted for a group of 50 district computer coordinators obtained from the Computer Education division of the Michigan Department of Education. These questionnaires included a question asking for a personal ranking of the computer use in the elementary schools in their district. The surveys were then divided into schools with elementary computer models that computer coordinators ranked highly, and those which computer coordinators felt were lacking. When all responses were totaled, the results of each question were subjected to a chi-square.

The main goal of this study was to gather and summarize research on factors that improve overall computer usage at the elementary level, and to disseminate this information.
Data and Results

A phone survey was attempted of a group of district computer coordinators obtained from the Computer Education division of the Michigan Department of Education. Of the fifty district computer coordinators contacted, twenty-six completed the survey. This is a return rate of 52%.

The first question of the survey was:

"How do you rank the elementary computer program?"
From this question, all surveys were divided into two groups. Fourteen surveys were placed in the low rated group, twelve were placed in the highly rated group. The following questions were then subjected to a chi-square test in regard to these groupings. Each question and its results follow.

The researcher is aware of the fact that many of the questions were found to be insignificant, but in the interest of consistency, results were reported in the following manner:

"When subjected to a chi-square test, $\chi^2 = 2.37$ resulted. This is significant at the 0.12 level."

Since this is preliminary research, the researcher was looking for trends. For this reason, a fairly high level of significance was allowed. Those factors with a significance to the 0.20 level and lower were considered significant in the conclusion.
"2. What is the predominant type of computer used?"

Of the schools that only had one type of computer used in their school, 3 schools reported using IBM or compatible computers, 13 schools reported using Macintosh, and 3 schools used only Apple II family computers. Interestingly, all of the Apple II only schools had a low rating. Most surprisingly though, when the data was broken down into schools that use one type of computer versus those with a mixed battery of computers there was more significance.
Only one school reporting a high rating uses a "mixed" group of computers.

Of the schools reporting a low rating, the level was fairly evenly split.

When subjected to a chi-square test, $\chi^2 = 2.37$ resulted. This is significant at the 0.12 level. It seems that having a mixed group of computers gives a better chance of a low rating.
"3. Where are computers usually located?"

"Both" was the most popular response in both groups, "Lab" was the least popular. When subjected to a chi-square test, $\chi^2 = 1.73$ resulted. This is significant at the 0.42 level.
"4. Is there a district-wide technology plan in place?"

These results show an even split in both groups of surveys. There was no significance found in this question. It seems that a technology plan is not an indicator of the success of any computer program.
"5. If yes, were elementary teachers involved in its development?"

Although having a technology plan does not show any significance, elementary teacher involvement, or the goal of elementary teacher involvement in the development of the plan seems to be important. When subjected to a chi-square test, $\chi^2 = 2.59$ resulted. This is significant at the 0.11 level. It seems that having elementary involvement gives a better chance of a high rating.
"6. Was a computer consultant used in the planning of computer purchases?"

Although it is interesting to note that use of an outside computer consultant was more prevalent in schools with a low rating, there was very little significance found in this question. When subjected to a chi-square test, $\chi^2 = 0.11$ resulted. This is significant at the 0.74 level.
"7. Is there school level administrative support for computer implementation?"

All of the "No" responses to this question were in the low-rated group. When subjected to a chi-square test, \( \chi^2 = 2.15 \) resulted. This is significant at the 0.14 level. It seems that lack of school level administrative support is a good indicator of a low-rated program.
8. Has a business or college partnership been established?

It is interesting to note that while this is a very popular action -- 70% of all respondents have established a business or college partnership -- it is not a significant factor. When subjected to a chi-square test, $\chi^2 = 0.03$ resulted. This is significant at the 0.87 level.
"9. Is there a full-time computer teacher or lab assistant at each school?"

This is not a very popular option. The only "yes" response was found in the highly rated group. When subjected to a chi-square test, \( \chi^2 = 0.73 \) resulted. This is significant at the 0.39 level.
10. Is there a district wide software and computer information clearinghouse in place?"

This is a very popular option, but it is not a significant factor. When subjected to a chi-square test, $\chi^2 = 0.04$ resulted. This is significant at the 0.85 level.
"11. If yes, has it become part of the regular library media collection?"

This is interesting, in that it is of more significance that the clearinghouse be part of the regular media center collection. When subjected to a chi-square test, $\chi^2 = 1.03$ resulted. This is significant at the 0.31 level.
"12. Has release time been given for teacher computer experimentation?"

There is a much higher level of "yes" answers in the highly rated section. When subjected to a chi-square test, $\chi^2 = 3.44$ resulted. This is significant at the 0.06 level. This seems to be a significant indicator of success, even though there are some "yes" answers in the low rated group.
"13. Have computers been available for summer checkout by teachers?"

This is a very popular activity. Ninety two percent of all respondents gave a "yes" answer to this question. When subjected to a chi-square test, $\chi^2 = 0.01$ resulted. This is significant at the 0.94 level.
"14. Have computer activities been implemented into the regular curriculum?"

It is interesting to note that all of the "no" responses were given by schools in the low-rated group. The good news is that 85% of all respondents gave the answer "yes." When subjected to a chi-square test, \( \chi^2 = 2.15 \) resulted. This is significant at the 0.14 level. A "no" answer seems to be a significant indicator of a low-rated program.
"15. Are computers being used mainly for drill and practice?"

The good news is that 77% of all respondents gave the answer "no."

When subjected to a chi-square test, $\chi^2 = 1.40$ resulted. This is significant at the 0.24 level. A "yes" answer seems to be a fair indicator of a low rated program.
"16. Do you have a school contact at every school who is in charge of the school's computers?"

This is happening in all but two of the schools surveyed. In many cases, the contact is the media specialist. When subjected to a chi-square test, $\chi^2 = 0.39$ resulted. This is significant at the 0.53 level. This is not a very significant factor.
"17. Were 1 or 2 teachers instrumental in getting the computers into the elementary schools?"

When subjected to a chi-square test, $\chi^2 = 3.87$ resulted. This is significant at the 0.05 level. It seems that a "yes" answer is a good indicator of a low rated model.
"18. Was training available to teachers?"

All respondents answered "yes" to this question. This is a good sign. It is not a significant indicator of the success of a program, but specifics of the training program seem to be significant.
19. Was this training mandatory?

When subjected to a chi-square test, $\chi^2 = 0.08$ resulted. This is significant at the 0.77 level. This is not a significant factor.
"20. Is this training on-going?"

When subjected to a chi-square test, $\chi^2 = 1.87$ resulted. This is significant at the 0.17 level. A "yes" answer is a fairly significant indicator of a highly rated program.
"21. Is this training planned pertaining to the expressed needs of teachers?"

A "yes" response occurred in 93% of cases. When subjected to a chi-square test, $\chi^2 = 0.39$ resulted. This is significant at the 0.53 level. This is not considered a very significant factor in indicating a highly rated program.
"22. Are rewards given for completion of training?"

Some of the rewards mentioned were: "discounts on computers for home purchase," "software for the teacher's classroom," and "certificates of achievement." When subjected to a chi-square test, $\chi^2 = 2.60$ resulted. This is significant at the 0.11 level. A "no" answer seems to be a significant indicator of a low rated program.
"23. Does training happen during the regular school day?"

Responses were pretty evenly split in both groups. When subjected to a chi-square test, a significance at the 0.98 level resulted. This is not a significant indicator.
"24. If training happens other than school day, are participants paid?"

This is the question with the highest significance of all asked. Every school with a low rating gave a "no" response. When subjected to a chi-square test, $\chi^2 = 8.41$ resulted. This is significant at the 0.01 level. It seems that a "no" response is a significant indicator of a low rated program.
"25. Is training led by school district employees?"

All respondents gave a "yes" answer. This is not a significant factor in identifying a highly rated program.
26. How would you characterize your school district?

When subjected to a chi-square test, $\chi^2 = 0.03$ resulted. This is significant at the 0.98 level. This is not a significant indicator.
When subjected to a chi-square test, \( \chi^2 = 5.89 \) resulted. This is significant at the 0.05 level. This is a fairly high significance, but it seems more to reflect the sample. Only computer coordinators were contacted. Larger school systems are the ones that would have computer coordinators.
"28. Expenditures: per student?"

On average, highly rated models have higher expenditures, and low-rated programs have lower expenditures. When subjected to a chi-square test, $\chi^2 = 6.20$ resulted. This is significant at the 0.05 level. It seems that expenditure is a good indicator of program rank, but all levels of expenditures are represented in both groups.
Conclusions

Certain validity problems keep this from being a definitive study. Most of these problems come from the choice of sample. The sample is small, and thus is not very representative. Another limitation is the fact that only districts with computer coordinators were consulted. This factor seems to have had a strong effect on certain questions.

Question #6 deals with the use of an outside consultant. Most districts did not use outside consultants. This is not surprising, since the computer coordinator is oftentimes hired to do this job. Question #25 deals with employee led training. This question again deals with something that is considered to be part of a computer coordinator's position. Not surprisingly, all respondents gave a "yes" answer. Finally, question #27 deals with school district size. A large number of these districts were in the largest of possible categories. This seems to be in response to the sampling also, since computer coordinators are hired mostly in large school systems.

One other problem with validity has to do with the method of separating school systems into groups. Since these were divided solely on the opinion of different individuals, the validity of these opinions is subject to question. Despite all of the validity problems, the collected data does
give insight into many of the recommendations made in the literature.

Many of the questions supported the findings of other studies. Becker's 1986 survey of American schools indicates that everyone at the elementary level is expected to use the computer, and that usually a computer specialist is not present in the school. Question #9 of this study supported this statistic by showing that only 8% of the schools contacted had hired a full-time computer instructor or assistant.

A National Education Association Communications Survey (1993) of computer-using teachers found that "In elementary grades computers tend to be distributed in individual classrooms." (p. 92) Question #3 of this study supported this statistic by showing that only 19% of the schools contacted had computers located in a laboratory setting only. It is interesting to note that the majority of schools (52%) had computers in both labs and classrooms.

This same study found that "large city schools are more technologically backward than schools in small town and rural America." (National Education Association Communications Survey, 1993, p. 92) Question #28 supported this in finding a .05 level of significance for highly rated school computer programs being in the more affluent districts.

Finally, the same National Education Association Communications
Survey (1993) of computer using teachers found that "A high technology environment is more likely for affluent and suburban schools." (p. 92)

This survey does not support that finding. Question #26 found no significant difference between the number of computer programs rated high or low in relation to their demographic specification.

This study also provides support for many of the recommendations given in the reviewed literature. It has been reported that an administrative commitment to computer usage should be evidenced in effective elementary computer models (Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology, 1991; Brennan, 1991; Goor & others, 1981). This is covered by question #7. It was found that school level administrative support was cited in all school systems reporting a high ranking, with a significance of 0.14.

From this school-level administrative support flows all other recommendations. The most frequently mentioned factor is that of teacher in-service (Becker, 1986; 1993; Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology, 1991; Brennan, 1991; Moursund, 1989; Hancock & Betts, 1994). This training is dealt with in many of the questions. Question #18 asks about the availability of computer training at the outset of computer implementation. All answers to this question
were "yes." Training in itself was not enough to ensure a successful program, but specifics about the training were significant.

Question #19 showed that making training mandatory did not help. Question #21 explained that training to meet the expressed needs of teachers is also a major part of all programs, and 92% of all contacted schools have this component of training.

The importance of a continuous program of flexible training sessions has been reported in many studies (Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology, 1991; Brennan, 1991; Fulton, 1988; Nichols & Frazer, 1992; Scrogen, 1989; Winner, 1993). Question #20 deals with on-going training. All but two of the highly ranked systems had on-going training, while only half of the low-rated systems included this component. This was found to have significance at a 0.17 level.

To supplement this on-going training, districts must give teachers time to experiment with the computers (Winner, 1993). Question #12 asked specifically about release time for computer experimentation. This was found to be one of the most significant indicators. All but one of the highly rated systems had this feature. This was found to have significance to the 0.06 level.

Also, Winkler, et al. (1986) spent a considerable amount of time on
the idea of incentives for teachers. (p. 9) Question #22 deals with rewards. It was found that most systems don't have rewards, but 88% of the systems that do were rated highly. This was found to be significant to the 0.11 level. Question #24 is the most significant of the findings. This question deals with compensation for extra training sessions. Although a "no" answer does not ensure a low rating, every single low-rated program did not pay teachers for extra training. It was found that this had a significance of 0.01.

Other factors must be considered in addition to training. One such factor is the type of software used with the computers. The use of learner-driven software versus drill-and-practice software seemed to have a positive effect on computer implementation (Microcomputers in the Schools-Implementation in Special Education, 1983). Question #14 asks about the level of computer integration into the core curriculum. All highly rated school models gave a "yes" response. This was found to be of significance to the 0.14 level. Question #15 supports this idea by showing that 83% of all elementary schools using computers mainly for drill and practice had a low rating. This was found to be significant to the 0.24 level.

The importance of a technology plan is often mentioned. One survey
explained that administrators should, "set long- and short-term goals for equipment acquisition." (Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology 1991, p. 38) Question #4 asks about the existence of a district-wide technology plan. The plans were equally presented in both high and low ranking programs.

Despite this parity, the importance of shared decision-making (Microcomputers in the Schools-Implementation in Special Education, 1983) is supported. It was found that 64% of low ranking systems did not have, or were not planning to have, elementary teacher involvement in the development of a technology plan. This was found to be significant to the 0.11 level.

Another factor that is often mentioned is that administrators should "develop and sustain business partnerships that help support equipping, training and networking for school systems." (Bits, Bytes, and Barriers: Tennessee Teachers' Use of Technology 1991) Question #8 does not support this assumption. Although partnerships were found to be popular, with 70% of all respondents reporting the existence of a partnership at the elementary level, it was found not to be a significant factor in the prediction of success. The significance was found to be to the 0.87 level.

A final factor often mentioned in a successful program is the
presence of a computer coordinator (Cohen & others, 1986). Although all individuals in the present sample are districts with computer coordinators, certain important factors, beside the ones mentioned above, are best carried out by a computer coordinator. Question #12 found that when a clearing-house is part of the regular media collection, there is a better incidence of a high rating. This was found to be significant to the 0.31 level. Question #17 found that if only a few teachers were instrumental in getting computers into their schools, there was a very good chance that the system would receive a low rating. This was the case in 77% of responses, and was found to be significant to the 0.05 level. It seems that a computer coordinator, armed with a district-wide plan, can provide better implementation. This may be explained in question #2. In this question it was found to be significant to the 0.12 level that schools using a mixed group of computers were much more likely to be rated low. Eighty-five percent of all mixed-computer schools were ranked low. Obviously, a computer coordinator would be beneficial in this instance.

Looking at these conclusions, it is important to note that, although certain factors were found to be more significant than others, there is no one factor that seems to be a major indicator of a quality program. All of these important factors must be taken together.
Recommendations

Upon completion of this study, many recommendations can be made for administrators, or other individuals involved in the planning of an elementary computer implementation model. These recommendations basically fall into two groups: district-wide strategies and those that must occur at the individual school level.

At the district level it is recommended that a technology plan be adopted. It is imperative that this plan be developed with the input of elementary teachers. Secondly, it is important to hire a full-time computer/technology coordinator. This person would oversee purchasing, training, and maintenance. Finally, there should be a computer information clearing-house, used for previewing software, and sharing expensive applications such as laser disks. This clearing-house is best utilized as part of the existing district-wide media collection.

At the school level, computer implementation is much more complex. It is very important to develop a plan including both long- and short-term goals. These goals must take into account the uniqueness of the elementary program, specifically the fact that all teachers in the school will eventually be expected to use the computers with their own classes. The plans must also include specific areas where the computers will augment
the regular curriculum.

Secondly, when equipment acquisition is being planned, it is important to purchase only compatible equipment. Apple II family computers are no longer available to purchase new; thus the options have been limited to Macintosh or IBM compatible machines. Research on these options should be conducted to determine which computers best fit the school’s individual needs. If other incompatible computers are present in the school, it may be beneficial to sell or donate them to other schools. This should reduce confusion about compatibility differences.

Another factor to consider when purchasing computers and software is the quantity. Ideally, enough computers should be purchased to allow for a small laboratory and one computer in each classroom. These could be networked together. In addition to the hardware, enough copies of the requested software must be purchased to have one copy for each computer. Lab packs and site-licenses are a cost effective solution to this problem.

A training program for teachers is of extreme importance. This training must be developed with the teachers' needs in mind, and it must be on-going. It is also important to arrange for some sort of reward for teachers completing a certain amount of training. The most interesting
reward noted was the purchase of software for the teacher’s classroom. If training occurs at a time other than the school day, participants should be paid.

Another important factor in training is the inclusion of release time for experimentation with the computers, and for planning to implement computers into regular curriculum. This would probably be best utilized if the release time was planned for team members to meet together. Finally, those teachers who show exemplary work with the computers should be rewarded in some way. They could be given stipend positions as trainers, specialists, or school level computer coordinators.

The addition of a lab to a school will require many hours of work. It is highly recommended that each school hire a teacher as a part-time computer coordinator. If funds are not available to hire a half-time teacher, it is recommended that at least a stipend position be developed for a computer coordinator. This person would oversee the computers, the software purchasing, and the training schedules. They would also be the main contact of the district level computer coordinator.

Another recommended strategy is getting computers into the hands of the teachers at home. Purchasing some compatible lap-top computers and having these available for teacher check-out throughout the school
year is highly advised. Schools should also allow teachers to take computers home for the summer. This is the best time for teachers to become acquainted with new programs.

College or business partnerships seem to be very popular. This is a good way to increase funding for computer equipment and software, along with providing experienced and knowledgeable training personnel. Partnerships do not seem to be an indicator of a successful program, but if it fits with an individual school's needs, a business or college partnership should be attempted.

Finally, the most important recommendation is that administrative backing for the technology implementation be very visible. It is imperative that encouragement be shown at every juncture. This true support will manifest itself naturally into many of the recommendations listed above.
Further Study

Due to the many validity problems, this study could never be considered to be definitive. As a continuance of this initial study, it would be worthwhile to develop a list of criteria that could be used to identify exemplary computer using schools. A group of researchers would then go to a large random sample of U.S. schools and rank them accordingly. Historical and current conditions pertaining to computer use would then be compiled, comparisons run, and a list of "Exemplary Educational Computer Use Tenets" would be developed.
Plans for Dissemination

The final product of this report will be an easy to understand, short article (Appendix B). In this article, the factors that have been found to be of importance are listed and explained. The findings of this study will be shared informally with many colleagues, both in building administration, and at the district level, when computer implementation is an issue. In addition, there is currently negotiation underway to publish this article through American Library Inc. Interest has been expressed by the "MACUL Newsletter," and plans are being made to disseminate this article via the Internet. Other possible avenues of publication may be educational magazines such as Elementary Principal: Michigan Elementary and Middle School Principal's Association and Educational Leadership.
References


Hancock, V., & Betts F. (1994). From the Lagging to the Leading Edge.  


Appendix A:

Survey
Elementary Computer Program Survey

Please answer the following questions about elementary schools in your district.

1. How do you rank the elementary computer program?  
   Excellent  Good  Okay  Needs Work

2. What is the predominate type of computer used?  
   IBM or clone  Macintosh  Apple II

3. Where are computers usually located?  
   Lab  Classrooms  Both

4. Is there a district wide technology plan in place?  yes  no

5. If yes, were elementary teachers involved in its development?  yes  no

6. Was a computer consultant used in the planning of computer purchases?  yes  no

7. Is there school level, administrative support for computer implementation?  yes  no

8. Has a business or college partnership been established?  yes  no

9. Is there a full time computer teacher or lab assistant at each school?  yes  no

10. Is there a district wide software and computer information clearing house in place?  yes  no

11. If yes, has it become part of the regular library-media collection?  yes  no

12. Has release time been given for teacher computer experimentation?  yes  no

13. Have computers been available for summer checkout by teachers?  yes  no

14. Have computer activities been implemented into the regular curriculum?  yes  no
15. Are computers being used mainly for drill and practice? yes no
16. Do you have a school contact at every school who is in charge of the school's computers? yes no
17. Were 1 or 2 teachers instrumental in getting the computers into the elementary schools? yes no

The remaining questions deal specifically with teacher training:

18. Was training available to teachers? yes no
   If yes please continue:
19. Was this training mandatory? yes no
20. Is this training ongoing? yes no
21. Is this training planned pertaining to the expressed needs of teachers? yes no
22. Are rewards given for completion of training? yes no
23. Does training happen during the regular school day? yes no
24. If training happens other than school day, are participants paid? yes no
25. Is training led by school district employees? yes no

Demographic Information

26. How would you characterize your school district? Rural Suburban Urban
27. Size? Class: A B C D
28. Expenditures: per student <$4500 $4500-$6500 >$6500

Thank you for your time.
Appendix B:

Article for submission to the

Elementary Principal:

Michigan Elementary and

Middle School

Principal's Association
Administrative Factors that May Improve Elementary Classroom Computer Use

Today, schools in the United States own a large number of computers. In the majority of cases students have some contact with computers during their educational careers. In 1992 it was reported that the ratio of students to computers in American schools was 16 to 1 (Becker, 1993, p. 26), and ninety-eight percent of all U.S. schools reported having at least one computer (Kondracke, p. 234).

Unfortunately, when computers are purchased for an elementary school, very little time is spent to ensure that they will be used effectively with the students. Charles Piller (1992) states, "Counting computers means nothing. Nearly every school in America owns personal computers. But without expertise to use and maintain them, thousands lie fallow." (p. 221) In fact, only 52.3% of all elementary students use computers at school (Kondracke, 1992, p. 236). Recently, a National Council of Teachers of Mathematics study found that, of all the elementary math teachers surveyed, only 53% feel well prepared to use computers as an integral part of their mathematics instruction. This is compared with the 90% who feel well prepared to use manipulatives (cited in Hill, 1992, p. 30)
Even with the disappointing evidence of student computer use at the elementary level, the funding of computer and technology continues to be an area of growth. In a survey by the magazine *Electronic Learning*, it was found that 60.8% of all school districts planned to increase or keep constant their future expenditures on technology (Bruder, 1993, p. 20).

How can an administrator ensure that new computers will be better utilized than those purchased in the past? Research on this subject is limited and not readily available to the public. Many administrators have little or no experience with using technology in the classroom. They are not aware of the factors in addition to computers and software, that must be in place to ensure a successful program, and they lack the time to research this information. Elementary administrators, media specialists, and technology coordinators need a clear guide as to what factors will increase student and teacher computer use in their schools. Educational dollars and opportunities are being lost. This study was conducted in direct response to this need.

In completion of this study an exhaustive review of research dealing with factors pertaining to successful elementary computer programs was conducted. From this review, a list of factors was created, and a survey developed. A phone survey was then completed for a group of 26 district
computer coordinators. Fourteen surveys were placed in the low-rated group, twelve were placed in the highly rated group. The questions were then subjected to a chi-square test in regard to these groupings.

Many questions were found to have some significance. A list of questions that indicated a significance level of 0.20 or better can be found on Chart 1.
<table>
<thead>
<tr>
<th>Question</th>
<th>High-rank</th>
<th>Low-rank</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the predominant type of computer used?</td>
<td>Same:</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Mixed:</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Were elementary teachers involved in technology plan?</td>
<td>Yes:</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>No:</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Is there school level administrative support?</td>
<td>Yes:</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>No:</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Was release time given for teachers to practice using computers?</td>
<td>Yes:</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>No:</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Are computer activities integrated into the regular curriculum?</td>
<td>Yes:</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>No:</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Is computer training on-going?</td>
<td>Yes:</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>No:</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Are rewards given for training completion?</td>
<td>Yes:</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>No:</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Are participants in extra training paid?</td>
<td>Yes:</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>No:</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>What is the district per-pupil expenditure?</td>
<td>&lt;$4500:</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>$4500-$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$6500:</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>&gt;$6500:</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>
Upon review of the significant factors and the literature, many recommendations can be made for administrators or other individuals involved in the planning of an elementary computer implementation model. These recommendations basically fall into two groups: district wide strategies and those that must occur at the individual school level.

At the district level it is recommended that a technology plan be adopted. It is imperative that this plan be developed with the input of elementary teachers. Secondly, it is important to hire a full-time computer/technology coordinator. This person should oversee purchasing, training, and maintenance. Finally, there should be a computer information clearing-house, used for previewing software, and sharing expensive applications such as laser disks. This clearing-house is best utilized as part of the existing district-wide media collection.

At the school level it is also important to develop a technology plan. This should include both long- and short-term goals, taking into account the uniqueness of the elementary program, specifically the fact that all teachers in the school will eventually be expected to use the computers with their own classes. The plan must also include specific areas where the computers will augment the regular curriculum.

Secondly, when equipment acquisition is being planned, it is
important to purchase only compatible equipment. Apple II family computers are no longer available to purchase as new, thus the options have basically been limited to Macintosh or IBM compatible machines. Research on these options should be conducted to determine which computers best fit the school’s individual needs. If other incompatible computers are present in the school, it may be beneficial to sell or donate them to other schools. This should reduce any confusion about compatibility differences.

Another factor to consider when purchasing computers and software is the quantity. Ideally, enough computers should be purchased to allow for a small laboratory, and one computer in each classroom. These could be networked together. In addition to the hardware, enough copies of the requested software must be purchased to have one copy for each computer. Lab packs and Site-licenses are a cost effective solution to this problem.

A training program for teachers is of extreme importance. This training must be developed with the teachers’ needs in mind, and it must be on-going. It is also important to arrange for some sort of reward for teachers completing a certain amount of training. The most interesting reward noted was the purchase of software for the teacher’s classroom. If
training occurs at a time other than the school day, participants should be paid.

Another important factor in training is the inclusion of release time for experimentation with the computers, and for planning to implement computers into regular curriculum. This would probably be best utilized if the release time was planned for team members to meet together. Finally, those teachers who show exemplary work with the computers should be rewarded in some way. They could be given stipend positions as trainers, specialists, or school level computer coordinators.

It is highly recommended that each school hire a part-time computer coordinator, a person who is also a teacher. The addition of a lab to a school will require many hours of work. If it is not possible to free a teacher of half-time duties, it is recommended that at least a stipend position be developed for a computer coordinator. This person would oversee the computers, the software purchasing, and the training schedules. They would also be the main contact of the district level computer coordinator.

Another important strategy is to get computers into the hands of the teachers at home. It is highly recommended to purchase some compatible lap-top computers and to have these available for teacher check-out
throughout the school year. Along with this, all schools should allow teachers to take home computers for the summer. This is the best time for teachers to become acquainted with new programs.

College or business partnerships seem to be very popular. This is a good way to increase funding for computer equipment and software, along with providing experienced and knowledgeable training personnel. Partnerships do not seem to be an indicator of a successful program, but if it fits with an individual school's needs, a business or college partnership should be pursued.

Finally, the most important recommendation is that administrative support for the technology implementation be very visible. It is imperative that at every juncture support is shown. This true support will manifest itself naturally into many of the recommendations listed above.
References


ABSTRACT: 2 - 3 sentences that describe the contents of your paper (50 words or less).

A review of literature and survey of computer coordinators was completed to identify factors that positively influence elementary school computer use. The study concludes with recommendations for district and school level administrators.

* Note: This page must be included as the last page in your master’s paper.