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Abstract approved: _

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Although the public schools have spent billions of dollars on computer
technology, only a few teachers are integrating them into their teaching. The
purpose of this study was to determine barriers to the integration of computers into
teaching and potential teaching strategies to encourage integration. Teachers ($N =$
122) from 14 elementary schools completed a questionnaire that assessed computer
use. Nine experienced teachers representing different levels of computer use were
then selected to participated in interviews that focused on barriers to the integration
of computer technology into their teaching. Results indicate barriers exist in two
broad areas: institutional limitations (i.e., equipment, training, support, and
leadership) and legislative mandates (i.e., benchmarks and state tests). Teachers
report a significant lack of computers available for students in the classroom and
computer labs, a lack of training and knowledge of how to use software, and a lack

of support and leadership at the district and building level. Overall, teachers perceive significant barriers to the integration of computer technology exist in the areas of equipment, training, support and leadership. The findings suggest that some school districts may fail to recognize the need to adequately provide teachers with the necessary external factors of equipment, training, support and leadership, and they may fail to consider the internal factors of perceived relevance, and self-competence that are essential for the integration of technology. The study may also suggest that school districts fail to account for educational reform measures, and their impact on teacher ability to integrate computers into the teaching and learning process. Results of this study may indicate that the interrelationship of the external and internal factors must be recognized and integrated when developing learning strategies for the training of integrating computer technology into the teaching and learning process.

A Study of Factors that Influence
Experienced Teachers in Grades Kindergarten Through Five to
Integrate Computer Technology into the Teaching and Learning Process

by

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Redacted for privacy

Major Professor, representing Education

Redacted for privacy

Director of School of Education

Redacted for privacy

Dean of Graduate School

I understand that my thesis will become part of the permanent collection of the Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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Doss C. Bradford, Author

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1. INTRODUCTION

The purpose of this study was to identify factors that influence elementary

school teachers to integrate computer technology into the teaching and learning

process. Specifically, this study proposed to identify barriers and potential learning

strategies for teachers who do not integrate computer technology into the teaching

and learning process.

Background

The integration of computer technology into the classroom "is based on the

assumption that computers should be an integral part of the learning process"

(Morton, 1996a, p. 2). This belief has a tremendous amount of support from the

educational community and those interested in education (ERIC Clearinghouse on

Teaching and Teacher Education, 1996; Liu, Reed, & Phillips, 1996; Moursund &

Bielefeldt, 1999; Overbaugh & Reed, 1995). To encourage the integration of

computer technology, school districts have increased the number of computers in

U.S. public schools significantly, somewhere between 300,000 and 400,000 each

year, for the past ten years (Becker, 1994a; Office of Technology Assessment, U.

S. Congress, 1995). During the 1997-98 school year, K-12 public schools in the

United States spent over $4.8 billion on computer technology. It is estimated

schools will spend an additional $5.4 billion during the 1998-99 school year

bringing the number of U.S. public schools with computers to 98% (QED, 1999).

Despite this large monetary investment, the integration of computer

technology into the teaching and learning process has been much slower than

anticipated. Nationwide studies have found that very few teachers actually use

computer technology in their classrooms on a regular basis (President's Committee

of Advisors on Science and Technology, Panel on Educational Technology, 1997;

Solmon, 1998). A number of recent studies indicate that the majority of teachers

entering the teaching profession do not feel prepared to integrate computer

technology into the teaching and learning process (O'Bannon, Matthew, & Thomas,

1998; U. S. Department of Education, National Center for Education Statistics,

1999). The result is that more than half of the teachers make little or no use of

computers in their classroom, and, typically, only one teacher in each school has

actually integrated computers into his or her teaching (Marcinkiewicz & Regstad,

1996; Mehlinger, 1996; Randall, 1996; Solmon, 1998).

Integration of computer technology involves more than having a computer

in the classroom and allowing students to practice basic skill drills and play games.

In its most basic form, integration of computer technology is the combining of

computer activities with teaching and learning activities occurring in the classroom

(Evans-Andris, 1995a). Morton (1996a) stated that integration involved "learning

with, through and from computers across the curriculum" (p. 108). Integration has

also been looked at as a progression of increasing the use of computers within the teacher's instructional program. This progression begins when the computer becomes a critical factor in the creation and implementation of the teacher's lesson plans. Its development continues when the computer is used as a multipurpose tool incorporating activities that involve higher order thinking and problem solving. During this phase, the teacher begins to restructure the development of the teaching and learning activities and to adjust the instructor's role within those activities, from a provider of information to a facilitator of information (Marcinkiewicz, 1995; Rieber & Welliver, 1989).

While most educational leaders in the United States believe teachers should integrate computer technology into their curriculum, these same leaders are failing to provide teachers with the training, support, or equipment necessary to accomplish this task. Teacher educators, as well as school districts, need to implement training programs that will provide teachers with the knowledge and skills to integrate computer technology into their teaching and learning. In addition, school leaders should let the classroom teachers know that integration of computers into the curriculum is important by modeling the use of computer technology, encouraging teachers to integrate technology into their lessons, and providing support staff to troubleshoot technology problems (Marcinkiewicz & Regstad, 1996; Morton, 1996a; Moursund & Bielefeldt, 1999; U. S. Department of Education, National Center for Education Statistics, 1999). School leaders also need to improve the computer/student ratio and update the computer technology in

the schools. Without these changes, teachers will not integrate computer technology into the teaching and learning process and underutilization of computer technology in our schools will continue (Becker, 1994a; Kaplan & Rogers, 1996; Solmon, 1998).

While the availability of the external factors of computers, training, and support are considered to be important in determining whether teachers integrate computer technology into the teaching and learning process, internal factors also need to be examined. Marcinkiewicz (1996) indicated, when studying the integration of computers, internal and external factors should be considered as complementary areas and not mutually exclusive, because, if the teachers' needs for external and internal factors are not satisfied, they will not integrate computer technology into the teaching and learning process.

Teachers must go through a transformation to successfully integrate computer technology into teaching and learning; this transformation is a five step hierarchical process: (1) familiarization,(2) utilization, (3) integration, (4) reorientation, and (5) evolution (Rieber & Welliver, 1989). Once a teacher enters the integration step, a dynamic transformation of the teaching role, problem-solving process, methodologies, and teaching strategies will occur.

In an attempt to explain why teachers are not integrating computer technology into the teaching and learning process, researchers have approached the problem from two major perspectives. The first perspective examined external factors such as training, support, and equipment. While external factors are

considered necessary, they do not explain the discrepancy between the number of computers available and the lack of integration into the teaching and learning process. The second perspective, internal factors, influences the way we approach learning how to integrate computer technology into the teaching and learning process. Internal factors, such as perceived relevance, and self-competence, can be used to predict a teacher's computer use (Hannafin, 1999; Kay, 1990; 1993; Marcinkiewicz, 1994; 1995; Marcinkiewicz, 1996; 1996).

Statement of the Problem

Public schools have spent billions of dollars over the past 15 years adding computers into the K-12 public school system. However, recent studies indicate that less than 15% of the K-12 public school teachers have integrated computers into the teaching and learning process (Becker, 1994a; Solmon, 1998). External factors such as training, support, and equipment are important and necessary components if the integration of computer technology is to occur within the public school system. However, if the external factors are available, yet the teachers do not use computers, we should consider that this non-use occurs due to internal factors, or a combination of internal and external factors.

Internal factors formulate our prospective of how we approach things in our environment. Kay (1990; 1993) and Marcinkiewicz (1994; 1995; 1996) indicated that the personal variables of perceived relevance and self-competence could be

used to predict a teacher's computer use and any deficiencies within these areas can usually be corrected through appropriate training or coaching.

The integration of computer technology into the teaching and learning process is expected to be an integral part of the learning process by educational leaders and those interested in education (ERIC Clearinghouse on Teaching and Teacher Education, 1996; Liu et al., 1996; Overbaugh & Reed, 1995; President's Committee of Advisors on Science and Technology, Panel on Educational Technology, 1997). If this expectation is to be met, a study to identify the barriers and potential learning strategies for teachers who do not integrate computer technology into the teaching and learning process may help us understand what motivates some individuals to integrate computer technology into the teaching and learning process. In most cases, there is a lack of studies investigating the barriers to integrating technology into the teaching and learning process. In addition, there is a lack of knowledge of potential learning strategies that can be used to motivate teachers to integrate computer technology. Most studies dealing with computer technology in the past have focused on the computer itself to determine how well students can master a particular language, or software, or computer course, or their attitude toward a particular computer language, software or course. In addition, a great deal of research has looked at single areas such as training, support, or equipment to find a single solution to the question of why teachers don't integrate computer technology into the teaching and learning process. There is also a lack of studies that have considered the level of an individual's computer use (i.e.,

integration, utilization, nonuse), and the barriers that may hinder those individuals from integrating computer technology. Finally, the majority of past studies have gathered data through evaluations, questionnaires, and surveys which limit the depth and richness of information regarding why teachers are not integrating computer technology into the teaching process. Therefore, this study will seek to answer the following question through a qualitative study: what factors influence or prevent teachers from integrating computer technology into the teaching and learning process? Specifically, what are the barriers that prevent teachers from integrating computer technology?

Significance of the Problem

Computer technology has become one of the most important training and working tools in American business society, yet "schools have been among the most laggard institutions in using the information technologies of the computer age" (Davis & Botkin, 1995, p. 80). Although 300,000 to 400,000 computers are purchased for schools each year, few teachers are integrating computer technology into their teaching. Changes in the teaching profession resulting from the need for integrating computer technology into the teaching and learning process has been unsettling for many teachers. Not only will the integration of technology require teachers to incorporate new teaching strategies and methodologies (Rivard, 1995; U. S. Department of Education, National Center for Education Statistics, 1999), but

they will also need to learn new problem solving skills specific to computer technology (Wu, Custer, & Dyrenfurth, 1996).

Because computers are so underutilized, it is important to not only identify which external and internal variables compel teachers to use computer technology in the teaching and learning process, but to determine barriers to the integration of computer technology. A better understanding of the barriers to these internal variables will allow teacher education programs and school districts to identify the motivators within individuals that influence the integration of computer technology into the teaching and learning process.

Definition of Terms

Benchmarks – Specific requirements established by the Oregon Department of Education. They are the portion of the content standards to be assessed statewide at a particular grade level (i.e., 3, 5, 8, 10 or 12). The content standards identify the curriculum areas where statewide assessment will occur. The benchmarks more specifically describe what will be assessed statewide at a particular grade level.

Internet – a global network of computers that enables the exchange of information and data.

Hub – a device that allows one or more computers to be interconnected to a network allowing the connected computers to use email and the Internet.

State tests – standardized, criterion-referenced state tests in English, mathematics, science and the social sciences containing multiple choice, essay and mathematics problem-solving questions.

WWW – World Wide Web, a sector of the Internet which can be explored with Web browsers such as Netscape Navigator and Microsoft Internet Explorer.

2. REVIEW OF RELATED LITERATURE

Although there has been a significant increase in the number of computers available to classroom teachers, few teachers use computers on a regular basis for instructional purposes. Citing a 1990 study Marcinkiewicz (1996) indicated an average of only one teacher per school had integrated computer technology into the teaching and learning process. Additionally, a report by the National Center for Education Statistics (1999) suggest the number of teachers integrating computer technology into the teaching and learning process has changed very little since 1990, if at all. Considering the large amount of money being invested in computer technology, and the lack of integration of that technology, it is imperative that further research be conducted on why teachers do or do not integrate computer technology into the teaching and learning process.

This review investigates some of the reasons why teachers do not integrate computer technology into the teaching and learning process. Research on this question has been approached from two major perspectives, external factors and internal factors. The first perspective, external factors will review topics of training, support, and equipment. The second perspective, internal factors will discuss the areas of perceived relevance, and self-competence.

External Factors

External factors affecting why teachers do not integrate computer technology into the teaching and learning process are factors considered to be beyond the teacher's ability to control. For example, in most cases, teachers usually do not determine the number of computers which are available for teaching and learning, where they are located (e.g., classroom or lab), types of software, if they are networked, the kind of training needed, or amount of technical staff support. Other areas considered as external factors are age, sex, and grade level taught. Three broad external categories, computer training, support, and equipment, appear to have had the greatest influence on whether a teacher will or will not integrate computer technology into the teaching and learning process (Dupagne & Krendl, 1992).

Training

Computers will soon become one of the largest capital assets in most school districts (Gattiker, 1991). If the schools and its patrons are to benefit from this investment, teachers must receive appropriate training on how to use and integrate computer technology into the teaching and learning process (Handler, 1993; Overbaugh & Reed, 1995; President's Committee of Advisors on Science and Technology, Panel on Educational Technology, 1997). Although there has been a substantial increase in the number of computers available in schools, and the majority of educators recognize their importance, less than 20% of teachers

surveyed in a 1998 study felt adequately prepared to use them for anything beyond drill and practice (U. S. Department of Education, National Center for Education Statistics, 1999). In most schools, a lack of training is considered the norm rather than the exception (Mehlinger, 1996). The result of this lack of training is that the majority of teachers are not confident in their ability to use computers, become more anxious when required to use computers, and dislike having to work with computers (Dupagne & Krendl, 1992; Wallace & Sinclair, 1995).

The district's administration, teacher education programs, and the teachers themselves share responsibility for the training of teachers in the use of computer technology. Part of the difficulty in setting up appropriate training for teachers is the lack of knowledge about computer technology by school superintendents and principals. Because of this lack of knowledge, they fail to plan or budget for inservice programs to teach how to integrate computer technology into the teaching and learning process (Kaplan & Rogers, 1996; Morton, 1996b; President's Committee of Advisors on Science and Technology, Panel on Educational Technology, 1997). Although school administrators want to have their teachers trained to integrate computer technology into the curriculum, they want to do it as cheaply as possible (Mehlinger, 1996). Therefore, training is often left up to the teachers or presented in a single lesson encompassing computer operations, software, and curriculum (Cates & McNaull, 1993). A study in 1996 by the National Center for Educational Statistics, found only 13% of the public schools in the U.S. mandated computer technology training, 31% encouraged training by

offering incentives, and over 50% left it up to the teachers to initiate any training (Heaviside, Riggins, & Farris, 1997).

The lack of a teacher's ability to use a computer or integrate its use into teaching and learning cannot rest solely on the school district. Teacher education programs are slow to meet the needs of preservice teachers in developing courses on computer skills and teaching them how to integrate those skills into their future teaching assignments (Moursund & Bielefeldt, 1999; President's Committee of Advisors on Science and Technology, Panel on Educational Technology, 1997; Queitzsch, 1997). While it is estimated that 89% of all teacher education programs offer courses in computer technology (Handler, 1993), almost half of them do not require or recommend that preservice teachers take these classes (Cates & McNaull, 1993). The majority of these classes teach the preservice teacher how to program computers or to use them for keyboarding and word processing. However, very few courses are designed to give instruction on how to integrate computers into the curriculum (ERIC Clearinghouse on Teaching and Teacher Education, 1996; Randall, 1996; Rieber & Welliver, 1989; U. S. Department of Education, National Center for Education Statistics, 1999).

Classroom teachers often avoid computer training because they believe computers are a dehumanizing tool; they are resistant to change; they fear loss of power, control, or status; and they do not perceive computers as relevant to their teaching subject(s). These negative perceptions held by many teachers severely hinder their motivation to use computers for integrating technology into the

teaching and learning process (Mehlinger, 1996; Morton, 1996a; Wallace &
Sinclair, 1995).

Training teachers how to integrate computer technology into the teaching
and learning process at both the university and school district levels is critical if the
United States intends to revitalize an educational system that is "a technological
generation behind in their use of computers and information technology" (Davis &
Botkin, 1995, p. 82). Teacher education programs and school district's training for
integrating computer technology must be relevant to the teacher's specialization.
When investigating the influence of university coursework and district inservice
training, Cates and McNaull (1993) found two or three days of inservice training on
integrating technology into teaching and learning had a more positive impact on
teachers' computer skills than six hours of university training. The critical factor
appears to be the relevancy or meaningfulness of the training provided. The
majority of computer courses taught in teacher education programs do not integrate
computer instruction with "curriculum, methods, field experience, or practice
teaching" (Moursund & Bielefeldt, 1999, p. 8). In addition, Handler (1993) found
that curriculum based (e.g. reading or math skills) courses taught to build
preservice teachers' computer technology skills may not be sufficient. He indicated
that preservice teachers need courses that teach and allow them hands-on practice
on how to use computer technology to integrate their subject matter into the
teaching and learning process. When the teachers perceive the training to be
relevant to their instructional needs, the likelihood is greater that integration of

computer technology into the teaching and learning process will take place (Lee, 1997).

If teachers are expected to make full use of the available computer technology and integrate it into the teaching and learning process, teacher educators and school district personnel in charge of teacher training need to recognize the process necessary to achieve computer integration. Marcinkiewicz (1995) indicated that teachers progress through five levels to reach the mastery level of integration: familiarization, utilization, integration, reorientation, and evolution. Familiarization begins when the teacher first starts using computers. Utilization occurs when the teacher begins using the computer in the classroom. Integration takes place when the teacher actually integrates the computer into lessons. It has also been indicated that when the teacher reaches this level, the computer has become an important part of the teaching and learning process and cannot be removed without disrupting the educational program (Rieber & Welliver, 1989). Reorientation develops when the teacher begins to restructure or change the curriculum to incorporate computer technology. The final level, evolution, is reached when the teacher redefines the instructional process and continues to develop instructional strategies through the integration of computer technology. If teacher educators, school administrators, and teaching professionals expect teachers to be able to integrate computer technology into the teaching and learning process, schools of education and school district personnel in charge of teacher training need to recognize the importance of appropriate training and the progressive steps involved in integration.

Support

Support for teachers, who are expected to integrate computer technology into their classrooms, can take many forms such as modeling, encouragement, expected behavior, and technical or financial assistance. While expected behavior is not usually considered an area of support, Marcinkiewicz (1996) suggested:

> In order for teachers to adopt computers, there needs to be a perception generated by the professional environment that computer integration is expected. This can be established by modeling use by administrators, colleagues, students, and the profession. A work environment would be equipped and faculty training and support would also be available. (p. 471)

When the integration of computer technology is modeled by relevant others (e.g., the teacher's administrators, colleagues, and profession), and perceived by the teacher as being important, it can become a motivating factor that may significantly influence a teacher to integrate computer technology into the teaching and learning process (Becker, 1994b; Moursund & Bielefeldt, 1999).

While administrative, university faculty, and peer support is critical to the successful use of technology, it is rarely provided (Dupagne & Krendl, 1992). Fishbein and Ajzen (as cited in Marcinkiewicz & Regstad, 1996, p. 28) used the term subjective norms, "the perception of whether relevant others think an individual should engage in specific behavior," as being a motivating factor in using computers. This idea could easily be conveyed to preservice teachers by their professors or through specially selected teaching internships. If the teacher education courses were designed to encourage and create a positive technological climate by expressing the importance of, and modeling the use of technology in the

classroom, preservice teachers may view the integration of technology as a necessary teaching skill. However, in a national study of 500 university's educational programs "only 7% said that their professors used computers in their courses" (Morton, 1996b, p. 418). Since preservice teachers, upon graduation, usually teach in the same way they are taught, the importance of modeling the integration of computer technology into the teaching and learning process by university teacher educators should not be underestimated (Handler, 1993; O'Bannon et al., 1998; Randall, 1996).

Teacher educators should serve as role models for preservice teachers. They can be effective models by having a positive attitude toward the use of technology and by using it when teaching their courses. Randall (1996) found many professors who were reported to integrate computer technology into their teaching, in actuality do not use computers regularly and they do not use them when teaching curricular instruction courses. The message given to preservice teachers, through the professor's lack of modeling, is that the integration of computers is not important in the teaching and learning process. This can result in a major impediment to the learning of technology once the preservice teacher becomes a regular classroom teacher. A recent survey found that only 20% of America's teachers reported that they felt they were prepared to integrate technology into their teaching once they were employed as teachers (U. S. Department of Education, National Center for Education Statistics, 1999). When teacher education programs were examined to determine why the professors were not modeling and encouraging the use of

computers through their instruction, they gave the same reasons presented by K-12 school teachers: lack of time, software, hardware, training, technology resources, technology support, and administrative support. Without the proper equipment, training, and support, teacher educators themselves will be unable to successfully model, or teach preservice teachers how to integrate computers into the teaching and learning process (Handler, 1993; Mackowiak, 1991; O'Bannon et al., 1998; Randall, 1996).

Upon graduation and acceptance of a teaching position, teachers look toward administrators and peers for support. At this time, it is critical that the school system creates the perception that integration of computer technology is expected from all staff members (Evans-Andris, 1995b; Marcinkiewicz, 1996; 1996). While administrative support is a strong predictor of successful integration of computer technology into the teaching and learning process, actually getting this support can be extremely difficult (Dupagne & Krendl, 1992; MacArthur et al., 1995; Morton, 1996a). In 1989-90, an information survey was conducted on New York and Rhode Island school superintendents. It found that 95% of the superintendents knew nothing about educational computing, and 85% of them had never used a computer and did not plan to use one in the future (Morton, 1996b). This information can be very troubling as these school leaders make the financial decisions about whether teachers should have the training and the equipment needed to integrate computer technology into their classrooms. While examining how exemplary computing teachers were different from other teachers, Becker

(1994b) found school districts, with the greatest number of exceptional teachers, provided the greatest amount of support for the integration of computers into the curriculum. This support was shown through the district and building administrators who were willing to invest a great deal of time and finances in staff development and encouraged teachers to borrow school computers for home use. In addition, a full time building or district level computer coordinator was available to provide hardware, software, and technical support. According to Becker (1994b), because of the support, a larger number of exceptional computer using teachers were present in these districts, and these teachers worked to create an environment that encouraged all teachers to improve their computer skills and increase their use of computers.

Another approach to providing support for teachers, is the establishment of a computer mentor program. MacArthur et al. (1995) and Gilmore (1995) studied the effect mentor programs had on non-computer using classroom teachers. In both studies, mentor teachers were well respected by their peers in the school and district and had successfully integrated computer technology into their teaching. Gilmore (1995) did not believe that integration of technology occurs simply through the acquisition of knowledge. Integration of technology requires both training and the support of individuals who would provide assistance to the teachers when it was needed. The project started with seven experienced teachers who had successfully integrated computers into their teaching. These seven teachers were to be mentor/lead teachers and provide training to 710 classroom teachers who were

clustered into groups of ten. All of the teachers started the project with a one-day computer-training program taught by the mentor/lead teachers. During the next six weeks, the clustered teachers were to meet, share ideas, learn about other teachers' projects and encourage each other. The mentor/lead teachers also had two meetings with individual teachers at their school to answer any software, hardware or technical questions and to help the classroom teacher plan a computer-integrated lesson. A second one-day meeting was held at the conclusion of the project with all of the teachers to allow them to share their successes and difficulties, and to write a report evaluating their experiences. While the cluster teachers and mentor/lead teachers stated the project had been helpful, they also suggested that future teacher clusters be composed of teachers in the same school or close proximity. This would enhance the sharing of information and networking the teachers felt was missing by not being in the same school. Overall the on-site-visits were considered very encouraging because they increased the teachers' confidence level and provided them with a positive incentive to use computer technology in their lessons. Gilmore (1995) felt a higher level of teacher confidence and competence could be maintained if the project continued into a second session or another (similar) project was done the following year.

MacArthur et al. (1995) began with mentor teachers who were well respected in their schools, had successfully integrated computers into their teaching, and were recommended by their building administrator. The mentor teachers participated in a semester long class taught by university and public school

staff on leadership skills for mentoring and applying computer applications. While taking the leadership course, the mentors worked in partnership with one to five teachers from their school. The mentors and their protégés had formal weekly meetings to develop lessons on how to integrate computer technology, discuss problems, share ideas, and evaluate software for use in their classes. In addition to the weekly meetings, each protégé developed Individual Mentoring Plans collaboratively with their mentor. Support was provided by the mentors through the modeling of how to integrate the computer into the teaching program and practicing troubleshooting of software and hardware problems. Each semester during the last session of the mentor's leadership class, the mentors and their protégés made a presentation on their computer skills and school and district staff were invited to attend. The mentoring program was reported to be very successful and created an environment within each school that supported and encouraged integration of technology into the teachers' instructional programs. One of the results of this support and encouragement was that teachers who had been protégés one semester, if recommended by their mentor and building administrator, became mentors the following semester for other teachers. Mentors and protégés reported a number of building staff members who were not participating had become interested in computer technology and wanted to learn more about computers because of the program. This increased interest in technology occurred most often in schools where the building principal took an active and supportive role in the project. Support was also shown by the school district by providing participating

teachers additional time for meetings, access to technology and workshops, and granting university credit for mentors and in-district credit for protégés. Starting with 10 to 15 mentors each semester, by the end of three years a total of 59 mentors and 154 protégés had participated in this program.

Support by building administrators and peers have been shown to be very effective in encouraging and promoting the use of computers among teachers (Dupagne & Krendl, 1992; MacArthur et al., 1995; Morton, 1996a). Teacher education programs, school administrators, and building staffs need to establish a perception that the integration of computer technology into the teaching and learning process is expected by teachers at all grade levels. This perception can be encouraged through modeling, mentoring, and support by district and building administration, and technical personnel (Marcinkiewicz, 1996; Moursund & Bielefeldt, 1999; O'Bannon et al., 1998).

Equipment

The physical location of computers, the number of computers, and the usefulness of the computers can support or hinder the integration of computers into the teaching and learning process. As stated earlier, over $4.8 billion was spent on computer technology in U.S. public schools in 1997-98 with an estimated $5.4 billion more to be spent in 1998-99 (QED, 1999). It is estimated that this budget is adding approximately 300,000 to 400,000 computers to the public schools' inventory each year. While this initially would indicate that all teachers and their

students should soon end up with a computer on their desk, Becker (1994a) and

Mehlinger (1996) suggest this will not occur in the public schools in the near

future. While 98% of the public schools are said to have computers, only 35% are

located in teachers' classrooms. Fifty percent are located in computer labs, and the

remainder is in libraries, offices, and support areas. In a report to the U.S. Congress

Office of Technology Assessment, Becker (1994a) indicated, while most teachers

believe they have access to a computer somewhere in their school, teachers will

rarely use them if the computers are physically located outside of the classroom.

While computer labs usually allow teachers to seat each student in their class

before a computer, the distance between the lab and the classroom makes it difficult

for the majority of classroom teachers to integrate computer technology into their

curriculum. Evans-Andris (1995b) observed 72 teachers who taught in a school

computer lab. She found that about 30% of the teachers used the computer lab to

integrate technology into their teaching process. However, over 70% of the teachers

used the lab as tutorial rooms having the students use drill and practice software to

reinforce basic academic skills. Reasons given by the teachers for not using the

computer lab to integrate technology into their teaching were scheduling

difficulties, lack of time to preview the software, the feeling of being overwhelmed

by the regular curriculum, and the physical distance between the lab and the

classroom.

While having 35% of the computers in classrooms may sound encouraging,

Becker (1994a) found this actually indicates that approximately 50% of public

school teachers in the U.S. have only one or two computers located in their classroom. In a survey of the public schools in 21 states, Solmon (1998) reported, the actual student to computer ratio (i.e., computers connected to the Internet, and accessible to students) was a surprising 1:36.3. Despite the vast amount of money spent on computer hardware in the United States each year, Solmon's data appears to validate Becker's (1994a) findings four years earlier. Even with the low number of computers available to teachers, they are expected to integrate computer technology into the teaching and learning process (ERIC Clearinghouse on Teaching and Teacher Education, 1996; Randall, 1996). While this is not an impossible task, it is difficult. If this same teacher had only one or two textbooks for the same number of students, the public outrage would be heard across the U.S. Yet no one raises the question of why there are so few computers in the classrooms. To further illustrate this issue, if all of the computers in the U.S. public schools were accessible to students (i.e., a ratio of one student to 10 computers) (QED, 1997a), it is estimated that each student would have access to a computer less than 40 minutes a week (Becker, 1994a). Having access to only one or two computers in a classroom can create severe scheduling problems for the teacher, and this may result in the teacher becoming dissatisfied with the computers and frustrated when attempting to integrate computer technology into the teaching and learning process. If teachers are expected to integrate computer technology into the teaching and learning process it is extremely important that the teachers, and their students, have

access to computers when they are needed (Becker, 1994a; ERIC Clearinghouse on Teaching and Teacher Education, 1996).

Another way in which equipment hinders the integration of computer technology into the curriculum is that many of the computers and software are obsolete, constantly breaking down and not compatible with today's advanced technology (e.g., many new programs will not run on older, less powerful, computers) (Chiero, 1997; President's Committee of Advisors on Science and Technology, Panel on Educational Technology, 1997). In 1992 approximately 60% of public school inventories listed older 8-bit DOS or outmoded Apple IIGS computers. Besides being very slow, parts are difficult to obtain, and these computers do not work on today's high-speed networks. In addition, software is no longer being developed for their use, and peripheral hardware such as CD-ROMs cannot be connected to the older computers. Approximately 80% of the computers in K-12 schools do not have a hard drive, nor are they connected to a server or network. This makes it difficult, if not impossible, for a teacher or student to use the older computers for more than rudimentary word processors or drill and practice. For integration of technology into the teaching and learning process to occur, teachers and their students need to have access to computers that have enough power, the capability to use up-to-date software, and access to a server and network Becker (1994a).

Summary of External Factors

Although public school districts in the United States have spent billions of dollars on computer equipment in the past 10 years less than 15% of the teachers are integrating computer technology into the teaching and learning process (Solmon, 1998). It is important that teacher educators and leaders in the school districts provide teachers with the training, support, and equipment they need to integrate computer technology. Not only do teacher educators and school leaders need to encourage and model the use of computer technology, they need to develop training programs that will provide teachers with the knowledge and skills to integrate computers into the teaching process (Marcinkiewicz & Regstad, 1996; Morton, 1996a; Moursund & Bielefeldt, 1999). In addition, school leaders need to update and increase the number of computers available to students in the schools. All of the external variables, training, support, and equipment must be present if a teacher is going to integrate computer technology into the teaching and learning process. However, if all of these variables are present and the teacher still refuses to accept or use computer technology, internal factors must be considered.

Internal Factors

Researchers continue to seek what internally motivates teachers to spend many hours of their own time, without assistance from others, learning to integrate computers into the teaching and learning process. Because of the large variation in the way teachers feel about computers, it is important to consider what role the

teacher's beliefs or values may play in influencing the integration of computers into the teaching and learning process. Marcinkiewicz (1994) suggested that internal, or personal variables, might explain what intrinsically motivated teachers to integrate computers into their teaching. Personal variables are said to be composed of two internal characteristics, the individual's perception and the motivation toward a task or situation. Personal variables having the greatest influence on computer-using teachers are perceived relevance, and self-competence (Kellenberger, 1996; Marcinkiewicz, 1996; Morton, 1996a).

Perceived Relevance

Perceived relevance is defined as an individual's perception, belief, or value, of whether computer technology is instrumental in achieving the goal of increased student learning. Studies conducted on this behavior found that a "teacher's beliefs or values play an important role in influencing the integration of computers in general teaching areas" (Morton, 1996a, p. 108). In a case study of secondary school teachers and their use of computer technology, it was discovered that perceived relevance significantly influenced whether the teachers integrated computer technology into their curriculum (Hannafin, 1999). Perceived relevance appears to be strongly influenced by the teacher's pedagogy, curriculum, viewed role as facilitator or knowledge giver, and subject area. Of these four areas, pedagogical strategy and subject content were found to have the greatest impact on the teacher's beliefs (Morton, 1996a; Veen, 1993).

While some teachers have more computer experience than others and express positive attitudes toward computers in general, dependent upon the teacher's pedagogy and subject area, they may or may not perceive computer technology as being relevant in the classroom. Other areas that appear to have little impact on perceived relevance are teaching experience, software and hardware availability, and the level of technical support provided. Veen (1993) reported that teachers would return to their old way of teaching if the availability, use of computers, or software caused them to deviate from their regular routine. Reasons given by teachers for not using computers were the following: the software did not fit close enough to the textbook being used (Tillema, 1995); a lack of motivation of the students (Veen, 1993); the computer lab was too far away; concerns about how to schedule and group students to work in teams (Evans-Andris, 1995b). Teachers would also become frustrated and stop using a computer if it developed a hardware or software problem if someone was not around to provide immediate technical support (Hannafin, 1999; O'Bannon et al., 1998). The teachers were simply unwilling or unable to take time from their teaching to solve the problem (Kellenberger, 1996; Veen, 1993).

It is important that teachers be given the time to become familiar with computers and learn how to work with them. It is also important that the initial introduction to computers be presented as a positive experience allowing the teachers to discover how well they can help in their day to day work. If the teachers do not perceive the relevance of integrating computer technology into the teaching

process, regardless of how important it may be to others, they will find reasons for not integrating computer technology into the teaching and learning process (Hannafin, 1999; Mitra, 1998; O'Bannon et al., 1998).

Self-Competence

The internal variable of self-competence is a better predictor of whether preservice teachers, and regular classroom teachers, would integrate computers into their teaching than perceived relevance (Marcinkiewicz, 1996). Self-competence addresses whether teachers feel or believe they can competently integrate computer technology into their teaching. Marcinkiewicz and Regstad (1996) found a strong relationship between self-competence and perceived relevance. Acting together, these two variables provide a strong indicator of motivation to integrate computers into the teaching and learning process. Without self-competence, teachers are not motivated to improve their skills and increase their knowledge of computer technology. However, the higher an individual's perceived self-competence, the more positive their attitude, and the harder and longer they will work to complete their objectives (Mitra, 1998; Zhang & Espinoza, 1998). This self-competence motivates teachers to investigate the uses of computer technology and to develop the ability to apply that knowledge to their curriculum. Having the confidence and believing (i.e., perceived relevance) that integration of technology will increase student learning, teachers are willing to change from the traditional teaching paradigm and integrate computers into their curriculum.

While personal variables can predict whether a teacher will or will not integrate computer technology into the teaching process they do not tell us what predisposes a teacher to develop perceived relevance, or self-competence toward computer technology. Because these variables alone do not fully explain why some teachers do or do not integrate computer technology into the teaching and learning process, it is necessary to consider other factors that may influence a teacher's decision to integrate computer technology. What predisposes a teacher to develop perceived relevance, or self-competence? Identifying what influences these internal variables may be helpful in better understanding why teachers do or do not integrate computer technology into the teaching and learning process.

Summary of Internal Factors

Gattiker (1991), Handler (1993), and Rieber (1989) investigated the difference between the potential use of computer technology and actual use. The majority of this research has focused on external factors (i.e. training, support, and equipment) that influence a teacher's computer use (Kay, 1994; Marcinkiewicz, 1995). However, external factors alone do not explain the difference between teachers who require training, support, and a full array of computer equipment before they will start to use computers, and teachers who borrow a computer, learn how to use it on their own time, and view it as a tool for teaching and learning. In addition, external factors do not specify why some teachers are motivated to spend the extra time and energy learning how to integrate computer technology into their

teaching, while other teachers resist using computers (Becker, 1994a; Marcinkiewicz & Regstad, 1996; Morton, 1996a). There appears to be a fundamental difference between teachers who embrace the integration of computer technology, and those who avoid using computers, that research on external factors does not address. To gain a clearer understanding of these differences, Marcinkiewicz (1995) began investigating internal factors, or a teacher's predisposition, that influenced the integration of computer technology into the curriculum. Unlike external factors that do not predict computer use, the internal factors, personal variables (Marcinkiewicz, 1995; 1996), appear to be predictive of whether a teacher will or will not integrate computer technology into the teaching and learning process. It is important to understand which internal factors have the greatest affect on teachers integrating computers so the integration of computer technology can be promoted. "Unless the classroom teacher can effectively use educational technology, its potential for facilitating and enhancing the teaching/learning process will never be realized" (Hunt & Bohlin, 1993, p. 487).

> As schools continue to acquire more and better hardware and software, the benefit to students increasingly will depend on the skill with which some three million teachers are able to use these new tools. In order to make effective use of educational technology, teachers will have to master a variety of powerful tools, redesign their lesson plans around technology-enhanced resources, solve the logistical problem of how to teach a class full of students with a smaller number of computers, and take on a complex new role in the technologically transformed classroom (President's Committee of Advisors on Science and Technology, Panel on Educational Technology, 1997, p. 47).

Because these changes are affecting so many teachers, it is important to identify how external and internal variables work separately or combined, to

motivate teachers to integrate computer technology in the teaching and learning process. Understanding the importance of these variables, and how they act as barriers will allow teacher education programs and school districts to identify the motivators that influence the integration of computer technology into the teaching and learning process.

3. METHODOLOGY

Population and Sample

The sample was composed of (N = 145) practicing elementary school

teachers in Kindergarten through fifth grade. The sample represented 18 out of 32

elementary schools, in the Eugene 4J School District, which is a predominately

urban school district located in Oregon's Southern-Willamette Valley. The district

was made up of approximately 975 teachers in six high schools, eight middle

schools, and 32 elementary schools. The number of teachers in the individual

elementary schools ranged from six to 25. Using a model developed by

Marcinkiewicz (1994), three criteria were used to select the schools and subjects.

The first criterion was that the teachers must teach a variety of subjects to

their students during the school day. Therefore, they were less likely to be

influenced by a particular subject area that emphasized the use of computer

technology. Unlike secondary school or support teachers (i.e., librarians, special

education, music teachers) who are subject area specialists, full-time elementary

teachers were selected because they teach a variety of subjects to their students.

This criterion was also established to counteract the influence of learning style

preferences toward specific subjects found in secondary education (e.g., business,

science) where computers are used more (Hansen, 1995; Tieger & Barron-Tieger,

1995).

The second criterion was that a minimum number of computers were available to teachers for use in their teaching. A minimum number of computers for this study was established as a ratio of one computer for every ten students (1:10). This is based on the reported ratio for all public (K-12) schools in the United States (Becker, 1994a; QED, 1996). This ratio was used to insure that teachers would at least have this minimum number of computers available for use in the teaching and learning process.

The third criterion was that the school had had computers available for the teachers' use for at least three years. Computer availability for three years would allow teachers adequate time to become familiar with computers and accept them as a part of the culture of their school (Office of Technology Assessment. U. S. Congress, 1995). During the 1993-94 school year, the Eugene School District passed a school funding bond that included technology improvements, such as the purchase of computers, networking, and Internet access for every classroom in the district. In addition, schools who had older computers on their inventory (i.e., Apple IIe) could exchange the old computer for a newer, more powerful one. During the 1994-95 school year, computers were purchased, and at least one computer was placed in each classroom for the teacher to use. Each school in the district then independently elected to either establish a computer lab, or divide the remaining computers among the classroom teachers.

The three criterion used in Marcinkiewicz's model were developed to "ensure that computers were available so that teachers would be confronted with

them" (Marcinkiewicz, 1994, p. 225). Because of the availability and sheer number of computers in the school, teachers would be forced to make a conscious decision to either use the computers or reject them (Marcinkiewicz, 1994; 1995; 1996).

Because all of the elementary schools in the district met the specified research criteria, it was decided to select the participating elementary schools using the cluster random sampling process (Fraenkel & Wallen, 1996). Cluster random sampling allows the selection of groups of individuals (i.e., teachers by school) rather than single individuals, reducing the time required to select subjects for the study. It also removed the possibility of researcher or district bias of self-selecting specific elementary schools with principals or highly motivated teachers who emphasize the integration of computer technology into the teaching and learning process. In addition, the cluster sampling process may remove the possible bias of age, gender, or experience of teachers participating in the study. Participating schools were randomly drawn until a total of 145 full time elementary classroom teachers were selected to participate in the study. By using 145 teachers, a more powerful sample is obtained resulting in a more meaningful study and possibly indicating a closer representation of the population.

Collection of Data

The researcher met with the building principals in the 18 elementary schools selected to participate in the study and discussed the purpose of the study. The building principals then met with their staff to determine if the classroom

teachers in grades K-5 were willing to complete the MUQ evaluation. If the classroom teachers were willing to participate in the study, the building principal contacted the researcher and a meeting with the teachers was scheduled. A "Control Number" was randomly assigned to each teacher and placed on the MUQ. The teacher's name and control numbers were checked as the instrument was completed and returned. The Levels of Computer Use (LCU) section of the questionnaire was scored within seven days of testing to identify teachers at the integration, utilization, and nonuse levels. The teacher's control number was assigned to all of the data collected from the nine interviews (i.e., fieldnotes, transcripts, and tapes).

Research Measures

The 145 teachers were asked to complete the Microcomputer Use Questionnaire (MUQ) to determine the teachers Level of Computer Use (LCU) and gather demographic data (see Appendix A). The instruments took approximately five minutes to complete. As an incentive to participate, a computer CD (e.g., Oregon Trail, Yukon Trail, Amazon Trail, Africa Trail, and Mayaquest Mystery Trail) was given to each teacher who completed the MUQ. After scoring the Levels of Computer Use (LCU) portion of the questionnaire, nine teachers, three scoring at the integration level, three scoring at the utilization level and three scoring at the nonuse level on the LCU were selected and asked to participate in a 45-minute interview. Four open-ended questions were initially posed to these selected teachers: (a) What would motivate you to increase your use of computer

technology? (b) If you could design a training program for teachers to integrate computer technology into the teaching and learning process, how would you do it? (c) Describe your access to computers. Are computers available when you want them for teaching and for student's learning? (d) How often do you use computers for teaching and learning, and in what ways?

Microcomputer Use Questionnaire

The Microcomputer Use Questionnaire (MUQ) is composed of 23 questions. This study used the MUQ to obtain three sets of information. First, the teachers' levels of computer use according to the LCU. Second, the teachers' perceived level of computer use, and third, demographic data on the teachers (i.e., age, gender, teaching and computer experience, grade level, and computer access).

Levels of Computer Use

The Levels of Computer Use (LCU) Scale developed by Marcinkiewicz and Welliver (1993) is used to measure the teacher's level of computer use in the teaching and learning process (see items #13-16, Appendix A). Using a forced-choice response procedure, this portion of the questionnaire measures three progressive levels of a teacher's computer use: nonuse, utilization, and integration (Marcinkiewicz & Welliver, 1993). Nonuse indicates a total absence of computer use in the teaching and learning process. Utilization occurs when the teacher begins using computers in the classroom. Integration, a higher level of use, takes place

when the computers become an important part of the teaching and learning process and cannot be removed from the classroom without disrupting the current educational program (Rieber & Welliver, 1989).

The LCU is composed of four items in paired statements representing utilization and integration. Each of the four items were paired alternately with statements indicating the levels of utilization and integration. For example, in items #13 through #16, each had two possible responses (13a, 13b), (14a 14b), (15a, 15b), (16a, 16b). The paired responses would be 13a/14a and 15b/16b indicating the utilization level, and 13b/14b and 15a/16a indicating the integration level. This design was developed to prevent subjects from anticipating a particular pattern of responses for the evaluation (Marcinkiewicz & Welliver, 1993; Salant & Dillman, 1994). A forced choice response procedure was used which required the subject to select one item per pair. If the subject responded, following either anticipated pattern, consistency was indicated. Inconsistent patterns indicated the individual either did not use computer technology (i.e., nonuse) or they were not being honest in their responses. Consistent responses would score 4 or 8 on the LCU. Scores of 6 or 7 would indicate an inconsistency. Based on these scores a value of one (1) was assigned to responses indicating the nonuse level, a value of two (2) was assigned to responses indicating the utilization level and a value of three (3) was assigned to responses indicating the integration level. Item #17 on the questionnaire was a control item providing a self-reported check of the subject's perceived computer use.

Final field testing of the LCU was done with elementary school teachers. Using the control item (#17) on the questionnaire, criterion related validity of the instrument was estimated to be .72 using Cohen's kappa (U. S. Department of Education, National Center for Education Statistics, 1997). The estimated reliability of the LCU, using the Coefficient of Reproducibility (CR) was .96 (Marcinkiewicz & Welliver, 1993).

Demographic Data

Demographic data were collected for age, experience using computers, grade level taught, teaching experience, gender, and access to computers (see items #18-23, Appendix A). The relationship of age and gender to computer use has changed in the past 10 years. While earlier studies indicated that younger males (i.e., < 20 years old) use computers more often than older males (i.e., > 30 years old) or females of any age, recent studies indicate the age and gender difference is minimal (Anderson, 1996; Ayersman & Reed, 1996; Francis, 1994; Marcinkiewicz, 1994; 1995; Marcinkiewicz & Regstad, 1996). Experience using computers has been shown to be related to an individual's attitude toward the use of computers (Anderson, 1996; Becker, 1994b; Craig, 1994; Dobbs, 1993). Access to computers has an impact on whether teachers use computer technology in the teaching and learning process. Teachers will rarely use computers located outside of their classroom. However, because of limited funding, many schools continue to place computers in a lab setting rather than the classroom. Unless a teacher is highly

motivated, computers located outside of the classroom are used for only drill and practice to reinforce basic academic skills, and computer games (Becker, 1994a; Evans-Andris, 1995b). The demographic scale was adapted from Marcinkiewicz (1993) sub-test used in the MUQ.

Characteristics of the Sample

Of the teachers taking part in this study, 110 were female (90.2%) and 12 were male (9.8%). The mean age for the teachers was 47.34 ($n = 115$), with the youngest being 23 years old and the oldest 62 years of age. Eighty-five percent of the teachers were at the median age (i.e., $Mdn = 48$, $M = 47.34$, $SD = 6.9$) or above, and 54% of them were above the first quartile (i.e., 54 years of age or older). The responses on teaching experience were similar with the median experience at 20 years ($n = 122$, $m = 19.42$, $SD = 8.74$) within a range from one to 38 years. Of these, 83% had 19 plus years of experience, and 55% had more than 28 years of teaching experience. The teachers' experience using computers ranged from two to 22 years, with a median of 10 years ($M = 10.04$, $SD = 4.36$). Of these, 78% indicated they had at least 10 or more years of experience using computers. Computer access was somewhat evenly divided with 62 teachers (50.8%) indicating their computers were in their classroom and 59 teachers (48.4%) indicating the computers were located in a computer lab. Only one teacher, a nonuser, reported computer access at another location. The subject reported she had given the computers to another teacher because she believed the computers were

"not time efficient and didn't address learning" at the second grade level (interview with Sally).

Descriptive statistics were computed from the teachers' answers on the MUQ. Data for the LCU (i.e., levels of computer use) is summarized in Table 1 and shows a consistent pattern of computer use with national studies, 89.3% of the teachers ($N = 122$) scored at the nonuse and utilization level while 10.7% of the teachers scored at the integration level.

Table 1 *Teacher Distribution by LCU*

Value Label	Value	Frequency	Percent
Nonuse	1	51	41.8
Utilization	2	58	47.5
Integration	3	13	10.7
Total Teachers	--	122	100

Three of the teachers participating in the study teach blended classes spanning two or more grade levels, preventing descriptive analysis. Descriptive data (i.e., age, computer and teaching experience, and computer access) are summarized in Table 2.

The Interview

The interviews were conducted to identify barriers to, and potential learning strategies for integrating computer technology into the teaching and learning process. An Interview Request form was attached to the back of the MUQ, and teachers were asked to indicate on the form if they were willing to participate in an interview. After scoring the LCU, teachers were divided into three groups based on

Table 2 *Descriptive Statistics (n = 122)*

Variable	Mean	Actual Range	Possible Range	SD
age	47.37	23 - 62	23-65	6.90
computer experience	10.04	2 - 22	No limit	4.36
teaching experience	19.42	1 - 38	No limit	8.74
computer access	1.50	1 – 3**	1 – 3**	0.52

** 1 = Classroom, 2 = Lab, 3 = Other

their level of computer use (i.e., integrator, utilization, nonuser). Fifty-eight individuals (47.5%), 51 females and 7 males, indicated they were willing to participate in the interview. Based on their willingness to be interviewed and consistency of their answers on the LCU and LCU control item, a total of 18 individuals (i.e., 15 females, 3 males), six scoring at each level of computer use, were selected for potential interview from the sample ($n = 122$). The researcher

contacted each individual's school and left a message asking the teacher to respond. Three teachers, all female, responded within 24 hours after the first contact and appointments for interviews were scheduled. A second call was made to the remaining individuals' schools and two female teachers replied within the following 24 hours. A third call was made to the schools and four female teachers responded. Interviews were then scheduled with the nine female teachers. None of the male teachers contacted by the researcher responded to the request for interviews.

A total of nine interviews were conducted with the selected elementary teachers. Eight of the interviews were held in the individual teacher's classroom at the end of the school day. The ninth individual requested that the interview be done in the staff room. Each teacher was assigned an alias by the researcher to provide confidentiality. The three teachers who scored at the nonuser level are referred to as Chris, Sally, and Pat. The three teachers scoring at the utilization level are referred to as Jo, Brandy, and Phyllis, and the three teachers who scored at the integration level are referred to as Kate, Mary, and Jan. Quotations were attributed to the individual teachers by using the aliases, and line numbers from the transcribed interviews are placed within parenthesis. Words or phrases inserted by the researcher to provide clarity within quotations are located within brackets "[]".

A semi-structured interview was conducted with the nine teachers. The semi-structured interview format allowed the researcher to have comparable data for all of the interview teachers, yet allowed the teachers to be at ease and talk

freely about their points of view (Bogdan & Biklen, 1992). Data were recorded

using fieldnotes and a tape recorder. The interviews were then transcribed, printed

in separate colors to maintain the individual subjects' voice, and combined with the

fieldnotes. By interviewing teachers at the integration, utilization, and nonuse

levels, it was believed that the selected teachers would identify barriers to, and

potential learning strategies for integrating computer technology into the teaching

and learning process (Bogdan & Biklen, 1992; Strauss & Corbin, 1990). This

process was intended to contribute additional information and understanding on the

subjects' use of computer technology, and any perceived barriers to its

implementation. It also provided data for the validation (i.e., triangulation) of

responses in the LCU and self-scoring control question (Bogdan & Biklen, 1992;

Strauss & Corbin, 1990).

Characteristics of the Interviewees

Nine female teachers participated in the interviews, three nonusers, three

utilizers, and three integrators (see Table 3). The age ($M = 47.25$), teaching

experience ($M = 20.3$) and computer experience ($M = 11.9$) of the teachers being

interviewed was similar to that of the sample population ($M = 47.34$, $M = 19.42$, $M = 10.04$, respectively).

Five of the teachers were in buildings where students used the computers in

a computer lab. Three teachers were in schools where the staff wanted to keep the

computers in the classroom rather than creating a computer lab. Only one of the

teachers being interviewed, a nonuser indicated that her computers were located in another location. She was in a school where the teachers kept the computers in their classroom and had given the computers to another teacher.

Table 3 *Interview Subjects (n = 9)*

Name	Levels of Computer Use	Age	Experience		Computer Access
			Teaching	Computer	Access
Chris	nonuser	44	23	4	lab
Sally	nonuser	45	18	15	other
Pat	nonuser	na	29	4	class
Jo	utilize	49	24	12	lab
Brandy	utilize	48	23	8	class
Phyllis	utilize	45	15	5	lab
Kate	integrator	51	15	15	class
Mary	integrator	51	21	13	lab
Jan	integrator	45	15	15	lab
	Mean	47.3	20.3	11.9	

na = Subject did not reveal age

Summary

The initial question for this study was to determine what are the barriers that prevent elementary teachers from integrating computer technology into the teaching and learning process.

A total of 18 elementary schools were selected to participate in the study. The Microcomputer Use Questionnaire (MUQ) was administered to 145 elementary teachers. The Microcomputer Use Questionnaire (MUQ) contained the Levels of Computer Use (LCU) assessment (i.e., integration, utilization, and nonuse) and demographic data (i.e., age, gender, teaching and computer experience, grade level, and computer access). Answers to the LCU were used to classify teachers into groups based on their level of computer use score and the self-reported control question. After the LCU assessment was scored, three teachers who scored at the integration level, three who scored at the utilization level, and three who scored at the nonuse level, were selected to be interviewed (Borg & Gall, 1989; Fraenkel & Wallen, 1996).

A qualitative model was employed by using an open-ended interview process to identify barriers to the integration of computer technology into the teaching and learning process (Bogdan & Biklen, 1992; Strauss & Corbin, 1990). It was hoped that this understanding would provide insight into designing professional development that would better meet the professional development needs of these teachers, and ultimately move those teachers scoring at the

utilization and nonuse levels toward the full integration of computer technology

into the teaching and learning process.

4. RESULTS

Introduction

Of the 18 schools selected to participate in this study, four schools elected to not participate because of other commitments. Working with the building principals from the remaining 14 schools, the researcher distributed 145 of the Microcomputer Use Questionnaires (MUQ), 122 questionnaires were completed and returned on Kindergarten through fifth grade teachers in the Eugene School District. Nine teachers (i.e., three scoring at the integration level, three scoring at the utilization level, and three scoring at the nonuse level) were selected from this sample population for interviews. For the purpose of this study, individuals' scoring at the nonuse level indicates only the absence of computer use in the individuals teaching and learning process, not the lack of experience or use of computers in general. The utilization level indicates that the teacher is beginning to use computers in the classroom. Integration occurs when computers become an important part of the teaching and learning process and cannot be removed without disrupting the teacher's current educational program (Rieber & Welliver, 1989).

Four questions were initially posed at the start of the interview process. Two additional questions developed during the interviews.

Original four questions:

1. What would motivate you to increase your use of computer technology?

2. If you could design a training program for teachers to integrate computer technology into the teaching and learning process, how would you do it?

3. Describe your access to computers. Are computers available when you want them for teaching and for students' learning?

4. How often do you use computers for teaching and learning and in what ways?

Two questions developed during the interviews:

5. How important is it for the building administrator to support the use of computer technology in your school?

6. If you could do one thing to have teachers integrate computer technology into the teaching and learning process, what would it be?

The interview results are divided into two broad themes or areas that quickly emerged during the interviews. The two themes are institutional limitations (i.e., equipment, training, support, leadership) and legislative mandates (i.e., matters related to school reform). The results of these interviews are as follows:

Institutional Limitations

Institutional limitations refer to areas that are beyond the control of teachers. For example, district and school budgets, equipment purchases, building maintenance or renovation, staffing positions or levels, and school culture. The concept of institutional limitations was adapted from Bruner (1996) who stated:

"Educational systems are themselves highly institutionalized in the grip of their own values"(p. 32). The four institutional limitations mentioned most often by the nine teachers were equipment, training, support, and leadership.

The Importance of Computer Equipment

Eight of the teachers interviewed (2 nonuser, 3 utilizer, 3 integrator) indicated they would be motivated to increase the use of computer technology if the district increased the number of computers available to the students in the classroom and the lab settings. Not only did they want more computers; they wanted all of them to be up-to-date and all having the same programs and connected to the Internet. While the teachers interviewed were somewhat evenly divided by schools having computers in their classroom or in a lab setting, six of the teachers interviewed expressed a desire to have additional computers in the classroom. Kate (integrator), a teacher who works in a school where the computers for students are located in the classroom rather than a computer lab has ten computers in her room. Four of the computers belong to the school district, the other six computers are older and were given to her by family members or purchased by her at garage sales. Kate (integrator) stated,

> I have already managed to come up with 10 of them [computers].
> But still, with 28 or 29 kids we are always battling for time on the
> computers. When you put some kids on the computers you have to
> have the other kids doing something else, and it is really distracting
> to them, [be]cause they are always looking at the computers,
> wanting to get on the computers. It would be nice to have a
> computer for every two kids. (4-8)

Jo (utilizer) who taught in a building with a computer lab stated a similar thought, "Obviously, if we had more equipment available in the classroom, it would be easier to integrate it into what we are doing." Two teachers who worked in schools with a computer lab wanted to also increase the number of computers in the labs. Their primary concern was that they were usually scheduled for only one hour in the computer lab each week. With 29 or 30 students in a class and the computer labs usually having 12 to 15 computers, many of the labs didn't have enough computers for individual use by all of the students in a classroom. Jo (utilizer) stated, "Classes were so large you couldn't get them all on a computer, then it turns into a management kind of thing and trying to problem solve that situation." Chris (nonuser) indicated the two most popular solutions for this problem were that teachers would split their class in half and each group would go to the computer lab for only 30 minutes each week. The other solution was to have at least two students share a computer. Both teachers felt that the school district should increase the number of computers in the computer lab, or reduce the number of students in a classroom to allow more student time on the computers. The schedules usually had empty periods, and teachers who were working on special projects could sign up for an empty period or negotiate with another teacher for extra time in the computer lab

Five teachers who are in schools with computer labs indicated they also had a computer in their classroom for teacher use. Each of these teachers could choose to allow students to use the computer if they wanted to so they felt they had access

to a computer whenever they desired. Four teachers have chosen to have computers

in the classroom, they usually have three or four computers in the classroom. Three

of these teachers say they enjoy the immediate access to their computers. Kate, who

scored at the integration level, has the largest number of computers in her

classroom (10). She takes great pride in having the computers available to her and

the students all of the time. She believes having the computers in the classroom

allows her to fully integrate the computers into the teaching and learning process.

> I would much rather have them [computers] in my classroom where
> they are 100% available to me to use whenever I need them. I don't
> have to worry about scheduling a lab, or having to have everyone
> doing the same thing at the same time because we have only one
> hour a week in a computer lab. If we want to start looking up
> something, we just get on the computers and look it up. We can do
> an Internet search whenever we have to. So the computers are very
> integrated into the classroom structure. They are a part of our life
> rather than something that is down the hallway and locked up.
> (interview with Kate, integrator, 254-259)

Kate suggested that another way to add additional computers into

classrooms would be to take the computers from teachers who don't use them. She

and other teachers in her building have expressed frustration with their perception

that they needed more computers in the classroom for students to use and couldn't

get them. Yet, in some cases she said they could look across the hall and see

teachers who didn't use the computers in their classroom. She also expressed

frustration because the teachers who didn't use their computers would complain to

the building principal if the teachers who actually used the computers had more

computers than they did, even though they didn't actually use them. Kate

(integrator) indicated this frustration was compounded when she and the other

computer using teachers in her building asked the principal for additional

computers and technology equipment and was told there isn't enough money in the

budget to buy more computers. Evidence of this frustration was given by Kate

(integrator):

> If there is equipment worth thousands of dollars sitting in your
> room, you had better prove that you are using it or it should be taken
> away from you, but I know that will never happen. The new .
> computers should be given to teachers who have demonstrated that
> they will use them. Not to teachers that refuse to use them and
> refuse to get any training.... Computers are too expensive for
> everybody to be treated the same.... It is a scarcity of economics. If
> everybody has plenty of stuff nobody cares. But as soon as there is a
> scarcity of stuff, people get after each other. (55-66)

Seven teachers (2 nonuser, 2 utilizer, 3 integrator) felt they had computers

accessible to them and their students, but the majority of computers were at least

six to ten years old and were extremely limited in their use. "Some of them are very

old, and all you can do is word processing on them and play a few little games.

They aren't hooked up to the Internet, which I would really like to do, and you

can't do CD-ROM's on them, which the kids really like. What is really worthwhile

for the kids to do is limited on the older computers" (interview with Kate,

integrator). Not only did the older computers lack the ability to connect to the

Internet and use CD-ROM's, they were unable to use the network printers and

many of the programs used in the district's classrooms. For example, the district is

using ClarisWorks 5.0 as its primary word processing program. The older

computers, because of lack of RAM (i.e., memory), or hard drive space, are unable

to load the newer version of ClarisWorks. In order for the teachers, or their

students, to print what they typed using an older computer and older version of

ClarisWorks, they had to copy their work onto a disk, take it to a newer computer, open their work using ClarisWorks 5.0, and then print their work out on paper. The teachers believed this process wasted a great deal of their time and their students' time.

While seven teachers (2 nonuser, 2 utilizer, 3 integrator) wanted more up-to-date computers in their classroom, three of these teachers (1 nonuser, 1 utilizer, 1 integrator) realized this would cause another problem. Most of the elementary school buildings are over 20 years old, and the buildings were not built with the idea of computers in the classroom. Therefore, even if they could get additional computers in the classroom, they lack the physical space to set them up. "Most classrooms are the standard size. You just don't have the room. It would be awfully close and cluttered, especially in the primary grades because the kids need room to move" (interview with Sally, nonuser). Adding to this problem is the limited number of electrical power connections and lack of Internet connections in most of the classrooms. Six years ago teachers having more than three electrical plug-in boxes in their room thought they were fortunate to have that many connections (interview with Kate, integrator). While the district has remodeled some of the elementary schools and updated wiring systems to meet today's technology needs, a number of elementary schools are still finding it difficult to plug in their computers.

Internet connections often create even greater difficulty for teachers wanting more than one computer in the classroom. When the district put Internet

connections into the classrooms, they put in a single connection box as close to the point of entry as possible usually next to the door. This requires the teacher to have the computer located only next to the door or to get a long cable and stretch it around the room. This web of wiring becomes even more extensive in the classrooms where hubs were installed. They were also located next to the door and cables of varying size provided to extend the computers along the one wall. Jo (utilizer) summed up the problem by stating, "you are dealing with space and the way the classroom is set up, and this is really an old building."

Another difficulty mentioned was that the limited number of computers in the classroom required an extensive amount of planning to try and integrate computer technology into the teaching and learning process. Kate (integrator) stated:

> It makes it really hard to use computers; you have got to plan your classroom. Usually you are trying to do some kind of groups so they aren't up at the computers at the same time. That makes it harder because you are constantly juggling the schedule to make sure the kids that are on computers get everything the kids who weren't on computers get. So the scheduling becomes really complicated. Sometimes I have kids rotating around the room on computers for about half an hour out of each morning, but that's three or four groups rotating. The kids that are on computers are distracting the kids that are trying to work at their desk. With the transitions, I have a problem because every half-hour you have groups switch which gets the kids unsettled. With the computers, it is harder because the kids always seem drawn to the computers. So as soon as you start using computers in the room, it is distracting to the other kids. So if you are going to use computers more, you need to figure a way to schedule it, a way to arrange the room more so it would work, make sure that everybody gets on the computers for an equal amount of time, and make sure you have enough computers and that they are up to date. (25-37)

This frustration of not having enough computers in the classroom or lab was not held by all of the teachers interviewed. When two of the teachers who scored at the nonuse level were interviewed, they thought one computer was more than enough in their classroom. Pat (nonuser) stated, "I have one computer in my room and I have more access than I ever look for....I feel like I get enough computer time for what I want, which isn't much. I would probably be very happy if I was back in the days of the Waltons [without computers]." Sally (nonuser) had given her computers away to another classroom. When asked why she decided to do this she stated:

> I had my three computers [in my room], older ones. It was perfectly
> set up with a printer and everything. The more I thought about it and
> the more I got to know the kids, I said to myself, 'you know, this is
> crazy. This is not time efficient and it doesn't address their learning
> at this age.' There is just no way, no way. So I donated my
> computers to the Learning Center. (interview with Sally, nonuser,
> 21-25)

Two other perspectives were presented on what would motivate the teachers to use computer technology more. Brandy (utilizer) presented the first idea. She appreciated the training the district had provided on ClarisWorks, email, the Internet, report cards, and the state benchmarks. However, because she had only four computers in her classroom, she wanted the district to provide her with equipment and training necessary to provide computer presentations to her class. She believed, if she had access to a large TV that she could connect to her computer, all of her students could see and learn how to use computers and demonstrate what they had learned.

[I want to find] a way to present information to students about how to give steps to students in some sort of presenter format. Then you could say to the kids, 'when you get here it looks like this, this is what step one is and step two is,' before they get onto the computer, and you are trying to watch several of them at a time. I need a presenter system that is pretty user friendly. (interview with Brandy, utilizer, 9-13)

All of the teachers participating in the interviews stated that they use a computer on a daily basis particularly for word processing. Even the three teachers who scored at the nonuse level indicated that they use the word processing program on their computer every day. The majority of time they used it to type up their lesson plans, tests, old dittos, and homework papers. They felt the computer was an excellent tool for storing this information, and they liked how cleanly it printed out.

Teachers scoring at the utilization level also used the computer extensively for its word processing capabilities. At times they said they used email and the Internet. One of the teachers indicated that she would like to be able to use the computer to start developing portfolios for the students in class. However, she wanted to find someone else to do the scanning because she was concerned about the large amount of time she was spending on the computer because of the benchmarks. "I think one of the things I look at is the time that this is all taking. Not only are you delivering the instruction, but you are also doing all of the bookkeeping, and it is very frustrating" (interview with Jo, utilizer).

The teachers who scored at the integration level had the greatest variety of uses for the computer. They indicated that they use it every day in at least three or four different ways: newsletters and email to parents; locating Internet sites for students; lesson planning; report cards; student benchmarks; and various

demonstrations using a TV monitor. They indicated that this extensive computer use often requires a number of extra hours on the computer. Mary (integrator) stated "if I didn't have my own computer at home, when we get some new program, if I didn't take it home to play with it, it wouldn't happen. [Be]cause I don't have the time at school to play around with it."

Seven of the teachers (2 nonuser, 2 utilizer, 3 integrator) thought there needed to be more computers in individual classrooms to allow the students to be on them every day. Pat (nonuser) suggested that there should be at least 10 computers so "you could have your own little lab in the classroom, then it could be much more integrated into the everyday subjects." Phyllis (utilizer) felt, in order to really have teachers integrate computer technology into the teaching and learning process "a computer [should be] available for each student in the school".

While Phyllis (utilizer) wanted computer equipment for every student, she also thought it would be best for every teacher to "have access to a computer at home. Probably for me personally that would be the best thing. [Be]cause then I could, at my leisure, explore. Because when I am at school I have got this to do and that to do and there is no leisure time. Yah. That would help me grow if I had access to a computer." Mary (integrator) also suggested that the district should "provide a computer for everybody at their house to match the one at school." By doing this she felt the teachers who seldom use computers would start using the computer more. While the district does allow the teachers to take a computer home

overnight or during vacation periods, most of the teachers believe it is too heavy to carry back and forth between their homes and the school.

Two other ideas expressed regarding additional equipment were by Jo and Brandy. Jo (utilizer) thought an economical way to encourage the use of computers in the classroom would be to purchase an Alpha Smart®, somewhat like a small word processing laptop computer, for each student. The students could then type the information they wanted with the Alpha Smart® and later download the information into a computer to print their information. Brandy (utilizer) suggested that the teachers be allowed to purchase large screen TV monitors that they could connect to their computers allowing all of the students to observe and make presentations in the classroom. "This would let kids do research and motivate them to brainstorm and develop new ideas of learning and problem solving" (interview with Brandy, utilizer).

Discussion of Equipment

When teachers in the Eugene School District received their first computer in the classroom, Kate indicated the majority of teachers in the district were excited about the possibility of using the computer to teach, email, and access the Internet. Now, almost five years later, eight out of nine teachers interviewed (2 nonuser, 3 utilizer, 3 integrator) realize that one to four computers in the classroom, or one hour a week in the computer lab, will not allow them to fully integrate computer technology into the teaching and learning process. When first asked what the

largest barrier was to the integration of computer technology into the teaching and learning process, eight teachers (2 nonuser, 3 utilizer, 3 integrator) mentioned the lack of computers. This lack of computers is a common barrier found in a number of other studies (Chiero, 1997; Lee, 1997; President's Committee of Advisors on Science and Technology, Panel on Educational Technology, 1997; Solmon, 1998).

While every teacher has a computer in their classroom for their personal use, each school independently chose whether they wanted computers to be in the classroom or in a computer lab. Four teachers chose to have computers in the classroom (2 nonuser, 1 utilizer, 1 integrator), the teachers have only three computers for student use. Five teachers worked in schools with computer labs (1 nonuser, 2 utilizer, 2 integrator) most labs have between 12 to 15 computers. Because of the limited number of computers in both settings (i.e., those with computers in their classroom and those with computer labs), teachers have to group students into two or more groups. Students who will work on the computers, and students who will be in other activities. Teachers are then required to create elaborate schedules to make sure the students get equal time on the computers, and that the students participate equally in the other activities. While teachers schedule students to use computers on a regular basis, eight of the nine teachers are striving to use computers in the teaching and learning process and indicate that scheduling and managing students around the limited number of computers only amplifies the problem (3 nonuser, 2 utilizer, 3 integrator). Pat (nonuser) said, "with what we have now it is hard to do much of anything. You have to do it with a couple of kids, then

another group and you don't have consistency. It becomes more of a filler." This lack of perceived relevance in using computer technology in the classroom was observed by Häkkinen (1995) and Veen (1993). Dependent upon teachers' perceived relevance of computer technology, they may or may not feel the extra time needed for scheduling and managing students to use computers is worthwhile.

Seven of the teachers stated that another major barrier occurs because many of the computers are outdated (2 nonuser, 2 utilizer, 3 integrator). The outdated computers are often limited to older operating systems, have smaller hard drives, lack RAM, cannot support or don't have CD-ROM's, and do not have network capability. Other problems teachers have with the older computers is that many either do not have, or cannot run programs currently available. Because of these barriers the students are limited to word processing.

A solution recommended by eight of the teachers, would be to provide each student in the school with a computer. Although many of the schools had computer labs, the teachers believed if they had computers for every student in the classroom, it would be easier to integrate computer technology into their teaching. However, the teachers indicated this would actually create another barrier that would be extremely difficult to overcome. Because of the schools current physical configurations, particularly the age of the school and smaller classrooms, it would not be feasible to have a computer for every student. With 28 to 30 students in a classroom, the class would become wall to wall computer stations, eliminating room for most other activities. In addition, the majority of the schools do not have

enough electrical or Internet connections to allow a computer for each student. Another barrier and realistic consideration for Oregon and schools across the nation, is the lack of funds to purchase computers for all of the students.

A final barrier was the large amount of time teachers needed to devote to learning how to operate the computer, and the programs, and locate Internet sites for subjects within their responsibility. Three of the teachers (0 nonuser, 2 utilizer, 1 integrator) without computers at home felt they were at a disadvantage because they had to choose to either spend the extra time on the computer at school or spend time with their family. While they have the option of taking the computer home, teachers indicated it is difficult to take it home and bring it back the following day to use in the classroom.

Influence of Computer Training

The second institutional limitation is training. All of teachers interviewed had a number of suggestions for creating computer-training programs for teachers. Recognizing that there are a number of teachers in the district that did not use computers, Kate (integrator) stated:

> You have to make it at a convenient time and place for the teachers. You just have to make things so easy that they can't resist it, because there is so much pressure on teachers that, if there is a way to get out of something they will get out of it. They won't do it. But the thing that will motivate a teacher is money. Money, equipment, maybe some kind of financial reward or college credit. If you offer them something they will take you up on it. But if you are not offering them anything they will say 'sorry, I have other things I absolutely have to do, so I will not do computer training. (86-92)

At the present time, the Eugene School District does not offer any of the

incentives suggested by Kate (integrator). This could explain the statements given

by Sally and Pat, both computer nonusers. Each had their own idea about the value

of designing a training program for teachers to use computer technology. When

asked how they would design a training program, they had a great deal of difficulty

providing statements. Sally (nonuser) stated:

> I wouldn't do anything. I don't have the time. No, I really wouldn't
> even concern myself with it. If someone needed to get together a
> computer committee I would not even serve on it. I am just not
> interested. I don't see it is good for the kids, and I don't want to be
> politically involved that way, trying to tell people this is the way it is
> and this is the way it should be. If teachers want to use the
> computers for baby-sitters, let them do it! (interview with Sally,
> nonuser, 80-85)

Pat (nonuser) held a similar opinion toward computer training. However,

although she indicated that she hadn't had any computer training in the past, she

said she was willing to consider taking some classes in computer training in the

future, under certain conditions.

> The district has [training] programs at different areas, but I wouldn't
> sign up for them. I have never signed up for a computer course. It
> would have to be within my teaching day, or a staff meeting, or a
> program presentation that is something I really need. Setting up
> district workshops after school, I am a vegetable. I have other things
> going on in my life. I am an early person, do it at 6:00 or 7:00 am.
> At the end of the day, it is so hard for me to start thinking grownup
> things, especially computer things. My brain would not want to go
> there. (interview with Pat, nonuser, 45-50)

While both teachers expressed a desire to personally not attend computer

classes, Pat (nonuser) touched on a number of issues regarding training brought up

by other teachers, particularly where and when the classes are held. While it was

generally recognized by all of the teachers that the district offered a number of

computer training classes, eight teachers (2 nonuser, 3 utilizer, 3 integrator) felt

they needed to be closer to their own building, and conducted during the regular

work day instead of after the regular school day, requiring teachers to "carve out

time from your family" (interview with Brandy, utilizer). Chris (nonuser) stated,

"bring the training to our schools. Bring somebody out and give us a half day, or

some time we are here regular hours. I don't know, going someplace else like the

ESD [i.e., Lane Educational Service District] at the end of the day is hard. We are

tired and have a lot of schoolwork to do." The concern with holding computer

training after the regular school day has been an ongoing complaint that the district

has heard. For the last two years, they have been providing half or whole day

substitutes to allow the teachers to go to training. However, this has created

problems of its own. Brandy (utilizer) best expressed this problem when she stated:

> A lot of times we will get to go to workshops and they will
> compensate us a little bit or they will say, 'we will provide the
> substitutes'. But that is almost like giving the teachers additional
> work. Because, you always have to do the preparation it takes to
> have a sub come in, and when you come back you have to make sure
> you check out what was done, no matter how good the sub is. You
> still have to check with the kids especially if you really expected
> them to accomplish something. So it would be great if they [the
> district] had a way of compensating teachers in the way of training.
> That would be monetary compensation, or a way for teachers not to
> have to plan for a sub. Have a really qualified person who has their
> own mini-unit all ready, and all they are doing is stepping in your
> classroom with whatever they are doing and whatever they need.
> (34-43)

A second idea expressed by eight of the teachers (2 nonuser, 3 utilizer, 3

integrator) was that the training needed to be in areas that the teachers wanted.

Individuals who plan the training programs need to know their audience and make sure the training is connected with practical things teachers can do to enhance learning in the classroom. This was shown by statements given by three of the teachers interviewed (i.e., Phyllis, Sally, Pat). They indicated they were unable to see any real relevance (i.e., perceived relevance) between the use of computers and education for themselves or their students. Phyllis (utilizer) stated, "as far as my personal use, I don't like to tinker. I don't find it [computers] interesting. So, for me to get on [a computer] and to go here and to go there, I don't find it interesting. My lifestyle doesn't make it so that computers are interesting to me." Pat (nonuser) echoed the same opinion of computer technology. "I haven't taken the time to play the games and get use to them like the other teachers have. It drives me nuts. I am a hands-on kind of person that has to show product for my time spent to see that something has been accomplished. The computer hasn't shown me anything yet. I haven't seen anything for myself yet." Sally's (nonuser) view of computers was more succinct. She stated that computers are "not time efficient, and it doesn't address their [students'] learning at this age."

Computer training was also considered an important area if the district wanted more teachers to integrate computer technology into the teaching and learning process. If possible, the teachers wanted the training in their own schools and related to the district and state curriculum requirements. Specifically, they wanted computer software and training that would meet the state benchmarks. At the present time teachers in the district are "putting all of their interest into the

benchmark workshops, and they say they don't have time to do or learn anything else" (interview with Jan, integrator). Many of the teachers (2 nonuser, 3 utilizer, 3 integrator) indicated that they believe that the integration of computer technology and the benchmarks are simply additional task they are being required to accomplish, in addition to the regular instruction they are required to provide.

> They want us to teach and do all of this [computers and the benchmarks], but we don't have the time, I think if we had the time I could do it. This year I am taking an hour a week that I used to do something else to plug them in. So my Social Studies, I probably won't make it to the immigration because I have to do something else. You have to take from one area to put it into another. You end up shorting something to put in computers or do things for the benchmarks. (interview with Chris, nonuser, 66-70)

A concept a couple of teachers (1 nonuser, 1 utilizer) would like to design into a training program is to have software representative, or someone who is knowledgeable about the software, come into the school and show different programs and CD-ROMs to the teachers. How do they work, how can they can fit into their curriculum, how well will the software programs meet the state benchmark requirements, and maybe improve the student's scores on the state test? The major reason seven of the teachers emphasized this as a part of the training was that they recognized they, and the majority of their peers, didn't know where to go to get information about computer software, nor the time to go out and find new software (2 nonuser, 3 utilizer, 2 integrator). They felt that this type of training could be conducted in short time segments such as the start of staff meetings or by releasing school an hour early. Another suggestion by one of the teachers (utilizer) was to create special staff development days for training where the teacher doesn't

have to teach, or create lesson plans for a substitute teacher. The teachers could

recommend specific programs they wanted to learn, or the district could locate

software programs that would help the teachers meet state requirements. Mary

(integrator) suggested:

> I would design it so that it would fit into the curriculum that I know
> they [the teachers] are already responsible for. For example, if I
> know fourth grade is teaching Oregon History, I would make sure of
> the kinds of things that were available for them to do Oregon
> History. I would dig up some Oregon geography, and I would look
> up some web sites for them that I knew the kids would be successful
> getting to that had to do with what they were already doing, the
> same thing for science. Since the district is saying you will be
> teaching these three science units a year, that you have specific sites
> available, have them do a contest searching for things that have to
> do with the science units. They're the sorts of things that are real
> hands-on and real useful for the classroom teacher to use, and I
> would be more likely to use them. (21-28)

A third area presented as being very important by a majority of the teachers

(2 nonuser, 3 utilizer, 3 integrator) was that the training needed to be at the

teachers' knowledge level. "You need to train them at their level. If someone

doesn't know how to do email they don't care about sending attachments. They

don't even know how to access the email yet" (interview with Jan, integrator).

While Pat (nonuser) felt the district provided a lot of training, she felt the majority

of it was so far beyond her understanding that she had quit going to any training

sessions. "It takes me quite a while to learn how to do some of these things [with

the computer]. When someone says do this or that it takes me quite a while to

figure out how to get there. Things have to hit me right in the face to get me to do

that" (interview with Pat, nonuser). Phyllis (utilizer) expressed her frustration about

a computer class she had started, but ended up quitting after a couple of sessions

because she didn't understand the instructor. She also expressed frustration with

other workshops and computer classes she had taken in the past.

> I need an instructor who can show me how to use it [computer
> technology] in a single way I can understand and a way of
> approaching computers.... Most computer people are so up here
> [above my knowledge level] they can't get down to where most of
> us are. I don't know what I need because I don't know how to even
> ask intelligent questions [about computers]. I need someone [an
> instructor] who knows how to dummy down, for a lack of a better
> term. (interview with Phyllis, utilizer, 31-36)

Kate (integrator) and Phyllis (utilizer) also suggested that teachers be given

a pretest of some type to find their learning level, what kind of classes they have

had, and what kind of classes they want. Then group the teachers into groups like

beginning, novice, intermediate, and advanced. While they realized this might be

too many groups, they felt the instructors could present the material at the learners'

level. In addition, forming groups would ensure that "the teachers don't get bored

with repeating things they already know" (interview with Kate, integrator).

One of the greatest incentives cited by five of the teachers to get more

teachers to use computer technology is the district's adoption of electronic report

cards and the state benchmarks. While teachers view this more as a forced

incentive, they recognize if it were not required the teachers wouldn't do it.

> Teachers have to do some work on the benchmarks that they send
> down to the district office. That is forcing people into doing more
> with their computers in a way that they haven't in the past. There are
> some people who haven't had a real motivating reason until lately to
> use their computers. If they weren't doing this, I am not sure what
> would motivate them without this requirement. I don't know if they
> would see enough benefit. I think a lot of people get into it
> [computers] because they are required to know something or do
> something and not necessarily because on their own they are that
> interested. Once people recognize that it is a tool and it has a lot of

usefulness, it does become somewhat motivating within itself.
(interview with Brandy, (utilizer) 52-61)

However, this form of forced training alone will not cause the teachers to embrace computer technology and begin integrating it into the teaching and learning process. At the present time much of the training provided by the district is intended to train teachers to enter data into the computer for record keeping, not to support the integration of computer technology into the teaching and learning process. While the training has been appreciated, four of the teachers interviewed indicated they and their peers wanted training on how to find and use software programs that would allow them to actually meet the state benchmarks using computer technology (1 nonuser, 1 utilizer, 2 integrator).

To help teachers, the district developed report card and benchmark templates to maintain records. This information has to be entered by the teacher using the classroom computer. To train the teachers to use the report cards and benchmark templates, the school district held a number of classes throughout the district and developed handouts the teachers can refer to at a later date. These handouts, called "cheat sheets," "crib sheets," and "step-by-step packets" by the teachers, can be helpful if they are clearly written and handed out at every workshop. Phyllis (utilizer) stated, "I am pretty visual so going step by step [with cheat sheets] in that respect is pretty helpful. I don't always remember. It would be easier than asking people [be]cause if you ask somebody they usually like to go, 'zip here, zip there, zip, zip, zip.' I want to go step by step." Pat (nonuser) felt at the conclusion of every training session the trainers should provide the participants

with papers outlining what they had done in the class. This is important she said because it is often two or three weeks before the teachers have time to practice some of the things they learned in the training session. When they do find the time, the handout could serve as a reference when they don't remember how to perform a particular function and help the teacher move from one step to the next. A packet of this type was provided for some of the workshops, and it made a significant difference when she returned to her school and tried to work with the programs.

Another perspective was presented by Brandy (utilizer) on what would motivate the teachers to use computer technology more. She appreciated the training the district had provided on ClarisWorks, email, the Internet, report cards, and the state benchmarks. However, because she had only four computers in her classroom, she wanted the district to provide her with equipment and training necessary to provide computer presentations to her class. She believed, if she had access to a large TV that she could connect to her computer, all of her students could see and learn how to use computers and demonstrate what they had learned. "[I want to find] a way to present information to students about how to give steps to students in some sort of presenter format. Then you could say to the kids, 'when you get here it looks like this, this is what step one is and step two is,' before they get onto the computer, and you are trying to watch several of them at a time. I need a presenter system that is pretty user friendly" (interview with Brandy, utilizer).

Discussion of Training

In the area of training, the barriers mentioned by eight of the teachers were the time and location of the computer classes (2 nonuser, 3 utilizer, 3 integrator). While extensive training has been provided by the district and the ESD, after spending the day in a classroom with 28 to 30 students the teachers said they were too tired to drive 15 to 30 minutes to participate in computer classes. Chris (nonuser) stated: "We have too much to do already. Bring the training to our schools. Bring somebody out and give us a half a day, or sometime during regular hours. I don't know, going someplace else like the ESD at the end of the day is hard. We are tired and have a lot of schoolwork to do." In an effort to partially remove this barrier from the teachers, the district has provided money to hire substitute teachers to allow the regular classroom teacher to attend computer classes. According to two of the teachers (1 utilizer, 1 integrator), this gesture has almost been more of a punishment. "That is almost like giving the teachers additional work because you always have to do the preparation it takes to have a sub come in, and when you come back you have to make sure you check out what was done, no matter how good the sub is" (interview with Brandy, utilizer). Mary (integrator) also stated that this is a problem. "We don't want release time. We want to be here with our kids. So then, they have you go after work, well then you're not ready for the next day.... I know that teachers get tired and they don't feel like going [to computer classes] in the evening, but I also know that teachers don't like to be out of their classroom, so it is a real problem."

A second major barrier with the training is that it has always been program or task specific. For example, the teachers admit that they have received a lot of training in the areas of word processing, email, report cards, and benchmark record keeping. However, they have not had training on how to integrate computers into the teaching and learning process. As with many districts across the United States, computers and basic software packages were purchased, and placed in the classroom, and teachers have not learned how to integrate computers or software into their curriculum. "I think they put the cart before the horse in this particular school district, where in they got the computers and programs and went online before they got the technical assistance and without the training" (interview with Jan, integrator). Because school administrators do not understand integration, they don't know how to integrate computers into the teaching and learning process. Therefore, they often have the mistaken idea that if a teacher has a computer connected to the network, some software, and the district curriculum, it will somehow all blend together and an integrated curriculum will appear. However, past experience and studies indicate this probably will not happen (Hannafin, 1999; Zhang & Espinoza, 1998). Eight of the teachers, all of those in the nonuse and utilization areas, failed to see a connection or relevancy (i.e., perceived relevance) between the computers and their curriculum (2 nonuser, 3 utilizer, 3 integrator). While some teachers have more computer experience than others, dependent upon their pedagogy and grade taught, they may or may not perceive computer technology as being relevant in the classroom (Hannafin, 1999; Morton, 1996a;

Veen, 1993). This could explain why Sally, who indicated she has 15 years of computer experience, scored at the nonuser level on the LCU and self scoring control question. Sally's view of computer technology in the classroom was that computers were used as "baby sitters," "were not time efficient and didn't address their [students] learning at that age [second grade]. In addition, seven of the teachers (2 nonuser, 3 utilizer, 2 integrator) indicated they didn't have the time or knowledge to find software that would help them meet their curriculum needs. With the increase in teaching requirements mandated by the state of Oregon, particularly the benchmarks, teachers at the integration level are also starting to question how they are going to continue using computers with the perceived increase in their teaching duties.

> "There are just so many things coming at us all of the time demanding our attention. The computers are starting to loose our attention because they are not the newest kid on the block anymore. They have been around for awhile, and the benchmarks are coming down on our heads, especially at the fifth grade, so we have to forget about this other stuff and start paying attention to the benchmarks because it is really time consuming. It started five years ago, but now is coming to a climax where the kids are going to be tested on all of these things.... So if you are going to do training for teachers on computers, you are going to have to give them some reason to want to learn that stuff. The only reason I can think of right now to motivate the teacher is that they have to do the computerized report cards, they have to do the computerized benchmarks. (interview with Kate, integrator, 75-85)

The third training barrier that eight teachers (2 nonuser, 3 utilizer, 3 integrator) expressed frustration with was that the instructors had difficulty providing computer instruction at the teacher's level. Teachers often felt that

training was either too far beyond their understanding or had been given so often

and at such a basic level that they became bored.

> One of the things I find [is] most computer people are so up here
> [beyond my level] they can't get down to where most of us are.... I
> need an instructor who can show me how to use it [a computer] in a
> single way I can understand and a way of approaching computers....
> I started a class but I ended up dropping it. I think the main problem
> was that I was overwhelmed. Again, it was a person who would say,
> you go there, then you go there, then you go here, and I said, wait a
> minute, I am lost! Then he would tell me 'don't worry about it, it is
> OK'. I would tell them, don't tell me it is OK, it is patronizing and
> doesn't help me. (interview with Phyllis, utilizer, 31-43)

A fourth barrier that six teachers (2 nonuser, 2 utilizer, 2 integrator) talked

about was the lack of training on how to prevent or fix problems that developed

with the computer or the software resulting in a lack of self-competence. "Most

teachers don't know how to use the computers that much. I think a lot of reasons

are that they don't have much knowledge about how to use the computer

themselves.... We need more training and time" (interview with Chris, nonuser).

Not only were teachers not trained to solve the problems, seven of the teachers (2

nonuser, 3 utilizer, 2 integrator) don't know who to contact when a computer

crashed or a problem developed. Seven teachers (2 nonuser, 3 utilizer, 2 integrator)

said they usually know one or two individuals in the building, referred to as

computer experts, who can solve some computer problems. However, they realize

if they get the expert to come and work on their computer problem, the expert must

stop whatever they had been doing and leave their class. Consequently, the

majority of time when a hardware or software problem develops, the class activity

stops. With the older computers, crashes occur almost daily and even the newer

computers frequently have problems. This hardware unreliability is commonly

mentioned as a barrier to the integration of computers into the teaching process

(Lee, 1997) resulting in a reduction of self-competence to use computers in the

teaching process as indicated by Brandy (utilizer):

> One of the most frustrating things is a) I tried it and it didn't work
> and I don't know why, b) I know what I was doing, I tried it, but all
> of a sudden my computer said not enough memory. Now what do I
> do? There are other scenarios, but it is frustrating to have something
> not work and not know how to fix it. That is why many don't use
> computers because it is frustrating. (85-88)

The last training barrier that five of the teachers (1 nonuser, 2 utilizer, 2

integrator) talked about usually occurs a week or two after the training. "One of the

things that happens is that they forget real quick, how to do these things. They go

back the next day and they practice and things go pretty good, and then maybe a

week later they try to do it and they say wait a minute. I forgot how to do this"

(interview with Kate, integrator). Five of the teachers (1 nonuser, 2 utilizer, 2

integrator) wanted comprehensive cheat sheets or information packets at the

conclusion of every training session to provide them with step-by-step reminders of

what they covered during their training sessions. It should be pointed out that the

district has provided this information for email, report card, and benchmark classes.

The Importance of Support

The third institutional limitation category of support in the past has included

leadership. However, the type of leadership needed for the integration of

technology into the teaching and learning propose involves a more visionary aspect

than the traditional idea of support. So for the purpose of this study, leadership will be discussed later separate from the category of support.

In this category, a major component all of the teachers, except Sally (nonuser), wanted was a strong support base incorporated into their training program. The minimum amount of support the teachers wanted in a training program was an individual at the district office who would be available to answer computer questions on the telephone and email. The district may have someone who does this type of service for the teachers, but seven of the teachers interviewed did not know if there was a support person, or where they could find this information (2 nonuser, 3 utilizer, 2 integrator). The two other teachers never mentioned district support personnel. At the present time, seven of the teachers (2 nonuser, 3 utilizer, 2 integrator) say there is usually one or two individuals in their building that have some computer knowledge, and they become the building experts. Those who have been unofficially placed in this position help the teachers in the building because they enjoy working with computers and want to encourage others to work with them more in the classroom. However, the interviewees indicated they are having more and more difficulty finding the time to correct teachers' computer problems. Brandy (utilizer) put it this way, "In an ideal world they [the district] wouldn't just hope that, as a classroom teacher, I could carve out a few minutes out of my schedule to help others with computer problems. I have enough of my own work to do in my classroom."

Seven teachers (2 nonuser, 3 utilizer, 2 integrator) thought support for the teachers could be provided through resource personnel, individuals who would be available to answer questions, help troubleshoot software and hardware problems, and develop workshops and workshop schedules. Some teachers (1 nonuser, 1 utilizer, 3 integrator) thought the resource person could be located in the district office, and everyone would know who the individual was, the telephone number, and the email address. The teachers could contact the resource person by telephone or email and get answers to their questions about software or hardware problems. This individual would also be available to go to schools and meet with teachers to find out what kind of computer workshops they wanted to schedule and a convenient time for the workshop.

Four of the teachers (2 nonuser, 1 utilizer, 1 integrator) taking part in the interview would prefer to have at least a half-time individual assigned to their school building who could be available to answer questions on the phone and email. This individual should be able to devote all of their time toward helping the classroom teacher with computer technology and not have teaching duties. The resource person would be able to work closely with the staff and help them anytime they had problems with the computers. In addition, the resource person could take the time to "find resources that work specifically for the curriculum we are teaching" (interview with Mary, integrator). This individual could also hold weekly brainstorming sessions on how to enhance the curriculum and be responsible for

giving short presentations at weekly or monthly staff meetings on available

educational software and problem solving tips.

> In an ideal world, we would have an individual in our building,
> someone who isn't a regular classroom teacher, who would be on
> call, close enough so that when people do need that help it is there
> for them to get. Rather than just fixing the problem, they would
> come in and kind of teach the teacher how to solve the problem.
> That is a good way to learn, but by having someone in the building,
> at least half-time, to help when there is a hardware or software
> problem. Especially when the equipment breaks down. One of the
> most frustrating things is, I tried something and it didn't work and I
> don't know why, or I know what I was doing, I tried it, but all of a
> sudden my computer said 'not enough memory'. Now what do I do?
> There are other scenarios, but it is frustrating to have something not
> work and not know how to fix it. That is why many don't use
> computers because it is frustrating. (interview with Brandy,
> (utilizer), 80-88)

> However, for this to occur, four of the teachers (2 utilizer, 2 integrator)

indicated that there needed to be a commitment as a staff toward the integration of

computer technology before a resource person could be assigned to the building.

According to these teachers, creation of this committed staff could be accomplished

in one of two ways. The first, by staffing schools with only teachers who are

"committed and interested in using computers" (interview with Kate, integrator).

Grouping teachers into schools in this manner would establish a teaching staff with

an "agreed upon plan and commitment for each level" (interview with Jo, utilizer).

The second way to develop a committed staff is to hire teachers who are willing to

integrate computer technology into the teaching and learning process as the older

teachers retire. "You would interview people and find out who was technologically

aware. With all of the new people that will be coming in to replace the

retirees....[you could hire] a computer literate [teacher] that is beyond word

processing" (interview with Mary, integrator).

Another idea presented by Mary (integrator) was to draw resource persons

from the school's community.

> One other thing that would be great would be more links between
> the parents and the teachers. So the people that have the expertise
> from other areas could maybe help us more. That is not a problem
> here, but other schools could really link up more with the
> community like we do. I know there are a lot of people we probably
> are not tapping into either. They don't realize, gosh, we could really
> use your help because you know what you are doing. We could
> share information on technology on hardware and software. There
> are probably people who know a lot more about the Internet than we
> do, and they could help us look up places to go to for our
> curriculum. (interview with Mary, integrator, 105-113)

Another method five of the teachers (2 utilizer, 3 integrator) suggested that

would help support and encourage teachers to integrate computer technology was

to establish a mentor program. The mentor would be someone in the building that is

recognized as an individual who integrates computer technology into the teaching

and learning process.

> I think mentoring would be great, if there is a regular time set up,
> just like staff meetings where you would let the mentoring session
> happen. And then sharing, not only with each other, but with a
> bigger group. I would really enjoy it. Having the opportunity to have
> that feedback with each other on how we are doing. Maybe we could
> start it off with a pilot program, like we do with student teachers. It
> would be nice to be able to do this and have the time to do it.
> (interview with Jo, utilizer, 126-130)

The last support suggestion by Jo (utilizer), to help teachers integrate

computer technology was to have each building establish a common preparation

time period for all of the teachers. This would allow teachers to meet, in groupings

made up of individual grade levels, and as a full staff. The teachers would then be able to share their ideas and experiences using different software programs. They could also explain how they use computers to meet specific curriculum requirements.

The Eugene School District is developing other areas of support. One of them is a Web page they have created with links to eight Internet sites. Kate (integrator) felt this is a start to help the students locate good educational sites. Another area of support available to schools who choose to participate is a program called Virtual Eugene. This program is a partnership formed between the Eugene Water and Electric Board (EWEB) and the Eugene School District. At the present time somewhere between 10 to 13 elementary schools are involved. "Virtual Eugene is really committed to technology. I would say that they have shown more ways to use computers and the Internet in the classroom than anything else we have had in the district" (interview with Kate, integrator). Unlike the school district, the Virtual Eugene group has conducted workshops on the application of computer programs and how they can be used in the classroom. Although the emphasis of this group is water and electricity, the teacher connected with it felt constantly encouraged to use computer technology (interview with Kate, integrator).

Discussion of Support

There are two major barriers to the integration of computer technology within the area of support. The first major barrier reported by the teachers is a lack

of technical support from the district. Seven of the teachers in this study (2 nonuser, 3 utilizer, 2 integrator) indicated that they didn't know a resource person to contact when they had problems with their computers. While some of the schools have half-time media personnel, or classroom teachers in the school who are viewed as the computer experts, seven of the teachers (2 nonuser, 3 utilizer, 2 integrator) feel they were simply given the computers and expected to solve their own problems. Not knowing someone to call or email when the computer breaks down results in the teachers feeling abandoned with a room full of non-usable equipment. "Teachers' decisions about educational technology are significantly affected by the extent to which they have well coordinated access to resources and support" (Lee, 1997, p. 255)

Another area six teachers (2 nonuser, 2 utilizer, 2 integrator) viewed as a barrier and lack of support was the lack of time to locate software or look through Internet sites and find materials to help them meet the curriculum, state tests, and benchmark requirements. While teachers continue to hear there is software "out there" for the curriculum, they do not feel they have time to review the software catalogs, read the developers two sentence promotion, and then make a prudent decision. Even when they read about something that sounds like it may work, after receiving the software they often find the software is not user friendly. "I have one [software program] but I don't know how to use it. We get them and we don't know how to use them, and some of them you have to learn the little tricks. I tried and I can't open it. I don't know what I am doing wrong" (interview with Chris,

nonuser). In a study by Chiero (1997) "Not enough time to learn to use new software was rated the biggest obstacle" (p. 139) to the use of computers. The lack of support from computer resource personnel to solve hardware and software problems could have significantly negative results on teachers integrating computer technology into the teaching process (Lee, 1997). Not only does it negatively effect the teacher's self-competence to be able to use computers in the classroom, it also causes the teacher to question whether there is any benefit (i.e., perceived relevance) to using computers in the classroom. Teachers faced with this barrier (i.e., lack of perceived relevance) are unable to see or comprehend any positive uses for the computer in the educational process. While these teachers readily admit the computer is OK for students to play games with, and perhaps drill for the slower students, they believe that for the majority of students computers are not educationally worthwhile (Chiero, 1997; O'Bannon et al., 1998; Solmon, 1998).

Leadership

While leadership is often thought of as a part of support, the type of leadership needed for the integration of computer technology is visionary rather than technical. Eight of the teachers (2 nonuser, 3 utilizer, 3 integrator) felt the building administrator could have a significant impact on the teachers' attitude toward the integration of computer technology into the teaching and learning process. However, the impact can be either positive or negative. "If the principals think something is important, the more likely teachers are to get into it. That is the

whole idea of the principal being the leader in the school" (interview with Kate, integrator). Jan (integrator) said the principals "set the tone" for the school, not only by what they say, but also by their example. "If the teachers see them gaining in knowledge and being a good model [it is a strong incentive] for them to use computers more in the classroom" (interview with Jan, integrator). Brandy (utilizer) felt that the principal should "have a vision of what you can use computers for in the classroom and support teachers who want to improve their skills". Jo (utilizer) indicated that her principal was "very supportive and very appreciative of the [computer] skills their media instructor had." In addition, Jo (utilizer) stated, "he encourages us [the teachers] and is very helpful. He is trying to be a facilitator [for computer technology]."

While each of these teachers recognized the positive influence the building administrator can have on whether teachers use computer technology or not, not all of the principals are encouraging. Kate (integrator) summarized the overall feeling expressed by the teachers regarding non-supportive principals.

> I think it can make a big difference if the principal is a computer buff. Because at one school where the principal was, their teachers had their computers hooked up to a TV screen two to three years before we did, even though a couple of us kept asking and asking and asking. Our principal didn't know how to do it, and they even tried to tell us that the other principal didn't think it was worth doing. Even though he was the one doing it! But when we talked to the teachers we knew it was worth doing. But we never got it done because our principal was pretty middle of the road as far as computers go. She used them quite a bit, but, and she was really interested in them, but not totally enraptured with them. They used them for email, and writing reports and things like that. But I have never had a principal come in and have any idea of how anything is done with a computer in the classroom for instruction. That's not

their forte. Their forte is emailing people. They love to email people and send memos. They love to attach things; it helps keep them busy. But as far as actually instructing the kids, I just don't think they have much of an idea of how to do it. (interview with Kate, integrator, 179-191)

A second barrier in this area is what the teachers referred to as a lack of commitment to computer technology by the building administration and teaching staff. They believe computer technology has not been integrated into the teaching and learning process because principals and teachers in their buildings have not adopted a philosophy, and thereby a commitment, to the integration of computer technology.

In addition, four teachers (2 utilizer, 2 integrator) felt the district and building administration fail to support the integration of computers into the teaching and learning process because they fail to recognize teachers who spend a great deal of their personal time to learn how to use computers and take extra training to increase their ability to integrate computers into their teaching. These teachers often feel, instead of being rewarded for the hours of extra work, additional burdens are placed on them to solve other teachers' hardware and software problems, prepare and teach workshops, and serve on additional committees.

Discussion of Leadership

"In order to create deep changes in classroom practices and curriculum, teachers need to be sustained by professional assistance from administrators,

including principals, department heads and superintendents" (Lee, 1997, p. 256).

Eight of the teachers (2 nonuser, 3 utilizer, 3 integrator) interviewed recognized the importance of the building principal's influence on the integration of computer technology into the teaching and learning process. Four teachers (1 nonuser, 1 utilizer, 2 integrator) felt the principal needed to have a vision for the integration of computers. However, three teachers (1 nonuser, 1 utilizer, 1 integrator) indicated while supportive, their building principals had so many other responsibilities they were concerned with that they were not committed to computer technology. As a result, the teachers in the buildings were not committed to integrating computer technology into the teaching process. School administrators with a vision are able to "identify a clear sense of what the school can become, a picture of a positive future...continually identify and communicate the hopes and dreams of the school, thus refocusing and refining the school's purpose and mission (Deal & Peterson, 1999).

The areas mentioned most often by six of the teachers (2 nonuser, 2 utilizer, 2 integrator) was that the principal should be the school's leader, modeling the use of computers to the teachers through email and PowerPoint presentations in staff and parent meetings. In addition, the principal should keep up with new information on computer technology and be able to help teachers solve hardware and software problems that came up. Finally, these six teachers felt the principal needed to be a facilitator for computer technology. Facilitation by the principal was

mentioned most often regarding their control of the budget (1 nonuser, 2 utilizer, 2 integrator).

> "They are there and willing to say, OK, what do you need and let's see what we can do to accomplish that.... We wanted a hub in the 4/5 [grade] rooms so that we have more than one computer access to the Internet. We were really supported on that. We found the funding and we got it networked in.... When we say we need more memory or new equipment we look at the budget to see what we can do." (interview with Brandy, utilizer, 122-127)

Principals who can convey their vision of technology can influence teachers, stimulate their interest in computers, and motivate them into action (Deal & Peterson, 1999).

Legislative Mandates

In addition to institutional limitations, the second major category of barriers to the integration of computer technology into the teaching and learning process are the legislative mandates from Oregon lawmakers. Six teachers (1 nonuser, 2 utilizer, 3 integrator) feel that the district is continuing to push computer technology while at the same time the teachers are attempting to teach their regular curriculum and meet the state tests and benchmark requirements. They readily admit that they are overwhelmed by the state benchmark requirements, and they need support on how to meet the benchmark requirements with computer technology. These same six teachers (1 nonuser, 2 utilizer, 3 integrator) stated that they felt overloaded and were having difficulty teaching the required curriculum, implementing the benchmarks and getting the students ready for the state testing

requirements. Because of this perceived overload, they were cutting back on using the computers in the classroom.

During the interviews on what would motivate the teachers to increase the use of computer technology, two of the teachers began to talk about the importance of support. The primary theme of the support needed was at first expressed as needing support to find time to do their work. However, when asked what they meant by this, the two teachers expressed concern with the amount of work required to prepare students for the state assessment and the state benchmarks. Because of these additional requirements in the teaching day, Phyllis (utilizer) stated, "we just have had to cut back on the other areas. There is just not enough time to do all of the things I would like to do much less need to do". Jo (utilizer) felt much the same:

> It is not a lack of wanting to [use computer technology], I think it is a matter of the ability of what are our requirements in terms of a teacher. I feel no lack of motivation. I think it is a matter of, what are the realities of this job. Especially as the state assessment test begin to drive our curriculum more and more. I see less time available to use the technology end of it.... I love to learn and I love to teach, but then I have come to the point in my teaching where the reality is this and it includes these things and so I live within those parameters and I don't try to drive myself nuts to try to achieve things I can't do. I use to work really hard and long hours on creative things, but not anymore. (5-27)

All of the teachers being interviewed felt support is paramount when considering access and use of computers in the teaching and learning process. The following statements were taken from two of the teachers interviewed. When describing their access to computers both teachers expressed frustration about how

they were going to find time to use computers, even when they have access to them

because of the state benchmarks.

> With the new state benchmarks, I feel like I need to not do fun
> projects anymore. I feel I need to be on task, I feel like, as opposed
> to branching out, I feel like it is narrowing me, as opposed to letting
> me expand. The benchmarks are limiting my ability to use
> technology more and more. Until we get more comfortable and
> knowledgeable about what the benchmarks mean, what we need to
> do in order to get the kids to meet them, I see people really
> narrowing down their focus. I mean, we got this thing in the mail the
> other day about computer careers standards and how we are
> addressing the career standards in our building. We had, no time, no
> time, no time…. But with the benchmarks we have to do this, then
> we have to do this, we have no time. So, as far as integrating
> computers with the other ideas, for me it will be very tough. It will
> be way down the road where I feel like I can integrate. [Be]cause I
> am scrambling trying to figure out this, and scrambling trying to
> figure out computers, and computers are on the losing side. For me
> anyway, and I think for most people now. Computers used to be the
> thing. People were going to workshops and being trained, but not
> now. (interview with Phyllis, utilizer, 64-77)

> Something has to give. I feel very politically pushed, and well,
> professionally pushed. These assessment test [the state test and
> benchmarks] have really made a change in my teaching….At one
> point I was more center oriented, where kids had a specific time in
> the day where they would work on a particular area. I feel that I am
> doing less of that, and it is more whole group instruction. With the
> benchmarks and all that, that [my teaching] has changed, it is more
> group instruction focus and less of, these are the choices you have
> during this time. So it has become more difficult to have that happen
> [individual instruction, choices] than it was a few years ago. One
> teacher here has a couple of computers outside of his classroom, but
> he says there isn't time for the students to use them anymore.
> (interview with Jo, utilizer, 70-85)

Discussion of Legislative Mandates

Although it is assumed that all teachers in Oregon have heard about

benchmarks during the last five years of legislative reform, this is the first year

teachers have had to become responsible for benchmark evaluations, and scoring

work samples using the benchmark criteria. Kate stated:

> The benchmarks are coming down on our heads, especially at the
> fifth grade, so we have to forget about this other stuff and start
> paying attention to the benchmarks because it is really time
> consuming. It started five years ago, but now is coming to a climax
> where the kids are going to be tested on all of these things. But not
> only that, we [teachers] are going to be the ones who are going to
> have to put all of that stuff [results] into the computers. (interview
> with Kate, integrator, 78-81)

While the benchmarks are forcing teachers to use computers to record the

student results from work samples, the benchmarks are also causing four of the

teachers (1 nonuser, 3 integrator) to stop trying to integrate computer technology

into the teaching and learning process.

> The benchmarks are limiting my ability to use technology more and
> more…with the benchmarks we have to do this, then we have to do
> this. We have no time and da da, da da, da da. So as far as
> integrating computers with the other ideas, for me it will be very
> tough. It will be way down the road where I feel like I can integrate.
> [Be]cause I am scrambling trying to figure out this, and scrambling
> trying to figure out computers, and computers are on the loosing
> side. For me anyway and I think for most people now. Computers
> use to be the thing. People were going to workshops and being
> trained, but not now. (interview with Phyllis, utilizer, 66-77)

Mary, an integrator stated:

> Right now we are so centered on what the state is asking us to do. If
> the state said one of the benchmarks has to be completed through a
> certain medium, then that would happen, because that is where our
> main focus is. In the past this wouldn't have been true, but now that

things have changed, anything linked to the benchmarks would do it,
in the fifth grade this is really true. (4-8)

The barrier of the state benchmark requirements is perhaps the largest

barrier the teachers in this study are having to face and overcome if they are going

to integrate computers into the teaching process.

Despite the amount of equipment, and training provided, all of the teachers

interviewed in this study indicate they find their day-to-day experiences in the

classroom (combined with the perceived additional requirements of the

benchmarks, state tests, and lack of support) overwhelming. "They [teachers] are

putting all of their interest into the benchmark workshops and they say they don't

have time to do or learn anything else" (interview with Jan, integrator). All of these

barriers (institutional and legislative) appear to be significantly reducing the efforts

being made to integrate computers into their teaching. Because the teachers in this

study feel overwhelmed by the requirements of the legislated benchmarks, they are

making little or no attempt to integrate technology into the teaching and learning

process. When they do use technology, it is for routine record keeping and word

processing not for their instructional program or changing their pedagogy style.

5. DISCUSSION, CONCLUSIONS AND IMPLICATIONS

Over the last 15 years, there has been significant funding dedicated to introducing computer technology into the nation's public schools. Billions of dollars are spent in public school districts each year in the United States on computer hardware and software. However, the integration of computer technology into the teaching and learning process has been much slower than anticipated. At the present time less than 50% of teachers use computer technology in their classrooms on a daily basis, and fewer than 12% of the teachers integrate computer technology into the teaching and learning process (Hannafin, 1999; Moursund & Bielefeldt, 1999; Riley, 1999; U. S. Department of Education, National Center for Education Statistics, 1999). Because there is such a serious discrepancy between what is anticipated by societal, legislative, and educational leaders and what is being practiced in the public schools, this study was undertaken. The primary focus of this study has been to investigate the barriers that prevent teachers from integrating computer technology into the teaching and learning process.

During the interviews, the nine teachers pointed out a number of barriers within the broad categories of institutional limitations and legislative mandates. Several of these institutional limitations have been reported in other studies (i.e., lack of computers, lack of relevant training, need for mentors). The teachers also pointed out a number of institutional barriers that had not been addressed in earlier studies (i.e., student management/scheduling problems, time and location of training, lack of visionary leadership). In addition, an entirely new category of

barriers, legislative mandates, was revealed. The researcher was consistently told

by the teachers, even those at the integration and utilization levels how tired they

were, and because of the perceived overload of their teaching responsibilities, they

were reducing their use of computers.

> It will be way down the road where I feel like I can integrate.
> [Be]cause I am scrambling trying to figure out this [benchmarks and
> state tests], and scrambling trying to figure out computers, and
> computers are on the loosing side. For me anyway and I think for
> most people now. Computers use to be the thing. People were going
> to workshops and being trained, but not now. (interview with
> Phyllis, utilizer, 69-77)

Because this perception of overload is effecting all of the teachers regardless of

their level of computer use, it is important when looking at barriers to the

integration of technology to consider a broader, or systemic view, that includes

societal expectations, institutional limitations and legislative mandates.

Societal Expectations

For over a decade, teachers have been indirectly encouraged by business

leaders and politicians to integrate computer technology into the teaching and

learning process (Davis & Botkin, 1995; Moursund & Bielefeldt, 1999; Solmon,

1998; U. S. Department of Education, National Center for Education Statistics,

1999). To this end Apple, IBM, and other businesses have worked with the

government to encourage and promote the integration of computer technology into

the schools through grants and special contracts. The perception is that "Our

technologies are not making teachers and schools obsolete, but they are redefining

their roles" (Davis & Botkin, 1995, p. 17). In addition, the Milkin Exchange

believes that the integration of computer technology into the public school system

is a compelling national agenda. "The challenge confronting us is not whether

technology has a role in today's classrooms, but rather how to put into place the

essential conditions that will make these tools truly effective in improving student

performance" (Solmon, 1998). However, "how to put the essential conditions" into

place is still unknown. As a result the integration of computers continues to be

pushed and more computers are purchased and placed into the public schools. In

spite of all of these efforts:

> Schools have been among the most laggard institutions in using the
> information technologies of the information age.... By and large,
> schools are still in the first stage of computer use. Some are
> networked for attendance, grades, record keeping, and electronic
> catalogs for libraries, but these automate support operations rather
> than transform methods of instruction. (Davis & Botkin, 1995, p.
> 80)

Overall, the insertion of computer technology into the schools was not well

planned, as suggested by Jan (integrator): "I think they put the cart before the horse

in this particular school district, wherein they got the computers and programs and

went online before they got the technical assistance and without the training."

In addition to integrating computers, the report, A Nation at Risk (1983),

caused society to push for schools to improve their teaching. "Now a palpable

sense of crisis surrounded the nation's schools, featuring daily lamentations in the

media about how terrible they had become. The fact, however, was that most

schools had not changed for the worse; they simply had not changed for the better"

(Reich, 1992). The pressure applied by societal expectations (i.e., integration and

improvements) has been indirectly felt by the teachers interviewed. They indicated

they believed the district was constantly pushing them to integrate computers into

their teaching, while adding what they perceived to be the additional

responsibilities created by the Oregon State Legislature. The majority of teachers (2

nonuser, 3 utilizer, 3 integrator) interviewed felt, because of the benchmarks, state

tests, and regular teaching responsibilities, teachers were increasingly using their

computers for administrative responsibilities and decreasing time spent integrating

computers into their teaching. "They [teachers] are putting all of their interest into

the benchmark workshops and they say they don't have time to do or learn

anything else" (interview with Jan, integrator).

> The benchmarks are coming down on our heads...so we have to
> forget about this other stuff and start paying attention to the
> benchmarks because it is really time consuming.... But not only
> that, we [teachers] are going to be the ones who are going to have to
> put all of that stuff [results] into the computers. (interview with
> Kate, integrator, 78-81)

Institutional Limitations

Knowingly or unknowingly educational institutions have placed limitations

on the integration of computer technology into the teaching process in the areas of

equipment, training, support, and leadership. Teachers at all levels of computer use

(i.e., nonuser, utilizer, integrator) reported similar difficulties.

> Changes in education take a very long time to evolve. They are a
> consequence of greater transformations, often social, political,
> economic, or religious, and therefore are always a few steps behind
> the demands of the society they are designed to serve. But today

schools are more than a few steps behind, and many feel they are on the wrong path altogether. (Davis & Botkin, 1995, p. 23)

Equipment

Lack of equipment is one of the first institutional limitations mentioned by these nine teachers. The request for more computers and the updating or replacement of old computers by eight of the teachers interviewed is a common request in many studies (Becker, 1994a; 1994b; Lee, 1997; President's Committee of Advisors on Science and Technology, Panel on Educational Technology, 1997; Solmon, 1998). However, unlike studies done in the past, this study revealed additional barriers that other surveys or questionnaires failed to uncover. One of these barriers to integrating computers is the difficulty teachers have scheduling and managing 25 to 30 students on the three or four computers found in many of the Eugene elementary classrooms. The four teachers (2 nonuser, 1 utilizer, 1 integrator) who have computers in their classroom indicated this could be very difficult.

> Scheduling becomes really complicated. Sometimes I have kids rotating around the room on computers for about half an hour out of each morning, but that's three or four groups rotating. The kids that are on computers are distracting the kids that are trying to work at their desk. With the transitions I have a problem because every half-hour you have groups switch which gets the kids unsettled. Kids probably do anyway, but with the computers it is harder because the kids always seem drawn to the computers. So as soon as you start using computers in the room it is distracting to the other kids. So if you are going to use computers you need to figure a way to schedule it; a way to arrange the room more so it would work; make sure that everybody gets on the computers for an equal amount of time; make

sure you have enough computers and that they are up to date. (interview with Kate, integrator, 29-37)

Kate (integrator) and Brandy (utilizer) liked having the computers in the classroom, "so they can be used whenever they want rather than using them on a [lab] scheduled basis" (interview with Brandy). However, "with 28 or 29 kids we are always battling for time on the computers. When you put some kids on the computers you have to have the other kids doing something else, and it is really distracting to them because they are always looking at the computers, wanting to get on the computers" (interview with Kate, integrator). Brandy (utilizer) added: "Right now I have five or six kids per computer so it is difficult to have them get much time on the computers to do research." This same concern was echoed by Pat, a nonuser. "It is really hard in this particular class, when you only have a few computers in the classroom. You really can't make it as a subject, like your reading group.... There is just not enough [computers]."

While these teachers had problems with the scheduling and management of their students, teachers who used computer labs (1 nonuser, 2 utilizer, 2 integrator) also experienced problems getting their students on computers. Because of the size of the school, teachers had to schedule their class to use the computer lab for only one hour per week school. "it's not that easy with this large of a staff [18 teachers]. We schedule the lab so everyone has an hour a week... Our lab isn't large enough for all of the students so classes have to split in half to be able to use the lab" (interview with Mary, integrator). However, the low number of computers in the labs (i.e., 12 – 15 computers) usually resulted in each student in the class having

access to a computer for a maximum of 30 minutes each week. While they could

schedule additional time, if they had projects, it can be difficult. "I have the

students use them [computers] twice a week [in the lab]. Or if we are doing projects

or reports then I use them more often.... I am begging people and say, please,

please [let me use the computer lab]" (interview with Chris, nonuser).

While the teachers wanted additional computers, three (1 nonuser, 1 utilizer,

1 integrator) believed this would present another barrier or limitation to the

integration of computers into the teaching process. Most of the classrooms are too

small and do not have sufficient electrical or Internet wiring to add computers.

When talking about adding computers, teachers talked about these limitations. "It

wouldn't work for most classrooms because most classrooms are the standard size,

you just don't have the room. It would be awfully close and cluttered, especially in

the primary grades because the kids need room to move." (interview with Sally,

nonuser). "Obviously, then you are dealing with space and the way the classroom is

set up, and this is really an old building so that would have to definitely be a

consideration [if you wanted to add computers]" (interview with Jo, utilizer).

"Right now there isn't enough [electrical or Internet] plug-ins to connect the

computers we have in our classrooms. So we have to string the wires all over to be

able to get them to the computers and warn the kids not to step on them when they

walk around" (interview with Kate, integrator).

Perhaps the most logical, yet the most radical suggestion for removing one

of the institutional (i.e., district) limitations in the area of equipment was presented

by Kate (integrator). However, she recognized the resistance of the district to change.

> If there is equipment worth thousands of dollars sitting in your room, you had better prove that you are using it or it should be taken away from you, and I know that will never happen. The new computers should be given to teachers who have demonstrated that they will use them. Not to teachers that refuse to use them and refuse to get any training. They don't even know how to plug them in. But that won't happen because the district wants to treat everybody the same. Bit these computers are too expensive for everybody to be treated the same. But it isn't going to change, it has been that way forever. Every teacher has to have the same thing [even if the computers just sit]. (55-62)

While the teachers in this study expressed frustration with barriers surrounding equipment, they also suggested strategies to overcome some of these barriers. The following are potential strategies given by the teachers in this study to remove the limitations perceived by teachers in the area of equipment.

- Establish a minimum ratio of students to computer as 2:1 in each classroom.

- Replace or upgrade old computers with CD-ROM's, additional RAM, larger hard drives, and network capability.

- Add computers in classrooms where teachers are willing to integrate or learn to integrate computer technology into the teaching process.

- Maintain a minimum of 30 computers in each computer lab.

- Provide a computer for teachers to use in their home.

- Establish a program to remodel the older school buildings to make them technologically functional, ensuring the electrical and network connections are appropriately located throughout the room.

- Develop a model computer school or classroom.

While all nine of the teachers believed that equipment was the primary barrier to the integration of computer technology into the teaching and learning process, they also indicated the area of training was of equal concern.

Training

An institutional limitation that had not been addressed in earlier studies, but mentioned most often in this study, was the time and location of training on how to use computers. Eight of the teachers interviewed (2 nonuser, 3 utilizer, 3 integrator) stated 18 different times that this was the greatest barrier or limitation to the integration of computers into the teaching process. The teachers indicated they were too tired from teaching at the end of the school day to attend classes, and that the classes were held in locations too far away from their schools. Two nonusers, Chris and Pat presented the limitations of time and location of classes the clearest. Pat stated: "Setting up [in] district workshops after school, I am a vegetable. I have other things going on in my life.... At the end of the day it is so hard for me to start thinking grownup things, especially computer things. My brain would not want to go there." Chris (nonuser) added: Bring the training to our schools. Bring somebody out and give us a half a day, or some time we are here regular hours. I

don't know, going someplace else like the ESD at the end of the day is hard. We

are tired and have a lot of schoolwork to do."

In an effort to eliminate the above limitations, the district provided funding

for substitute teachers, allowing the regular classroom teacher to attend training

workshops during the school day. Unfortunately, according to three of the teachers

interviewed (1 utilizer, 2 integrator) this created another limitation.

> A lot of times we will get to go to workshops and they [the district] will compensate us a little bit or they will say, 'we will provide the substitutes'. But that is almost like giving the teachers additional work. Because you always have to do the preparation it takes to have a sub come in, and when you come back you have to make sure you check out what was done, no matter how good the sub is. You still have to check with the kids especially if you really expected them to accomplish something. (interview with Brandy, utilizer, 34-39

> There have been a lot of classes. I mean, at one point a year or two ago they were offering so many classes on computers. But there weren't many people who attended. I guess they couldn't get many people to come out. Most of those classes have disappeared. I guess they just couldn't get teachers to come after school, and that is when they would be offered, on the other side of town. So that didn't work. I guess they realized that they needed to give some people some release time and have it close to school.... However, they [teachers] don't really like to get ready for a sub. (interview with Kate, integrator, 237-242)

Mary (integrator) approached this limitation considering the districts and

teachers concerns:

> I am not really sure the district could do anything, because one approach we have had in the past is 'we [the district] will do inservices for you, provide money for you and release time.' We don't want release time. We want to be here with our kids. So then they have you go after work, well then you're not ready for the next day. It is a real problem. (83-86)

Another barrier within the training area is the relevancy of the training. While this limitation has been discussed in a number of studies in the past (Greenan, Wu, Mustapha, & Ncube, 1998; Hannafin, 1999; Lee, 1997; Moursund & Bielefeldt, 1999; Zhang & Espinoza, 1998), it is the teachers' perception that many of the same errors are being made. The first consideration is that "teachers need to be carefully grouped using selection processes which place participants in homogeneous groups by subject specialization and by skills level" (Lee, 1997, p. 257). Almost all of the computer classes in the past have been given with a shotgun approach. This concept is to throw enough information out in a single training session hoping everyone can use a little of that information presented. However, this approach doesn't usually work as indicated by U.S. Secretary of Education Riley: (1999) "The most common form of professional development activities continues to be the kind that teachers tell us are the least beneficial – the 'one shot' workshops that typically last no more than a day and often carry little relevance to teachers' work in the classroom" (p. 2). "If someone doesn't know how to do email they don't care about sending attachments. They don't even know email yet. Time and individual interest need to be addressed" (interview with Jan, integrator). In order for the teachers to be able to perceive relevancy, they need to understand what the training is about and have it presented at their instructional level. "Give a pretest first so you actually group the teachers in some way from beginning, novice, intermediate, to advanced so teachers don't get bored with, you know, repeating things they already know" (interview with Kate, integration). By grouping teachers

at their computer skill and knowledge level they will experience less frustration. "One of the things I find out about most computer people are [that] they are so up here they can't get down to where most of us are. I don't know what I need because I don't know how to even ask intelligent questions" (interview with Phyllis, utilizer).

Relevancy can also be accomplished when training is provided that shows teachers the relationship between their curriculum and how to integrate that curriculum with computer technology. It is a perception of some teachers that there is no relationship between computer technology and working with students in the classroom. "What I want to know is what I can do with my kids. I want to take my kids into the computer lab and [know] what I can do with them. Maybe what I am asking for isn't realistic" (interview with Phyllis, utilizer). However, other teachers have an idea of how computers can make the curriculum exciting, yet they believe they don't have the knowledge or training to begin changing their teaching to integrate computers.

> The kids would be more excited about what they are learning, using their time wisely, and it would also mean that the teachers would be excited about doing something more than teaching in the conventional way. I see it as something that could change the traditional way we teach, not that some of the traditional things aren't good. But this would let kids do research and motivate them to brainstorm and develop new ideas of learning and problem solving. We don't have the tools or knowledge to do it at this time. We need these and a mentor or someone to provide that personal extra training. (interview with Brandy, utilizer, 139-145)

Research agrees that computer training programs need to be related to the curriculum and activities taking place in the classroom [Lee, 1997 #152; Moursund,

1999 #145; Solmon, 1998 #159; U. S. Department of Education. National Center

for Education Statistics, 1999 #147]. Unless this connection is made teachers will

not perceive a relationship between computer technology and the curriculum, and

they will not develop the self-competence necessary to integrate computers into the

teaching process.

> A core argument is that unless professional development programs
> are carefully designed and implemented to provide continuity
> between what teachers learn and what goes on in their classrooms,
> these activities are not likely to produce any long-lasting effects on
> either teacher competence or student outcomes. In other words, as
> traditionally practiced, professional development activities may lack
> connection to the challenges teachers face in their classrooms (U. S.
> Department of Education, National Center for Education Statistics,
> 1999, p. 36).

Teachers at the integration level knew computer technology could be used

to teach the curriculum. However, they also recognized the training they were

receiving was not meeting this need.

> I would design it [a training program] so that it would fit into the
> curriculum that I know they [teachers] are already responsible for.
> For example, if I know fourth grade is teaching Oregon history, I
> would make sure of the kinds of things were available for them to do
> Oregon history. I would dig up some Oregon geography and I would
> look up some web sights for them that I knew the kids would be
> successful getting to, [something] that had to do with what they
> were already doing [in the classroom]. The same thing for science.
> Sense the district is saying you will be teaching these three science
> units a year that you will have specific [Internet] cites available....
> They're the sorts of things that are real hands on and real useful for
> the classroom teacher to use, I would be more likely to use them.
> (interview with Mary, integrator, 21-28)

> There are different areas teachers need to be educated on. Like they
> need to know how to use the computer for paper work. To do things
> like the benchmarks, report cards, and they also need to know how
> to integrate it into the curriculum. They need to be taught how, if
> you're going to do something, how could you do it instead on the

computer?... [However,] most computer stuff [training] we have
had in the last year has been nothing but how to use the computer
for computerized report cards and learning how to do [record and
score] the benchmarks. (interview with Kate, integrator, 102-112)

Many problems regarding relevancy of training can be solved, according to

some of the teachers, by simply asking them about training. "You need to train

them in areas that they want training in" (interview with Jan, integrator). Chris, a

nonuser suggested the following ideas:

I think they should probably have one person in charge per school,
and send that person once in awhile to ask questions, don't wait for
us to ask. Go to the schools and say 'how are you doing with the
computers, do you need any help? Do you know how to do your
email? Or I am available these days, do you need something
[training in some area]?' Because sometimes we are so busy. We
don't have time to ask for help, we just forget it. We should have a
person come around and ask and schedule a time that is convenient,
and maybe they could find out what training we want, and when we
want it. (76-81)

The teachers in this study presented the following ideas to improve their

training and to motivate other teachers to integrate computer technology into their

teaching.

- Provide training at the teacher's school or the nearest school possible.

- Provide training during school hours by having students stay home for

  half or full days, or hiring substitute teachers who bring pre-developed

  lessons to teach students.

- Survey staff members to determine their training needs, convenient

  training locations, and time.

- Pretest teachers to determine their skill and knowledge level for training and group them accordingly.

- Provide training for teachers based on their grade level, and computer skill and knowledge level.

- Provide training that is relevant to the district curriculum and ensure teachers can understand the relationship between the training and computers.

- Provide training by grade level on how district curriculum, state tests, and benchmarks requirements are inter-related and how the requirements can be met using computer technology.

- Provide training using specific programs that can meet the above requirements. If the software is not commercially available, design and produce user friendly software that is appropriate.

- Provide workshops where software vendors demonstrate their software and how it relates to the district curriculum, state tests, and benchmarks at the teacher's grade level. Computers would be set up to allow teachers hands on experience with the software.

- Have district personnel present five minute 'techno-tips' (i.e., motivating uses for computer technology related to the curriculum), at the beginning of staff meetings each month.

- At the conclusion of every training session, a comprehensive reference packet (i.e., reference sheet) should be given to everyone taking the training.

- Provide incentives for teachers attending training sessions in the form of money, CD-ROMs, computer equipment, college or in-district credit, or a certificate of accomplishment.

Support

The third area of institutional limitations is support. For over a decade studies have shown, in order for teachers to successfully learn how to integrate computers into the teaching and learning process they must have a strong support system (President's Committee of Advisors on Science and Technology, Panel on Educational Technology, 1997). "Our teachers need more support and collaboration than ever to get high standard in the classroom and address more diverse students, technology, and a growing list of other demands that we as a society place on them" (Riley, 1999).

One of the greatest limitations within the support area mentioned by seven of the teachers (2 nonuser, 3 utilizer, 2 integrator) was the perception that there were no known resource personnel in the district that would provide help with computer problems when they developed. "It does take time to learn to use technology, and frustration sets in very quickly when the technology does not work as they expect and there is no immediate help to solve their problems" (O'Bannon

et al., 1998). Without support, when the computer breaks down the lower the teachers' skills, the more likely they will abandon the use of technology and return to the traditional teaching skills with which they are comfortable (Lee, 1997; Veen, 1993). This is particularly true for teachers at the nonuse and utilization levels. "When teachers first commence to use computers they like to know that help is there. If help is available along the way, teachers can progress smoothly from one learning stage to the next.... Supporting the continual development of teachers is critical" (Lee, 1997).

> One of the most frustrating things is: a) I tried something and it
> didn't work and I don't know why, b) I know what I was doing, I
> tried it, but all of a sudden my computer said not enough memory.
> Now what do I do? There are other scenarios but it is frustrating to
> have something not work and not know how to fix it. That is why
> many don't use computers, because it is frustrating. (interview with
> Brandy, utilizer, 85-88)

Another area of support presented by five teachers was to establish a mentor program. Mentoring can have a significant influence on teachers' attitude and desire to integrate computers into the teaching and learning process (MacArthur et al., 1995). Districts instituting mentor programs have shown that "70 percent of teachers who were mentored at least once a week reported that it improved their teaching 'a lot'" (U. S. Department of Education, National Center for Education Statistics, 1999). Mary (integrator) stated, "it would work if we could do a mentoring program." Jo, a teacher at the utilizer level also liked the idea of a mentor program.

> I think the mentoring would be great, if there is a regular time set
> up, just like staff meetings, where you would let the mentoring
> session happen. And then sharing, not only with each other, but with

a bigger group. I would really enjoy it. Having the opportunity to
have that feedback with each other on how we are doing. Maybe we
could start it off with a pilot program, like we do with student
teachers. It would be nice to be able to do this and have the time to
do it. (124-130)

Support can also be provided through a number of other methods. To encourage teachers to integrate computer technology into the teaching and learning process, the nine teachers interviewed for this study suggested developing a strong support base using the following strategies.

- Establish a resource person at the district level to troubleshoot hardware and software problems.

- Staff a half time resource person at each building to answer computer questions. This individual could also provide individual and group training as needed and compile reference list of grade and curriculum appropriate Internet sites, CD's, and computer programs and games.

- Develop a one-on-one mentor program using teachers who are recognized by their peers as teachers who integrate computers into their teaching, and have them mentor volunteer teachers at the utilization and nonuse levels.

- Allow elementary schools to have a common preparation time every day to share information about software and ideas on how to integrate computers into their teaching.

Leadership

Eight out of the nine teachers interviewed (2 nonuser, 3 utilizer, 3 integrator) believed that the building principal should be the leader in providing the vision that is necessary for teachers to integrate computer technology into the teaching and learning process. "School and district administrators have the capacity to increase the number of teachers engaged in more efficacious teaching practices involving computers" (Becker, 1994b). With a strong vision, communication skills, and commitment, the principal can model the use of technology, and set the tone of how teachers perceive the use of computer technology in their teaching. "Studies by educational foundations, like Ford and Carnegie, have shown that individual principals are the most important element in school change and reform, and innovation" (Davis & Botkin, 1995, p. 135).

The following potential strategies for leaders were suggested by eight of the teachers interviewed (2 nonuser, 3 utilizer, 3 integrator). They believed if school and district administrators followed these strategies, these leaders may influence teachers to integrate computers into the teaching and learning process.

- Building administrators should be an example and model for teachers through their use of computer technology. They could also serve as a resource for teachers, encouraging them to use computers and acting as a facilitator.

- District and building administrators should keep records of the teacher's training and feedback on appropriateness.

- District and building administrators should provide recognition to teachers who spend extra time to learn how to integrate computer technology into the teaching and learning process. Recognition can be in the form of certificates, additional computers and equipment, and computer software.

Institutional limitations create barriers to the integration of computer technology into the teaching and learning process in the areas of equipment, training, support, and leadership. Individually these barriers may limit teachers ability to integrate computers into the teaching process, collectively they can stifle a teacher's desire to use computer technology in any form. "What the best teachers can do is limited by the context in which and by which much of the culture of schools is shaped – circumstances that lie largely beyond their making and remedying" (Goodland, 1994, p. xiv). Part of this problem is that "educational systems are themselves highly institutionalized, in the grip of their own values" (Bruner, 1996, p. 32). Because educational reform did not occur at the grass roots level, legislators set plans in motion to force a shift in the institutional paradigm, mandating changes from outside the institutions. These changes include the Oregon state tests and the benchmarks.

Legislative Mandates

In an effort to respond to societal expectations demanding an improvement in the educational system, the state of Oregon began developing what is referred to

as the Oregon Benchmarks (i.e., performance based educational standards for students in English, mathematics, science. and social sciences). To this end, the Oregon Department of Education formed committees composed of teachers, curriculum specialist, school administrators, parents, business and industry representatives and others. While these changes were intended to revitalize the educational system, they have, according to all nine of the teachers interviewed, almost paralyzed the teachers use of computer technology.

> Educational reformers and instructional designers may be facing resistance from experienced teachers who hold opposing views concerning the classroom learning environment. Many popular reform ideas call for instructional programs that represent a break from the traditional objectivist curriculum while teachers may be philosophically opposed to such changes. (Hannafin, 1999, p. 12)

While none of the teachers in this study said they were philosophically opposed to the Oregon benchmarks and state testing, they did indicate that teachers "were putting all of their interest into the benchmark workshops, and they say they don't have time to do or learn anything else" (interview with Jan, integrator). For example, Chris felt the benchmarks were taking time away from her ability to teach her regular curriculum.

> This year I am taking an hour a week that I use to do something else to plug in [the benchmarks]. So my Social Studies, I probably won't make it to the immigration because I have to do something else. You have to take from one area and put it into another. You end up shorting something to put in computers or do things for the benchmarks. (interview with Chris, nonuser, 67-70)

While the integration of computers into the teaching and learning process continues to be an important goal for some of the teachers, they do not believe they have the time available to use computers in the teaching process.

> It is not a lack of wanting to [use computers], I think it is a matter of the ability of what are our requirements in terms of a teacher. I feel no lack of motivation. I think it is a matter of, what are the realities of this job. Especially as the state assessment test [and benchmarks] began to drive our curriculum more and more. I see less time available to use the technology end of it. (interview with Jo, utilizer, 5-8)

Perhaps the effect of benchmarks was best expressed by Phyllis describing her perception of the benchmarks impact on teachers in the Eugene School District.

> I see people really narrowing down their focus.... Computers use to be the thing. People [teachers] were going to workshops and being trained, but not now. At this particular stage of education's growth I don't think the computers are going to be that important to what we do with our job [teaching]...because the benchmarks are taking all of the time.... Every time I go to a workshop on the benchmarks teachers are saying, where is the joy of teaching? Well, it's not there. You can't do imaginative fun kind of things, I feel, and I hear that from more and more people. No time for art, no time for social studies, no time for, I won't call them extras, but even integrating is difficult. When you have two difficult things you have to do benchmarks and you don't have to integrate. I let what I don't have to do slide back. (integrator, 76-89)

Information obtained in the interviews indicates that all nine of the teachers view the school and district curriculum, state tests, benchmarks, and computer technology as separate, unrelated areas. To reduce the paralyzing impact of the legislative mandates, the teachers interviewed suggested the following strategies to integrate computer technology with educational reforms.

- Develop training sessions for teachers showing how the curriculum, state tests, and benchmarks interrelate and how the requirements can be met using computer technology.

- Provide or develop software and Internet site resources and train teachers how to use computer technology in these areas to meet the above requirements.

Information obtained from this study suggests for integration of computer technology to occur, a systematic approach is required which incorporates the three areas of societal expectations (i.e., integration of computer technology), institutional limitations (i.e., equipment, training, support, and leadership), and legislative mandates (i.e., Oregon state tests and benchmarks). The start of the resolution to remove the barriers from teachers who do not integrate computers into the teaching and learning process may have been stated by Boyer (1988).

> We are troubled that the nation's teachers remain so skeptical. Why is it that teachers, of all people, are demoralized and largely unimpressed by the reform actions taken [thus far]?... The reform movement has been driven largely by legislative and administrative intervention. The push has been concerned more with regulation than renewal. Reforms typically have focused on graduation requirements, student achievement, teacher preparation and testing, and monitoring activities. But in all these matters, important as they are, teachers have been largely uninvolved...Indeed, the most disturbing finding in our study is this: Over half the teachers [surveyed] believe that, overall, morale within the profession has substantially declined since 1983...What is urgently needed—in the next phase of school reform—is a deep commitment to make teachers partners in renewal at all levels...The challenge now is to move beyond regulations, focus on renewal, and make teachers full participants in the process. (as cited by Bruner, 1996, p. 85)

Conclusions

Although this study is limited to a small sample within a single school district located in Oregon, recent studies suggest these same problems in

institutional limitations (i.e., equipment, training, support, leadership) and legislative mandates (i.e., educational reform) are common throughout the United States (Moursund & Bielefeldt, 1999; Solmon, 1998; U. S. Department of Education, National Center for Education Statistics, 1999). This study indicates that the effort to integrate computer technology into the teaching process by teachers in grades K-5 in the Eugene School District has not been successful.

How can teachers such as those used in this study meet the societal expectations of integrating computer technology into the teaching and learning process while overcoming the barriers to technology created by institutional limitations and legislative mandates?

Teachers and administrators need to give thought to how societal expectations, institutional limitations and legislative mandates can work together. The resolution to the barriers will be complicated as educators struggle to blend the demands of computer technology, equipment, training, and support, with state benchmarks. "The truly educated person understands how multifaceted are the goals of education in a free society, and how complex are the means" (Reich, 1992, p. 226). The nine teachers in this study indicated that they needed help with the institutional limitations which they perceived as mitigating against the integration of technology into the teaching and learning process. The nine teachers in this study considered the curriculum, state tests, benchmarks, and integration of computer technology as four separate areas within their teaching responsibilities. Figure 1 is presented to allow the reader to gain a better understanding of the

teachers' perceptions. When most teachers first receive computers they commonly view it as an add-on to their curriculum. Something they needed to teach to students even though they may have not understood the technology themselves. When Oregon began requiring state testing, many teachers view it as an add-on to the curriculum. Now in 1999, Oregon teachers are being required to implement state benchmarks, which they view as an add-on to the curriculum.

The teachers in this study are viewing the integration of computer technology, their curriculum responsibilities, and benchmarks as separate and unrelated responsibilities imposed upon them. They believe they have little control over the institutional limitations and legislative mandates that are handed down to them from the state.

The following model (Figure 1) illustrates the current perception by the nine Eugene grade K-five teachers of the barriers to the integration of technology into the teaching and learning process. The perception of the nine teachers in this study shows an opposing relationship between the institutional limitations (i.e., lack of equipment, support, leadership, and relevant training) and the legislative mandates (i.e., benchmarks and state tests). This perceived opposing relationship has, according to these teachers, created a work overload in the teaching process, forcing a reduction in the integration of computer technology into the teaching and learning process.
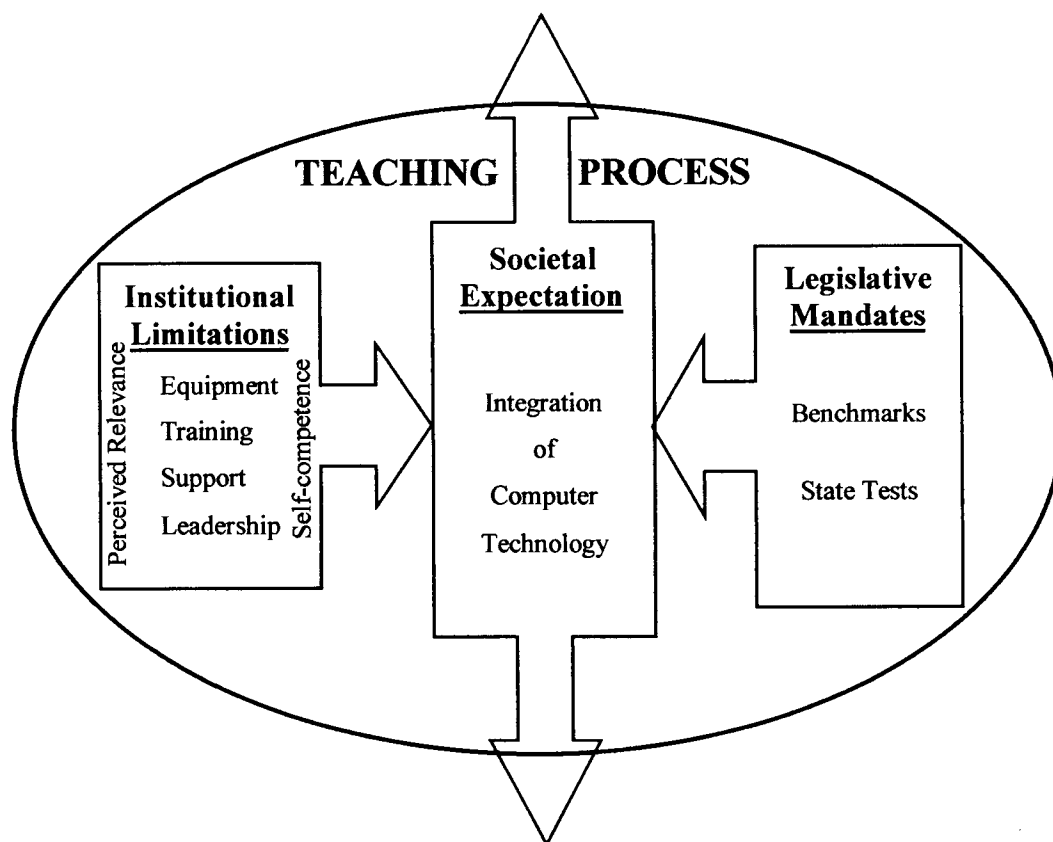
Figure 1. Teachers' (*n* = 9) opposing relationship between teachers' work load and the integration of technology.

It is therefore recommended that educational leaders step forward and provide teachers with training and support, which demonstrates how the curriculum, state tests, and benchmarks can be aligned. When this occurs, a more systematic approach to teaching and learning which integrates technology will be intricately woven into the fabric of the classroom (Figure 2).
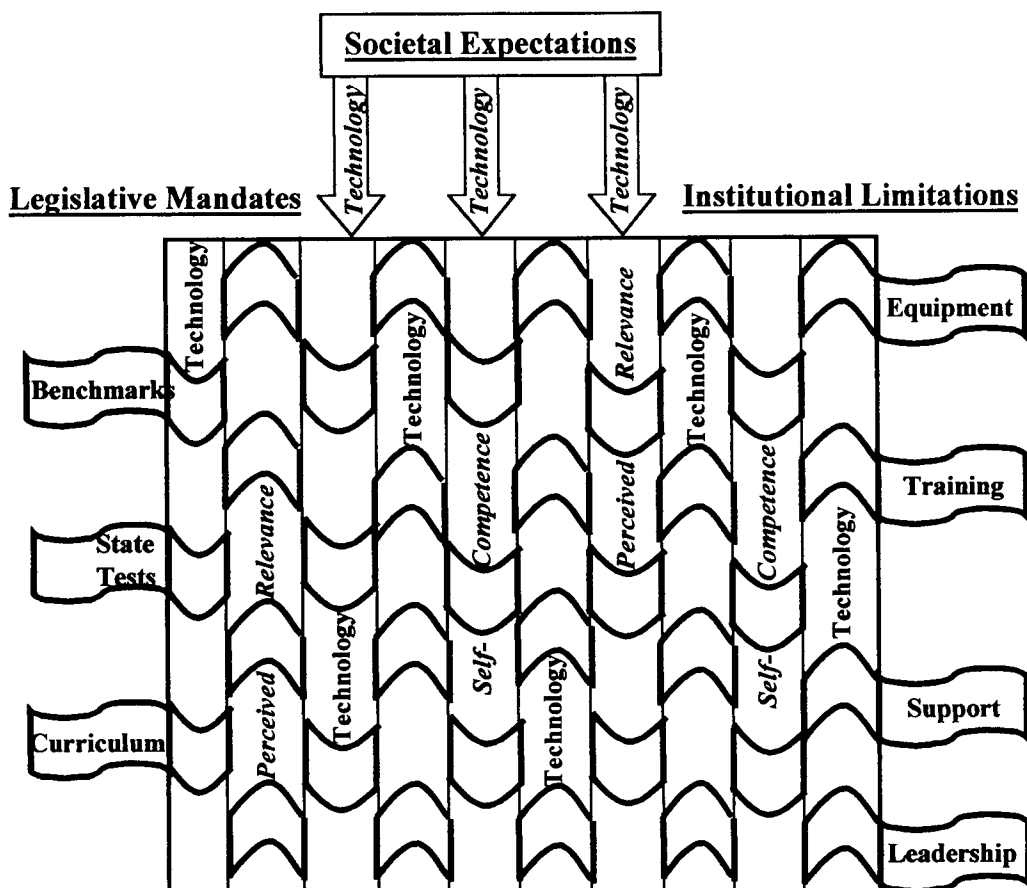
Figure 2. Weaving together societal expectations of technology integration with institutional limitations and legislative mandates to create perceived relevance and a systematic approach to integrating technology into the teaching and learning process.

Considering the strong societal expectation to incorporate computer technology into the teaching and learning process and the billions of dollars being spent, school districts should consider barriers that institutional limitations and legislative mandates may pose. This research suggests that school districts should

have a comprehensive systematic plan describing how they will blend the multi-facets of equipment, training, support, leadership, and educational reform together.

The integration of computer technology may have a greater chance of success when school leaders provide sufficient equipment with relevant training and support, and address the impact and relevancy of educational reform at the same time. Without appropriate consideration and application of all of these factors, computers may continue to be underutilized by teachers and the goal of full integration of computer technology into the teaching and learning process may still be decades away.

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APPENDICES

Appendix A

Microcomputer Use Questionnaire

Microcomputer Use Questionnaire

Read the following statements. To what degree do you agree that each statement is true about you? Circle the letter which most closely corresponds to your degree of agreement. Agreement is rated along a 7–point scale from **A** for *strongly agree* to **G** for *strongly disagree*.						
A Strongly Agree	**B** Agree	**C** Moderately Agree	**D** Undecided	**E** Moderately Disagree	**F** Disagree	**G** Strongly Disagree

1. I am generally cautious about accepting new ideas.

A Strongly Agree	**B** Agree	**C** Moderately Agree	**D** Undecided	**E** Moderately Disagree	**F** Disagree	**G** Strongly Disagree

2. I rarely trust new ideas until I can see whether the vast majority of people around me accept them.

A Strongly Agree	**B** Agree	**C** Moderately Agree	**D** Undecided	**E** Moderately Disagree	**F** Disagree	**G** Strongly Disagree

3. I am aware that I am usually one of the last people in my group to accept something new.

A Strongly Agree	**B** Agree	**C** Moderately Agree	**D** Undecided	**E** Moderately Disagree	**F** Disagree	**G** Strongly Disagree

4. I am reluctant about adopting new ways of doing things until I see them working for people around me.

A Strongly Agree	**B** Agree	**C** Moderately Agree	**D** Undecided	**E** Moderately Disagree	**F** Disagree	**G** Strongly Disagree

5. I find it stimulating to be original in my thinking and behavior.

A Strongly Agree	**B** Agree	**C** Moderately Agree	**D** Undecided	**E** Moderately Disagree	**F** Disagree	**G** Strongly Disagree

6. I tend to feel that the old way of living and doing things is the best way.

A Strongly Agree	**B** Agree	**C** Moderately Agree	**D** Undecided	**E** Moderately Disagree	**F** Disagree	**G** Strongly Disagree

7.   I am challenged by ambiguities and unsolved problems.

A Strongly Agree	B Agree	C Moderately Agree	D Undecided	E Moderately Disagree	F Disagree	G Strongly Disagree

8.   I must see other people using new innovations before I will consider them.

A Strongly Agree	B Agree	C Moderately Agree	D Undecided	E Moderately Disagree	F Disagree	G Strongly Disagree

9.   I am challenged by unanswered questions.

A Strongly Agree	B Agree	C Moderately Agree	D Undecided	E Moderately Disagree	F Disagree	G Strongly Disagree

10.   I often find myself skeptical of new ideas.

A Strongly Agree	B Agree	C Moderately Agree	D Undecided	E Moderately Disagree	F Disagree	G Strongly Disagree

11.   I believe that the use of microcomputers is relevant to teaching.

A Strongly Agree	B Agree	C Moderately Agree	D Undecided	E Moderately Disagree	F Disagree	G Strongly Disagree

12.   I believe that I am capable of using microcomputers competently in teaching.

A Strongly Agree	B Agree	C Moderately Agree	D Undecided	E Moderately Disagree	F Disagree	G Strongly Disagree

For items 13–16, select the one statement that is truer for your situation. In the box located under the statements, circle either **A** or **B**. NOTE: If you do not use microcomputers for teaching at all, mark **C**.

13.   a.   In my instruction, the use of the microcomputer is supplemental.
      b.   The microcomputer is critical to the functioning of my instruction.

A	B	C

14.   a.   The use of the microcomputer is not essential in my instruction.

b. For my teaching, the use of the microcomputer is indispensable.

A	B	C

15. a. The microcomputer is critical to the functioning of my instruction.
    b. The use of the microcomputer is not essential in my instruction.

A	B	C

16. a. For my teaching, the use of the microcomputer is indispensable.
    b. In my instruction, the use of the microcomputer is supplemental.

A	B	C

17. Complete this statement. "If all the microcomputers were suddenly removed from my school,...
    a.   ...it would have a significant impact on the way I teach."
    b.   ...it would have little effect on the way I teach."
    c.   ...it would have no effect on how I teach since I seldom if ever use computers."

A	B	C

18. Please indicate your age.

    Age _____

19. Please indicate the number of years of experience you have had with computers.

    Years of computer experience _____.

20. Please indicate the grade level you teach.

    Grade level taught _____.

21. Please indicate the number of years of teaching experience you have.

    Years of teaching experience _____.

22. Please indicate your gender. Circle the appropriate response below.

    Female   Male

23. Complete this statement. "The microcomputers accessible for teaching my students are located in, ...
    a.   ...my classroom."
    b.   ...a microcomputer lab."
    c.   ...in another teacher's classroom."

A	B	C

Appendix B

Interview Request Form

Control Number _____

Interview Request Form

It important to determine why teachers use (or do not use) computer technology in the teaching and learning process. While the questionnaire provides some information on what influences teachers to use computers, I would also like to interview at least nine teachers (out of 120 in this study) using computers at different levels (3/integration, 3/utilization, and 3/nonuse). If selected, would you be willing to meet with me at a convenient time for an interview (45 minutes maximum)? All information provided in the interview will remain confidential. In addition, teachers participating in the interviews will receive two additional educational CDs.

_____ Yes, I am willing to participate in an interview, if selected.

_____ No, I would prefer to not participate in an interview.

Please print your name _____ .

PLEASE REMOVE THIS PAGE FROM THE QUESTIONNAIRE, FOLD IT IN HALF, AND TURN IT IN SEPARATELY FROM THE QUESTIONNAIRE.