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Factors affecting computer implementation and impact on teaching and learning in northeast Louisiana

Ruth Bonner-Thompson
Louisiana Tech University

FACTORS AFFECTING COMPUTER IMPLEMENTATION AND IMPACT ON TEACHING AND LEARNING IN NORTHEAST LOUISIANA

by

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We hereby recommend that the dissertation prepared under our supervision

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Doctor of Education

Carolyn Talton
Supervisor of Dissertation Research

Head of Department

Curriculum, Instruction, & Leadership
Department

Recommendation concurred in:

Advisory Committee

Approved:

Director of Graduate Studies

Dean of the College

Approved:

Director of the Graduate School

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ABSTRACT

Ruth Bonner-Thompson

Factors Affecting Computer Implementation and Impact on Teaching and Learning in Northeast Louisiana

(Major Professor: Carolyn Talton, Ed. D.)

This study investigated the relationship between degree of computer implementation and (a) teacher personal use of computers, (b) teacher motivation, (c) curriculum integration training, and (d) curriculum integration support. The study also investigated the relationship between degree of computer implementation and (a) collaborative learning, (b) self-directed learning, (c) active learning, and (d)teacher practices. An analytical survey provided a numerical description of how the independent variables and the dependent variables were related in the population.

Quantitative data were analyzed using the following statistical procedures: (a) Mann-Whitney U test to determine the relationship between teacher motivation and degree of computer implementation, and to determine the relationship between frequency of teacher personal use of a computer and degree of implementation; (b) Kruskal-Wallis One-way Analysis of Variance by Ranks to determine the relationship between curriculum integration support and degree of implementation, and to determine the relationship between curriculum integration training and degree of implementation; (c) Pearson Product-Moment Coefficient of Correlation to determine the relationship between degree of implementation and (1) collaborative learning, (2) self-directed learning, (3) active learning, and (4) teacher practices; and (d) Stepwise Multiple

Regression Analysis in a post hoc analysis to determine how the variables teacher motivation, teacher personal use of computers, curriculum integration training, curriculum integration support, collaborative learning, self-directed learning, active learning, and teacher practices relate to or predict the degree of implementation.

Participants were teachers in grades 9-12 in public schools in northeast Louisiana. Forty-four schools were randomly selected to participate. Six hundred sixty-three teachers were given surveys and 445 teachers responded for a 70% response rate.

Results demonstrated a significant relationship ($p \leq .05$) between degree of computer implementation and (a) teacher personal use of computers, (b) curriculum integration training, and (c) curriculum integration support. No significant relationship was found between teacher motivation and degree of implementation. A significant relationship ($p \leq .01$) was found between degree of computer implementation and (a) collaborative learning, (b) self-directed learning, (c) active learning, and (d) teacher practices. Stepwise Multiple Regression Analysis showed self-directed learning, curriculum integration support, and teacher practices to be significant predictors of degree of computer implementation.

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CHAPTER 1

THE PROBLEM

Over the past decade, school systems across the United States have built impressive stockpiles of educational technology. The Goals 2000: Educate America Act pushed educational technology into the forefront of reform agendas. The Act urged each state to develop technology plans describing how they would support systemic reform through the use of technology (Glennan & Melmed, 1996; Kinnaman, 1994).

In 1996 the state of Louisiana embarked on a mission to upgrade public education and improve student achievement through a comprehensive, long-term plan entitled *LEARN for the 21st Century*. One of 11 objectives articulated in the plan was that all teachers and learners should have access to and be able to use technology effectively. The state technology plan which followed called for continuous and dynamic planning, and the meshing of educational technology, professional development, and curricular revision to accomplish the immediate end of improving student achievement and the ultimate end of preparing students to be responsible citizens in the information age (Louisiana Department of Education, 1996).

Many educational leaders contend that computer technology can serve as the catalyst for change necessary to transform classrooms from teacher-centered to student-centered learning environments, fostering student-directed learning, enhancing problem-solving skills, and developing critical thinking abilities far more effectively than other kinds of mediated interaction. Extremely optimistic claims are being made about how computer-based multimedia will transform American schools, with proponents of computer technology arguing that the design and use of the these media reflect and support cognitive science perspectives on teaching and learning (Braun, 1993; McGrath, 1998; Rice & Wilson, 1999; Weiss, 1994).

As in many other instances, however, what we believe to be true about a tool that could possibly be utilized to support or enhance educational goals and the reality of the classroom may be worlds apart. Lippman (1998) examined factors that influence the integration of computer technology in "technology rich" public schools in New Jersey. The survey technique and in-depth follow-up interviews were used to collect data from teachers and administrators. The study supported other research that has evidenced that even though many states, districts, and schools have made enormous investments in educational hardware and software, relatively few are actually using computer technology in the process of teaching and learning. In a case study examining the implementation of computer technology from both district and school perspectives, Quinlan (1997) found that even when schools utilize computer technology as a tool in teaching and learning processes, computers are often used to improve current instructional practice rather than explore new educational methods that might prove superior to old ones.

In an effort to move the "should be" or "could be" closer to the reality for which educators are hoping, administrators and technology leaders must have the necessary data to determine the following: What technologies are teachers currently using and for what purposes? What motivational and environmental factors appear to constrain or facilitate the transfer of technology skills and knowledge into the classroom environment? and What types of training and support result in more teachers utilizing the possibilities offered by computer technology to improve student learning experiences and teacher practices as well as to accomplish national, state, and local educational goals?

In a qualitative case study approach which examined how two teachers integrated computer usage into their instruction over time, Lecuyer (1997) found evidence that neither the mere presence of computers in classrooms nor existence of technology training for teachers assures that teachers will find technological tools an effective way to support and promote the curriculum they are required to teach. The research indicated that the computer learning process for teachers is long and gradual, and that teachers not only need to increase their own expertise with computers, but also need to learn how to use them effectively in instruction before they can successfully incorporate computer technology into the classroom as a tool to enhance student learning experiences and teacher practices.

Statement of Problem

Historically, the initial responses to most technologies introduced into American schools have been overly enthusiastic and full of expectations of profound change that failed to actualize. Because of this historical pattern of overstated expectations and disappointing outcomes, it is important for educators proceed with caution, utilizing research on best practices to avoid the pitfalls that have doomed other reform movements. Maddux (1994) and Noble (1996) purport that recent directives from the national level may set unrealistic goals regarding the use of computers in the classroom, and that without cautious planning, extensive teacher training, and follow-up support systems, this reform effort will not have a significant impact on school effectiveness.

Cuban (1990), Fullan (1985), and Hall and Hord (1987) examined numerous reform efforts, few of which have resulted in authentic change. Failure of these planned educational changes has been linked to lack of proper implementation of the innovations (Fullan, 1982; McLaughlin, 1990; Seidel & Perez, 1994). When schools and school systems attempt to institute change, it is necessary that leaders and other participants in the process understand circumstances under which authentic change will or will not likely take place.

The strategies used for training teachers to utilize teaching and learning tools have often been a major barrier in historical efforts toward educational change. Based on a study investigating the role of computer coordinators in the implementation of computer technology as a tool for school improvement and reform, Vojtek (1998) concluded that technology training should be imbedded in content and research-based instructional strategies, and that teachers must have time to learn, plan, and practice new instructional strategies with continued support. Observations and interviews conducted with seven professionals (technology coordinators, administrators, and teachers) in five Oregon school districts, however, supported previous research indicating that staff development efforts are often piecemeal and not connected to core curriculum or research-based instructional practices.

The problem addressed in this study was: What combination of motivational and environmental factors appears to facilitate the implementation of computers into the curriculum as a teaching and learning tool? When computers are used in the classroom as a teaching and learning tool, does their use bring authentic change in teacher practices and student learning experiences? If the use of computers and computer peripherals in the classroom does not support or contribute to the creation of a more constructivist, student-centered, active learning environment, then computers may well be added to the growing monument of tools which, hailed as the salvation for the American educational system, proved merely additional venues for continuing traditional practices.

Purpose of Study

The purpose of this study was to examine motivational and environmental factors (teacher motivation, curriculum integration training, curriculum integration support, and teacher personal use of computers) that have been demonstrated through research as likely to constrain or facilitate the implementation of computer technology into the curriculum. The study also examined changes to the learning environment in terms of student activities and teacher practices that may be associated with the implementation of computer technology into the curriculum.

The study was conducted with teachers in grades 9-12 in selected school districts in northeast Louisiana. Following the approval of the state technology plan, local technology plans were developed and implemented at system and school levels. Since the implementation process is unique to each local system, a closer look at individual change processes is necessary to tailor plans to meet local needs. If an innovation is not implemented and accepted by the smallest unit affected by change, then the expected outcome is not likely to be realized (McLaughlin, 1989).

Ongoing data collection for decision-making purposes is necessary so that initial plans can be modified to target areas of weakness in the change process. Many decisions regarding the use of computer technology as a teaching and learning tool are made at the local level. For example, local systems are responsible to a great extent for locating funding to implement projects and for providing teacher training and follow-up support. Decisions are also made at the local level regarding the purchase of the hardware and software that will be used by teachers in the classroom to enhance teacher practices and student learning experiences (Cage, Bienvenu, Hoover, & Thomas, 1998).

Since the nature of change is unique both to individuals and organizations, it is difficult, if not impossible, to replicate a change plan at another location in another time (Sarason, 1990; Bitner, 1994). Commonalities among the schools and districts in northeast Louisiana, including economic and structural factors, provide reasoning for looking at this group of schools separately from districts in other regions of the state. The results of this study will help local technology leaders and individual schools identify areas of weakness in technology plans and implementation processes which may be unique to this region. These areas can then be targeted for support and/or alteration. These researched-based efforts of formative evaluation during the change process will increase the likelihood of fulfilling the original objective of implementing computer technology into the classroom--improving student achievement and preparing students for responsible participation as citizens in the Information Age.

Research Questions

The following research questions were formulated regarding this study:

1. Does a significant relationship exist between teacher motivation to use computers and degree of implementation of computers into the curriculum?

2. Does a significant relationship exist between a teacher's personal use of computers and degree of implementation of computers into the curriculum?

3. Does a significant relationship exist between teacher training and degree of implementation of computers into the curriculum?

4. Does a significant relationship exist between curriculum integration support and the degree of implementation of computers into the curriculum?

5. Does the integration of computer technology into teaching and learning activities influence patterns of student/teacher interactions?

6. Does the integration of computer technology into teaching and learning activities tend to create a more constructivist, student-centered, active learning environment?

Statement of Hypotheses

The following null hypotheses were developed regarding this study:

Hypothesis One: There is no significant ($p \leq .05$) difference in degree of implementation of computers between teachers who are highly motivated and teachers who are moderately motivated to use computer technology as a teaching and learning tool.

Hypothesis Two: There is no significant ($p \leq .05$) difference in degree of implementation of computers between teachers who frequently use and teachers who do not frequently use computers at home.

Hypothesis Three: There is no significant ($p \leq .05$) difference in degree of implementation of computers among teachers who have received much curriculum integration training, a moderate amount of curriculum integration training, and little curriculum integration training.

Hypothesis Four: There is no significant ($p \leq .05$) difference in degree of implementation of computers among teachers who receive much curriculum integration support, a moderate amount of curriculum integration support, and little curriculum integration support during the implementation process.

Hypothesis Five: There is no significant ($p \leq .05$) relationship between degree of implementation of computers and the use of computer technology for collaborative learning.

Hypothesis Six: There is no significant ($p \leq .05$) relationship between degree of implementation of computers and the use of computer technology for self-directed learning.

Hypothesis Seven: There is no significant ($p \leq .05$) relationship between degree of implementation of computers and the use of computer technology for active learning.

Hypothesis Eight: There is no significant ($p \leq .05$) relationship between degree of implementation of computers and change in teacher practices.

Significance of Study

Many educators agree that attempting to fit computer technology into an industrial-age model of schooling will not improve education. There must be a commitment to integrate computer technology in new ways which create a system modeled from research supporting the ways that students learn best (Dyrli & Kinnaman, 1994). This process of change is a long-term endeavor. The process must be monitored and adjusted to avoid a repeat of failed attempts to utilize current technologies to transform the teaching and learning process to better meet the needs of students. Extensive planning, appropriate training and follow-up support are necessary to make a reform effort successful. The collection of data to support decision-making processes is critical for short- and long-term planning. Results of this study may be utilized by the participating schools and districts to facilitate this planning process.

While attempts are being made on behalf of local, state, and federal governments to encourage the use of computer technology by teachers and students to accomplish change, common barriers may be hindering the process. Becoming aware of factors that are affecting the implementation of computer technology will help leaders at grass-roots levels to minimize barriers to change and to provide support for successful implementation of computer technology into the curriculum as a tool to improve the teaching and learning process. These data can be used to support decision-making processes, in developing strategies for change, and in choosing appropriate technology models and successfully implementing the models (Hall, 1998). The results of this study will aid teachers, technology leaders, and administrators in northeast Louisiana in making crucial decisions related to the implementation of computers into the curriculum as a teaching and learning tool. Careful planning based on research findings is especially important in an area where the largest school and district-level budgets could be described as limited. Funding for training, support, equipment, and software is often inadequate, and provided almost exclusively through grant writing and other state and federal programs (Cage et al., 1998). Formative evaluation is essential to maintain quality programs that will endure long-term.

Definition of Terms

The following terms have been identified and defined to enable the reader to understand this study:

Active learning. Active learning refers to the time when learners are actively engaged with, thinking about, or working with the content that is being presented for them to learn. This is opposed to passive learning in which the learner is listening to the teacher talk about content or reading about content (Borich, 1996).

Collaborative learning. Collaborative learning describes learning activities through which learners apply critical thinking, reasoning, and problem-solving skills in a planned and organized interaction with other learners (Borich, 1996).

Constructivism. Constructivism is a term used to describe a movement in education which encourages more thinking and problem solving by requiring the learner to use personal sources of knowledge to actively construct his or her own interpretations and meanings rather than acquiring understanding by giving back knowledge already organized in the form in which it was told (Borich, 1996).

Curriculum integration support. In this study, curriculum integration support refers to assistance with lesson planning, with selection of appropriate software, or other instructional and/or curriculum-related support teachers have received from resource personnel during the implementation process.

Curriculum integration training. Curriculum integration training is defined as teacher training in a curricular context which focuses on the development of activities through which computers will be used as a tool to support or enhance teacher practices and student learning experiences in the classroom. Curriculum integration training does not include training with the sole purpose of teaching the participant(s) to use a particular software package or to operate and maintain hardware and peripherals.

Educational technology. In this study, technology will be defined as computers and peripherals used in conjunction with computers.

Implementation. For the purposes of this study, implementation refers to the integration of computers into the curriculum as a teaching and learning tool. This study focuses on the second stage of implementation which follows the acquiring, installing, and scheduling of access to computers. Implementation refers to the incorporation of computers into student learning experiences so that students have the opportunity to utilize computers to accomplish goals. Degree of implementation refers to the number of hours per week that students have the opportunity to use a computer as a learning tool to accomplish educational goals and objectives.

Impact. Impact refers to changes in practice that occur as a result of the implementation of an innovation. In this study, the following areas of impact in regard to the use of computers as a teaching and learning tool are addressed: (a) changes in student learning experiences, and (b) changes in teacher practices related to teachers integrating computers into the curriculum and their accustomed teacher style. Scales are used to identify types of learning experiences in which students are participating, and the frequency with which they participate in each. Another scale is used to measure the extent to which computers have increased teachers' opportunities to do certain types of activities with students and to examine student and teacher interactions.

Innovation. An innovation is an idea, practice, or object perceived as new by an individual or unit of adoption (Rogers, 1995).

Motivation. Motivation is an attitudinal construct that deals with the causes for engagement and performance during goal pursuit. In this study, teacher motivation to implement computers into the curriculum as a teaching and learning tool is assessed through stimulus items regarding task choice, interest and goal value, and self-efficacy.

Self-directed learning. Self-directed learning is a term used to describe student learning experiences which emphasize student decision-making regarding the type and content of the learning experience, and more direct experience, problem-solving, and social interaction for the student, while de-emphasizing the teacher role of lecturing and "telling" (Borich, 1996).

Self-efficacy. Bandura (1986) defines self-efficacy as an individual's judgment of his/her capabilities to perform given actions. For the purposes of this study, self-efficacy will be addressed in terms of whether the teacher feels he or she has the necessary skills to use computer technology in a manner that will benefit teaching and learning processes.

Teacher-centered environment. A teacher-centered environment is one in which the teacher is the major information provider. The teacher utilizes the direct instruction model a large percentage of allotted teaching time, with his or her role being to pass facts, rules, or action sequences on to students in the most direct way possible (Borich, 1996).

Assumptions and Limitations

Since the nature of change is so individual, it is difficult, if not impossible, to replicate one change plan in another location at another time. Due to the nature of adaptation and the many discrepancies that arise in attempting to repeat a change plan, Sarason (1990) suggests using the verb *imitate* rather than *replicate* to describe the process of looking at change that has occurred in one place to draw out factors which may facilitate or impede the change process in another location. Therefore, it is not the purpose of this study to propose a plan for change that can be generalized to other locations, but rather to propose suggestions to help facilitate change in the selected school districts in this study. The study is limited to grades 9-12 in schools and school systems in northeast Louisiana. The survey information is of a self-report nature and, therefore, relies on the accuracy of teacher responses. Despite the geographical limitations of this study, the variables examined in this study can be considered relevant in any given situation where teachers are the population, where computers are the innovation, and where the purpose is to identify factors that may facilitate or constrain the implementation of computer technology into the curriculum as a teaching and learning tool.

Overview of Study

Chapter II presents a review of literature related to the implementation of computers into the classroom environment, and the impact of computer technology on student learning experiences and teacher practices. Sub-topics discussed include motivational and environmental factors related to teacher change, implications for the use of computer technology in the classroom, and impact of computer technology on student learning experiences and teacher practices. Chapter III outlines the procedures for conducting this research, including a description of sources of data, the development of the survey instrument, results of the pilot study that was conducted, and treatment of data. Chapter IV presents a brief overview of the study, identifies the population and describes the sample in terms of demographic data collected, briefly describes the instrument used to collect data, identifies and defines methods utilized for data analyses, presents results of analyses of hypotheses, and identifies method utilized and results of the post hoc analysis of data. Chapter V presents a summary of research findings, conclusions drawn from findings, implications regarding findings, and recommendations for further study.

CHAPTER 2

REVIEW OF LITERATURE

Historical Background

The use of computer technology in the classroom and the perceived value of computers to the teaching and learning environment are by no means new concepts. The implementation of computer technology into the classroom as a teaching and learning tool, however, cannot currently be described as a successful venture. During the early 1900s, classroom use of film became a symbol of progressive teaching approaches, just as use of the computer has today (Cuban, 1986). A number studies conducted during the 1930s, however, revealed that teachers used film infrequently, with lack of skills in using the equipment cited by teachers as the primary reason (National Education Association, 1946). Likewise, Woelfel and Tyler (1945) found that even though radio usage in homes had spread rapidly during the 1940s, it had not become an accepted instrument in educational practice. Teachers indicated lack of equipment and instructional skills as reasons for infrequent usage.

During the 1970s, instructional television was promoted as the panacea for educational ills. A number of studies conducted from 1970-1981, however, demonstrated that relatively little instructional time was devoted to the use of this technology. In a preliminary report on the findings of a nationwide survey of the use of instructional television in schools, Dirr and Pedone (1978) reported as little as 2% to 4% of instructional time was being devoted to the use of instructional television. The use of calculators as an instructional tool has never advanced to the level some educators hoped it would. Reys and Smith (1994) suggested teachers' lack of understanding of the role of computational tools and the unavailability of curriculum guidelines for use of the tools as obstacles to the acceptance of these technologies as an integral part of the teaching and learning process.

Implications: The Future Meets the Past

History suggests that whenever a new technology is introduced, an individual's first inclination is to use it as they used the traditional technology it replaced. The case of educational technologies has been no exception (Mean, 1994). Film, radio, instructional television, the calculator, and the computer have all been promoted as educational technological tools to support needed change to the educational system. The implementing of the new technologies, however, has often resulted in teaching and learning strategies and activities no different than the traditional methods (Cuban, 1986; Mergendoller, 1997).

Stakeholders contend that educators must rethink how children are educated if all children are to be successful learners and be prepared for life in a global, technological society (Knapp & Glenn, 1996). Students will be entering a job market wherein 60% of the jobs will require technological competency and where they must have the ability to update their occupational and technological skills in order to be successful (Carlson, 1997). With politicians, business people, and parents across the United States calling for a change, the educational system is currently in the midst of massive restructuring efforts to include the use of computer technology as an important tool in teaching and learning processes. The question that would naturally follow this glimpse into the past is this: Is the current enthusiasm for computers different from the past surge of interest in radio, film, instructional television, and calculators, or is this current reform movement likewise doomed to come and go with little impact to teacher practices and student learning experiences or to the educational system as a whole?

Computers and Education: The Need for Change

Society has moved from the Industrial Age to the Informational Age; the educational system has not. Deal (1986) purported that while there has been an overwhelming amount of activity to make education different (e.g., the Trump Plan of the 1950s; innovation and alternative schools of the 1960s; the reform initiatives of the 1970s; and school improvement, effective schools, and educational excellence movements of the 1980s), the fundamental reality of the classroom and school has remained relatively constant over time. "Classrooms typically resemble their ancestors of 50 years ago more closely than operating rooms or business offices resemble their 1938 version" (Office of Technology Assessment, 1988, p. 1). "Inside classrooms across the country, there is little evidence that any kind of revolution has occurred" (David, 1994, p. 169).

The RAND Report (McLaughlin, 1990) suggested that a revolution in schooling could be brought about by the integration of computer technology into the classroom. Authors of the report identified numerous studies of a wide variety of specific applications of computer technology that demonstrated improvements in student performance, student motivation, and teacher satisfaction. Technology-rich schools reported significant improvements in student motivation and academic outcomes, as well as additional benefits such as students developing problem-solving capabilities and practicing collaboration.

"The revolution started by the printing press was a cow-path compared to the revolution started by electronic advances that have brought us to the Info Superhighway" (Rutherford & Grana, 1995, p. 83). Computer technology has become an indispensable part of the way we live and work. The educational system must accept some responsibility to prepare students for this reality. Grabe and Grabe (1996) expressed urgency for educational technology preparation. They believe that although computer technology already plays an important role in K-12 education, it must pay an increasingly important role in the future. Students who move through the educational system without acquiring technological skills will be at a disadvantage when they compete for better opportunities.

Successful integration of computer technology into education requires basic changes in the current model of schooling (Bain, 1996; Kinnaman, 1994). Charp (1996) declared, "The integration of technology into teaching and learning activities is now an accepted practice. It is ongoing and deemed essential for effective pedagogy" (p. 4). Integrating computer technology should not, however, become an adjunct to teaching. Computers are a powerful tool that can be used to engage students in meaningful learning experiences in conjunction with the pre-existing curriculum. Furthermore, the integration of educational technology allows the organization of the curriculum to interrelate or unify content areas that have traditionally been taught as separate subjects (McGrath, 1998).

Computer technology is not an elixir for curing all educational ills. Computers are merely a medium or a means to the task at hand. Computer technology can do much to activate passive courses, to personalize impersonal classes, to give access to education for those without access, and to better serve special needs populations. Educators should be careful that efforts for reform are not geared toward incorporating computer technology for technology's sake, however, but to improve the educational process (Rutherford & Grana, 1995).

Implementation: Computers, Teachers, and Change

Rutherford and Grana (1995) related the Chinese character for turmoil or potential for conspiracy--three women under one roof--to a similar ideograph for trouble in the educational arena: teachers, computers, and change under one roof. And because it is unlikely that any of the three occupants will leave the academic residence for the sake of achieving harmony, the academic residence, according to Rutherford and Grana, is due for a remodeling. Practices and attitudes must be adapted so that the three can cohabitate in a manner beneficial to teaching and learning processes. The introduction of computers as tools to support teaching and learning activities can only be successful if teachers are willing to accept the implied modifications (Hope, 1997). The most "innovative solutions to practical problems, the best packages of materials, can have no effect on practice if they are not diffused to the level of the practitioner" (Guba, 1968, p. 292). Computer technology may follow in the path of other innovations that never became an integral part of the curriculum unless teachers are convinced to embrace computers as a teaching and learning tool (Ely, 1995).

Asking teachers to integrate computers into the curriculum, not as a tool for drill and practice, but in an attempt to redefine the roles of both students and teachers as a result of the integration, results in a high cost to teachers involved. Teachers may be expected to change the materials they use, their personal approach to teaching, and perhaps some of their basic beliefs regarding teaching and learning. They will asked to throw away proven and trusted techniques for unknown ones. Recent studies show that teachers often do not have specific models on which to base this transition process, or the training and support necessary to facilitate the transformation. Bitner (1994) conducted a pseudoexperimental study that examined change in teachers' concerns and factors affecting this change during the early phase of a district-wide plan to integrate computers into the curriculum. The sample consisted of 86 elementary teachers participating in a summer training program. The Stages of Concerns Questionnaire was used as the pretest and posttest to determine change. At the time of the posttest, each teacher completed a self-report survey to provide data regarding factors affecting change. Analysis of the self-report survey indicated that two of the six factors impeding change were inadequate skills and training and no model to follow.

A study conducted with five teams of administrators and teachers from five different elementary schools documented an attempt on behalf of local, state, and federal governments to encourage the use of computer technology to restructure classroom instruction and to provide new ways for children to learn and teachers to teach. The study employed the development of a problem-based learning module to assist administrators and trainers in the development of a technology plan to met the training needs of a diverse faculty. The study revealed the need for identifying a faculty's level of use of computer technology so that steps could be made for initiating teacher training. The study also demonstrated that administrators need to become aware of how a faculty's concerns and stages of development affect the change process (Hall, 1998).

Rossett (1992) identified (a) a lack of skills and/or knowledge, (b) a flawed environment, and (c) lack of motivation as factors relating to human performance problems in an organizational setting. Selected motivational and environmental factors which may influence the implementation of computers into classroom activities, thereby impacting the teaching and learning environment, will be addressed in a review of teacher concerns as they begin, and continue, an attempt to integrate computers into the teaching and learning process.

Motivational Factors

Motivation is an attitudinal construct that deals with the causes for engagement and performance during goal pursuit. Technology leaders need to identify and begin to understand concepts behind teacher concerns, beliefs, and feelings regarding the use of computers in the classroom. Simply putting pressure on teachers to use computers does not correspond positively with use over time or with successful implementation. Teachers who already fear computers may become even more reluctant to use this technology if they feel it is being imposed on them. Leaders need to recognize teachers' points of view regarding the use of computers, and address issues surrounding teacher feelings as much as possible in order to provide the leadership necessary to make the implementation process a successful one. Teachers must be part of any systematic plan for integrating computers into the classroom (Hope, 1996; Soloway, 1996). Teacher motivation then becomes a primary issue of concern to be addressed in developing strategies to encourage teachers to engage in the process of change, and to continue when obstacles are encountered.

Lowe (1998) surveyed elementary, middle, and secondary school teachers who completed the Apple Classrooms of Tomorrow Teacher Development Center technology training program between 1992 and 1997 in a study that examined factors shown to constrain or facilitate the transfer of computer skills and knowledge from training to the classroom environment. Results of analyses utilizing Pearson Product Moment correlation method and multiple regression analysis supported other research indicating that the mere possession of necessary cognitive skills does not ensure that an individual will implement change (Lowe, 1998). Of seven factors identified as influencing change, teacher motivation was shown to be the highest predictive factor for computer technology implementation. Teachers who demonstrated a strong sense of self-efficacy, who were interested in computers, and who valued using computer technology as a teaching and learning tool demonstrated more frequent use of computers as tools in student learning experiences and teacher practices.

In the Rand Change Agent study, McLaughlin (1990) also found teachers' motivation played an important role in efforts for change. McLaughlin reported that new policies could achieve goals only when local instigators supported the change and were inspired to carry it out. The initiation and implementation phases of planned change receive energy from the motivation of advocates, individuals who believe in the effort and are willing to commit energy and effort to its success. In a national survey conducted to obtain a systematic profile of activities currently being undertaken by kindergarten through grade 12 educators in telecommunications technology, Honey & Henriquez

(1993) reported that the 550 educators from 48 states often indicated that their use of technology was driven by personal interest and motivation, rather than by school and district initiatives. Lippman (1998) likewise found teacher motivation to be a "pervasive" factor influencing the integration of computer technology in technology-rich schools. Both teachers and administrators who participated in the study rated their level of integration consistently with their personal motivation to integrate computer technology into the teaching and learning process.

The two basic elements of motivation that have been identified as influencing change in human performance are task choice and effort (Dweck, 1989). They are both cognitive and affective factors that influence an individual's choice and initiation of tasks, as well as the intensity and persistence with which they pursue the task. The quality and quantity of effort expended by an individual is influenced by his or her self-efficacy, beliefs, attributions, and goals. Each of these factors influences the amount and degree of effort a person will exert over time. Spencer (1995) surveyed teachers attending an intensive training course in computer-aided learning to determine their subsequent use of computers in the classroom, and factors influencing their computer use. Teachers reported an increase of computer use after the training course. Analysis of the data collected from the survey related teacher belief in computer effectiveness, and teacher competence in computer-assisted learning as factors influencing the increase in usage. Personal interest in computer-aided learning was ranked highest among reasons why teachers participated in the training. Spencer concluded that computer use increases when teachers are motivated, and when they receive adequate training.

The fact that teachers have access to computers does not mean that they will choose to use them. Access certainly does not translate into teachers expending the time and effort to accomplish changes in current practices necessary for computers to be used to their fullest potential to accomplish educational goals. Bernauer (1996) found that two problems associated with attempts to introduce computer technology into schools were the lack of use or under-use of available computers and computers being seen by teachers and students as irrelevant to the teaching and learning process. Teachers make conscious and subconscious decisions about whether the effort necessary to utilize computers in the classroom to achieve educational goals is worthwhile, and whether the activities necessary to accomplish these goals are worth the effort expended. In long-term efforts for reform, the task must be of such value as to cause a person not only to engage in a task, but also to persist when obstacles are encountered.

During the change process to incorporate computer technology into teacher practices and student learning experiences, teachers worry about getting enough tools and equipment to function comfortably, enough time to retool and reorganize, enough training in technological mechanics and methods to feel in control, and enough tolerance for change to get through what has fittingly been described as a massive and messy alteration. These concerns as well as others may prevent teachers from adapting their attitudes and practices, and from learning about and using new technologies in the classroom as a teaching and learning tool. Rutherford and Grana (1995) describe nine different types of fear that may prevent teachers from embracing new technologies: (a) fear of change itself, (b) fear of time commitment, (c) fear of appearing incompetent, (d) fear of "techno lingo," (e) fear of technology failure (functional failure of equipment and/or software applications), (f) fear of knowing where to start, (g) fear of making bad choices (in the selection of hardware and software), (h) fear of having to move backward to move forward (lack of basic skills such as keyboarding skills), and (i) fear of rejection or reprisals.

The following review will address task choice, goal value, self-efficacy, and effort as they relate to motivation to engage in a task, and motivation to continue the task long-term. Self-efficacy, for the purposes of this study, will be defined in terms of whether the teacher feels he or she has the necessary training and skills to use computer technology in a manner that will benefit teaching and learning processes. In order for a teacher to choose to use computers as a teaching and learning tool, the teacher must first see value in using the tool, and must also believe that he or she has the necessary skills to use the tool in an effective manner. Effort expended will be addressed in relation to both task choice and self-efficacy.

Task Choice and Effort

Task choice is an individual's decision to do something. The desire to initiate a task must be present in order for an individual to actually engage in a task. Motivation is comprised of constructs that affect decision-making processes and choice with respect to an individual's goals. The amount of interest or value a person associates with a task will not only affect motivation as it relates to effort, but also as it relates to persistence in a task. In an analysis of a conceptual change model for describing student learning by applying research on student learning to the process of conceptual change, Pintrich et al. (1993) suggested four general motivational constructs as potential mediators of the process. An individual's choice of tasks and the quality of his or her engagement were two of four motivational constructs that were found to be related to a person's reasons for engaging in tasks.

Factors that enhance or stimulate greater task/goal interest and value beliefs are more likely to influence an individual's decision to initiate a task. Pintrich et al. (1993) describe interest or value beliefs that influence task choice in three general categories: general attitude or personal preference for the task, utility value, and importance of the task. A person's general attitude or preference for the task refers simply to a personal interest in the area. An example of personal preference would choosing to participate in one activity over another, such as preferring to read a book rather than watch a movie.

The value a person attributes to the task influences his/her interest in choosing to do the task. Utility value is related to the purpose that a task serves for achieving future goals. An individual makes assessments about the potential usefulness of a task in order to determine how the task will enhance long-term goals. An example of utility value would be choosing to work toward a four-year degree in order to enhance possibilities of entering a certain occupation (Pintrich et al., 1993). The importance of a task refers to an individual's perception of the salience or significance of the content or task to the individual. For example, if a person sees herself as becoming a scientist, then science content and tasks may be perceived as being important regardless of mastery or performance.

Interest and value beliefs vary by individual and situation, and are assumed to be personal characteristics individuals bring to different tasks, rather than features of the task itself. Interest and value beliefs determine whether activities are undertaken and whether effort is maintained over time (Dweck, 1989). The degree of interest or value a person has for a task or goal affects task choice. Both goal value and means value affect a person's willingness to engage in a task. Goal value can be described as the importance and attractiveness of achievement goals. Initiation of a task, and effort expended to accomplish the task, are influenced by the value a person attributes to the achievement of a goal. According to goal-setting theory, task performance is regulated directly by the conscious goals that individuals are trying to achieve by engaging in the task. Means value, on the other hand, is the attractiveness or aversiveness of the activities necessary for goal attainment. Individuals that enjoy achievement tasks and settings will be motivated to engage in tasks (Pintrich, Marx, & Boyle, 1993).

Both performance and learning goals have been shown to affect goal value. Individuals motivated by performance goals are concerned with how competent they appear to others. Individuals with learning goals are motivated by the desire to increase knowledge and skills. The values individuals place on a goal, whether they be performance or learning in nature, affect task choice. Both goal and means value variables affect an individual's decision in determining whether activities will be undertaken (Pintrich, Marx, & Boyle, 1993).

Self-efficacy and Effort

The choice to participate in a task, especially on a long-term basis, is affected by the amount of effort a person is willing to apply to a task. Effort can be defined by the amount of energy a person is willing to invest to obtain a goal. The quality and quantity of effort expended by a person has been shown to be influenced by self-efficacy. Bandura (1986) defines self-efficacy as an individual's judgment of his/her capabilities to perform given actions. Through self-efficacy expectations, individuals believe their task performance will produce certain outcomes. On academic and other challenging tasks, effort is derived primarily from expectations for success, or a belief in one's ability to succeed at a given task. Persons who have a low sense of self-efficacy for achieving a task may avoid the task altogether, while persons who believe they are capable will participate more readily. Furthermore, a strong sense of efficacy is necessary for an individual to continue a task in the face of obstacles, pressing situational demands, and failure (Bandura, 1993).

Since motivation is heavily influenced by an individual's personal expectancy as to how well he or she will be able to do something, self-efficacy would be important to individual teachers in terms of confidence in his or her ability to implement computer-related activities into the curriculum (Shunk, 1991; Bandura, 1993). Even more important may be the degree to which the teacher is willing to persist when faced with obstacles that are certain to surface throughout the implementation process. An individuals self-efficacy with regard to a particular task has been shown to influence not only how much effort the individual is willing to expend, but also to affect an individual's willingness to persist when faced with obstacles or aversive experiences (Bandura, 1986; 1993).

Charp (1996) identified lack of confidence in using software and computers in general and difficulty integrating computers into teaching practices as a result of a lack of skills for instructional use of computers as two major problems teachers encounter when confronted with integrating computers into the curriculum as a teaching and learning tool. In a study conducted to determine what organizational, training, and resource needs teachers perceived as barriers to the instructional use of computer technology, Swartz (1997) also found that teachers need to feel confident in using computer technology with students in order for integration to occur. In a study which examined factors related to elementary teachers' instructional use of computers, Dawson (1998) found that among the factors skill, self-efficacy, support, and opportunity to perform, self-efficacy (with regard to the teacher's ability to use computers in classroom instruction strategies) most closely related to instructional computer use. Ninety-two percent of the teachers in a large urban school district in Virginia completed a survey regarding the factors listed above. Multiple regression analysis revealed efficacy in ability to use computers in instruction and training on classroom integration strategies to be predictors of effective instructional computer use. Lippman (1998) also found technology integration to be directly linked to teacher understanding and confidence.

Summary

Teachers often do not have the skills necessary to operate a computer for personal use, much less the skills to integrate the computer into the curriculum as a teaching and learning tool. Teachers must be able to overcome the anxiety and fear associated with computer usage before they can begin to see how computers can be utilized to improve the teaching and learning environment. Computers in and of themselves present a layer of difficulty that must be overcome before teachers can begin to use them at all with students, especially to integrate them into the classroom for instructional purposes.

Motivation has been shown to exert a major influence on performance. An individual's perceived self-efficacy may influence the initial decision to engage in the task, the amount of effort the individual will exert, and the length of time a person will persist in a task when obstacles are encountered. Individual performance is also guided by the goals a person is attempting to achieve. The interaction of self-efficacy and personal and professional goals provide individuals with the motivation needed to initiate a task, sustain effort to complete the task, and therefore to achieve desired goals. In reform movements designed to incorporate the use of computers into the curriculum, teacher motivation is one factor that must be addressed if successful implementation is likely to occur.

Environmental Factors

A number of environmental factors have been shown to constrain and/or facilitate the implementation of computers into the curriculum as a teaching and learning tool. This study addresses the following environmental variables in terms of how each might influence a teacher to utilize computers as a teaching and learning tool: (a) teacher's personal use of computers, (b) teacher training which focuses on curriculum integration, (c) and support following training which focuses specifically on aiding teachers in the process of integrating computers into all aspects of the curriculum.

Teacher Personal Use of Computers

If teachers themselves experience the benefits of computer technology, they become what Soloway (1996) terms evangelists, demanding more computers in their classrooms. Instead of leadership "pushing" computers into the classrooms, teachers will "pull" them there once they appreciate the value of computers in their own lives. Making computers an integral part of their individual classrooms requires a passion and relentless energy that comes only from teachers being "sold" on the value of computers through their personal experiences with technology. A number of studies over the past two decades have established a connection between a teacher's access to and personal use of computers with the use of computer applications in the classroom to support teaching and learning activities. In a special report issued by the National Education Association (1988) based on research findings, the NEA made 13 policy recommendations, among which were the recommendation that every teacher have a computer on his or her desk, and the recommendation that teachers have access to a computer at home. Lecuyer (1997) found teacher access to a computer at home to be one factor that facilitated the implementation process. The qualitative study utilizing a case study approach examined how two teachers, each with four classroom computers, integrated computer usage into their instruction over time. Several kinds of data including monthly teacher interviews, non-participant observations, sample instructional materials and student work, and interviews with the principal were gathered over the period of one school year. Results indicated that the computer learning process for the two teachers was long and gradual. They had to increase their own expertise with computers as well as learn how to use them effectively in instruction. Access to a computer at home was shown to facilitate this process.

In a recent study investigating factors associated with computer use in schools operated by a Newfoundland school board, Simmons (1995) administered a self-report survey to 198 primary, elementary, intermediate, and high school teachers. Results indicated a relationship between teachers' comfort level with computers and the amount of computer use away from and at school, as well as a relationship between the amount of non-instructional computer use either away from or at school and the amount of instructional computer use.

UCSC Extension and the Institute of Computer Technology of Sunnyvale, California jointly administered a researcher-designed questionnaire and interview protocol to eighty-three fourth through eighth-grade teachers who participated in educational technology classes. The purpose of the study was to identify factors that influenced application of skills learned by teachers in classroom practice. Analyses of data confirmed considerable agreement among teachers that as their personal computer skills increased, so did their use of computers in instruction (Scigliano, 1997). In another study to investigate variables associated with technology application by high school teachers in the ten largest Florida school districts, Hiatt (1999) found significant correlations between technology application and the independent construct, personal technology experience. Personal technology experience was found to be a significant predictor of technology application by high school teachers in the regression equation. Analysis of variance also revealed access to a personal computer as being influential on technology application.

Through an investigation of the impact of a computer-enhanced instruction staff development program on elementary teachers' self-efficacy and outcome expectancy in the use of computers, Smith (1999) found that teachers with home computers scored higher on a self-efficacy subscale than teacher without home computers. Westermeier (1999) found a significant correlation between teachers' levels of computer literacy and the amount of time their students used computers. Winches (1996) utilized the survey method to explore the relationship between teaching style and the instructional use of the microcomputer in upper elementary classrooms in the state of Alabama. A combination of qualitative and quantitative research designs was utilized with the primary qualitative method of analysis being the Pearson Product Moment correlation to measure relationships among variables. Results of the study indicated that teachers who used the computer personally and professionally to accomplish work were more likely to view it as a vehicle for student productivity. This was evidenced by the integrated instructional use of teachers who owned home computers.

Teacher Training Focusing on Curriculum Integration

Unprecedented technological changes in the latter half of the twentieth century will challenge professional educators to reconfigure their instructional skills and reformat their instructional delivery as they assist students in integrating the tools of technology with learning. Equipping teachers with the skills to promote the effective use of these tools constitutes the first step in achieving this reconfiguration. Vojtek (1998), however, found the content of the typically piecemeal technology staff development efforts (aimed at the integrating computer technology into the teaching and learning environment) to be disconnected from core curriculum or research-based instructional practices. "Getting the computers" often overshadowed the question of how teachers would need to change their instruction, and what role computers would play in the change. Although national educational goals and cultural mandates have included education in technologies as a basic skill necessary for all students, computers for the most part have been treated as an expensive add-on to existing curriculum or as a separate subject in computer literacy.

Providing the right kind of staff development for teachers is imperative to the successful combination of the two major movements in education today: educational reform and the implementation of educational technology into all curricular areas (Means, 1994). Continued training offered in a curricular context is necessary to foster the integrated use of computers. Any productive reform will require *sustained* attention to curricular and instructional change as they relate to computer technology, and these changes must be grounded in effective theories that can be put into action. The use of computer technology must be built on significant and meaningful curricula, and efforts to integrate computer technology into schools must be combined with ongoing professional development for teachers relating to effective curriculum design and instruction (Herman, 1994; Hope, 1997; Winches, 1996).

The International Society for Technology in Education conducted a study/project with 150 classroom teachers, school administrators, regional and state educational administrators, representatives of governors' offices, federal agency people, university researchers, evaluators, teacher educators, representatives of small businesses, and representatives of hardware and software companies. The study phase of the project included literature searches, interviews and conferences with individuals and groups of the 150 experts, and visits to school sites where computer technology had been used with great success in a wide variety of disciplines and with students over the spectrum of abilities. Of the five major conclusions of the study, two addressed the issue of curriculum integration training for teachers. The first conclusion was that teachers need training in the uses of computer technology in their perspective curricular areas. The second conclusion addressed the same issue, though in a round-about way: All children learn more and better *when they have access to technology in an intelligently designed environment*. A key component of an intelligently designed environment according to this study was a teacher who had been trained in the integration of the technology into the curriculum (Braun, 1993).

Wilson (1988) noted that logistical challenges relating to acquiring, installing, and scheduling access to computers merely set the stage for the second set of implementation tasks: helping teachers integrate a new technology into their curriculum and accustomed teaching style. The second stage requires a different and more subtle set of knowledge and skills than the logistical focus. Training for educators should include guided, structured training and demonstrations of real applications. Dawson (1998) found instruction and training on classroom integration strategies to be one of two factors most closely related to effective instructional computer use.

Lecuyer (1997) found that teachers not only needed to increase their own expertise with using computers over time, but also needed to learn *how* to use computers effectively in instruction. Lippman (1998) found factors that account for the successful implementation of computer technology to include its use in the classroom being closely linked to curricular goals. Charp (1996) identified a number of problems teachers encountered when attempting to utilize computer technology as a teaching and learning tool: (a) a lack of information regarding software availability, (b) a lack of software available which matched with learning objectives, and (c) difficulty integrating computers into teaching practices due to the lack of skills for instructional use of computers as a teaching and learning tool. This study demonstrated the need for educational technology staff development with an emphasis on curriculum integration as being paramount to effective computer usage. Staff development must provide teachers with more than basic skills or knowledge in the use of computer hardware and software. Training should also aid teachers in bridging the gap between knowing how to use computer technology and actually using computers in the classroom as a teaching and learning tool to support active learning.

In a qualitative study designed to identify major factors viewed as contributing to successful implementation of computer technology in schools, interviews were conducted with 25 participants including teachers, administrators, technology coordinators, community members, and students in three schools in a large suburban school system in the Southeastern United States. A questionnaire, on-site observations, and document analysis provided additional data for triangulation. Included in the eight major factors found to contribute to successful implementation of computer technology in the sites studied was the skill with which the staff were able to integrate the use of technology into the curriculum (Williams, 1995).

When educators are asked about challenges related to building effective technology programs in their schools, they invariably bring up the issue of training and staff development (Schmeltzer, 1995; Charp, 1996). In order to effectively integrate educational technology into the curriculum, teachers not only need technological training, but follow-up support activities throughout the learning and implementation processes that will facilitate successful transfer of knowledge gained and skills developed through training back into their classrooms. If computer technology is to be infused into the curriculum, meaningful training and support is critical. Teachers cannot "magically" utilize the many facets of computer technology without training, guidance, support, and models designed to provide structure and means of evaluation of the process (Armstrong, 1996; Kopp & Ferguson, 1996).

As a result of four national studies to collect data regarding students' computer-related experience and knowledge in an effort to describe more completely the role of computer technology in what students learn, Becker (1993) reported that schools were lagging behind in the critical area of curriculum development for using computer-based tools in subject matter classes. In the fourth survey, conducted in the spring of 1993, the pattern of computer use from the 1989 study remained virtually identical except for a continued decline in the proportion of computer time spent on programming instruction. Most subject-matter teachers had not yet learned how to use, for example, spreadsheets in relation to mathematics instruction, multimedia applications to enhance English or fine arts instruction, or databases to support learning activities in science applications. According to Becker, a major effort in curriculum upgrading is necessary within academic disciplines as they are practiced within typical school settings in order to avoid computer skills becoming yet another set of isolated skills and procedures to be mastered by students.

Teacher Support Focusing on Curriculum Integration

A number of educational leaders today contend that computer technology could serve as a catalyst to bring about the change necessary to transform America's schools (Lippman, 1998). These same leaders would agree that the benefits of computer technology cannot be fully realized until teachers receive the necessary training and support to effectively integrate computers into the curriculum in a manner which promotes learning environments where students are actively engaged in meaningful learning experiences on a daily basis. Assistance following training has long been considered a key change variable that leads to high levels of implementation of an innovation (Fullan, 1985; McLaughlin, 1990). Strong support leads to practice mastery and stabilization of the use of the innovation. In a three-part analysis of research on change processes at the school building level for the purpose of formulating a number of locally-based strategies for improving schools and classrooms, Fullan (1985) reported that support activities have strong, positive, and direct effects on longer-term project outcomes, teacher change, and the continuation of project methods and materials. Support activities in a variety of formats, including assistance from resource personnel, on-going training, and time can provide teachers with the resources they need to modify teaching practices. Teachers need role models, encouragement, ongoing staff development, time to explore the capabilities of computer technology, and a supportive environment (Hope, 1997).

Honey and Moeller (1990) completed a study to determine characteristics of teachers who had either a high level or low level of computer technology implementation in the classroom. Interviews were conducted with twenty teachers who either used or did not use computer technologies in their classroom. Teachers with a low level of implementation indicated that their first experience with computer technology had been a negative one, and because they had not seen appropriate examples in their subject area, they lacked ideas of how to incorporate computer technology into their curriculum area. Likewise, Lecuyer (1997) found the absence of on-site support to be an obstacle in the implementation process. Winches (1996) found that curriculum specialists or instructional supervisors provided the most effective type of on-site support when integrated use of computers was the goal, while assistance from technology coordinators did little to promote integrated computer use to advance curricular goals. Williams (1995) found supportive, visionary leadership to be one of eight major factors contributing to successful implementation of computer technology. The International Society for Educational Technology supports these conclusions: Teachers need training in the uses of computer technology in their curricular area; time to develop these uses; and support from their administrators in a risk-free environment. The study stressed that teachers need this training and support on a continuing, long-term basis (Braun, 1993).

Fullan (1985) emphases that no matter how much advance training occurs, people have the most specific concerns and doubts when they actually try to implement new approaches. It is extremely important that resource personnel be available to problem-solve and provide support during implementation. Support efforts should help teachers adapt methods and materials to their own situation. Support activities can aid teachers in understanding and applying complex strategies in ways that standard training, in terms of both form and content, cannot effectively do. Well-conducted support activities serve to reinforce the contribution of training. The quality of the support is also critical. Resource providers should be highly credible, having classroom experience with the innovation and experience in working with adult learners (Loucks & Zacchei, 1983). Further, support people need to be readily accessible. It is not feasible for a teacher to leave the room to telephone for help, or to wait for assistance for an extended period of time.

Impact on Student Experiences and Teacher Practices

Impact examines the types of things that have changed once an innovation is implemented, with an emphasis on actual changes in practice and beliefs due to the implementation. In this study, impact, in relation to the implementation of the use of computers in the classroom as a teaching and learning tool, will be addressed in terms of (a) changes in student learning experiences, and (b) changes in teacher practices. Implications for the use of computers in the classroom will be considered in terms of the possible benefits to the teaching and learning process.

Implications for the Use of Computers in the Classroom

Educational leaders today contend that computer technology can serve as a catalyst to bring about the change necessary to transform America's schools (Lippman, 1998). Because computer technology can remove constraints of time and distance, and because it can provide students and teachers with access to information and tools for digesting, manipulating, and processing information, many consider it an essential element in any intelligent plan to restructure schools (Braun, 1993). Computers provide tools that could be utilized to promote more individualized instruction according to student needs and learning styles. Numerous studies over the past decade demonstrate that computers provide the tools necessary to support more constructivist, student-centered, active learning environments. Computers allow access to a wide range of information, and provide power and speed to make this information readily available to students and teachers to at a moment's notice. What may prove to be even more important, however, is the computer's ability to assist teachers and students (both individually and in collaborative efforts) to become interactive users, allowing the user(s) to modify, experiment with, and customize information. Interactive multimedia allow the user to interact directly with media in real time and modify media to achieve a variety of instructional goals (Cartwright, 1993). Research from the past fifteen years, however, presents a mixed picture as to whether teachers actually change their instruction with the increased availability of computers in the classroom. Lecuyer (1997) found that while the presence of computers did not significantly change teacher methods immediately, they did support gradual change in instructional and learning activities over time.

Cuban (1986) asserts that the power of the computer is the ability of the machine to capture student attention and interest. Research demonstrates that "hooking" children into learning with computers helps them develop a more positive self-esteem, and a feeling of competence and control, especially when students are able to teach adults how to use computers. Proponents of computer technology insist that this element of empowerment can be utilized to assist students in learning to act independently, and ultimately to become independent learners. Others question the effect of the flat, two-dimensional, visually and externally supplied image on the development of a child's inner capacity to bring forth creative images of his/her own (Sloan, 1984).

Traditionally, instructors have been the gatekeepers of information: Teachers controlled the terms and facts of the subject matter that would be addressed in the classroom. They controlled the input, the throughout, and the output. Computer technology by nature undermines that control. Computer technology provides access to so many facts and so much data that control is no longer the issue: the issue becomes what to do with, and how to make decisions about, all that data (Rutherford & Grana, 1995). With the entrance of computer technology in the classroom as a teaching and learning tool comes changing roles for teachers and students and a knowledge base so expansive that information literacy appears to be the only solution to dealing with its expanse. The role changes are sure to meet with resistance at the onset. Students, for example, may resist new methods, preferring that the teacher give them the "right" answers. Teachers my resist because they, for the most part, teach only as they themselves were taught, which for many means exclusively lecturing. Enter teachers who are willing to renovate attitudes in order to accommodate these technology-inspired changes (Rutherford & Grana, 1995).

If schools continue to emphasize the accumulation of information, to employ didactic instruction, and to view students as empty vessels that need filling, then students and teachers will never realize the full potential offered by computer technology. Textbooks, which have traditionally been the primary source of access to facts and events for teachers and students, by nature provide a thin slice of information on any given topic, and do not promote serious inquiry. On the other hand, schools and teachers can use computers to enable students to probe deeply and intensively into a topic for an extended period of time. Computer technology also provides students with opportunities to make their observations and findings available to other interested parties and engage in dialogue with other parties. When utilized by students and teachers in this manner, computer technology can become a tool not only to change, but also to improve the way we teach and learn (Soloway, 1995).

Student Learning Experiences

Integrating computer technology into the classroom has the potential to improve both student learning and motivation. In a study which utilized a pre-post survey instrument to evaluate the effectiveness of a one-school-year educational technology staff development program for kindergarten through grade six classroom teachers in the Grand Forks Public School District, Carlson (1997) found teacher-perceived student learning benefits to include increased technology experiences, increased knowledge, improved comfort level in using computer technology, independence, and motivation. Teachers also believed computers presented expanded learning opportunities and helped better prepare students for future life and career experiences. In addition to these benefits offered by computer technology, researchers have found that with the glamour that computers bring to assignments, students routinely go beyond minimum requirements (Office of Technology, 1988).

Doyle (1994) defines an information-literate person as one who (a) can identify a problem, (b) recognize the need for accurate and complete information to make decisions, (c) ask questions based on information needs, (d) develop search strategies, (e) access and evaluate information, and (f) organize and integrate information and use it in critical thinking and problem solving. The emphasis is less on knowledge for its own sake and more on process based on utility. In today's classroom, students are often more technologically sophisticated than instructors. While this can be a threatening issue to teachers, student expertise can be tapped with dynamic results and doubled reward. By reversing roles with the instructor, not only do students become involved with conquering the content in question, but their learning relationship with the instructor shifts toward cooperation and egalitarianism, thus enhancing the learning process (Rutherford & Grana, 1995).

In classrooms where the emphasis has shifted from teaching to learning, transformations occur that take some adjustment. Learning becomes more active and less authority-dependent. Educational strategies that require more active engagement of students (case studies, cooperative learning, debates, peer projects, and other collaborative activities) are pushing the lecture method aside. These strategies are recommended by educational leaders and researchers to enhance the student learning process. Computer technology itself both mandates and assists active learning. No matter the form taken to utilize these strategies, the ultimate goal for these multi-dimensional methods is to prepare students to function independently and to think critically in daily experiences that they will encounter in school, at work, and in life (Rutherford & Grana, 1995).

Gardner (1991) believes that students who participate in traditional types of schooling often do not understand the concepts that they learn in school. They lack the capacity to take knowledge that has been learned in one setting and apply it effectively in a different setting. Many believe that the wise use of technology can transform the traditional teacher-centered classroom into interdisciplinary student-centered classrooms where students engage in meaningful learning experiences that promote true learning and understanding. Computers support this kind of learning environment better than any other existing medium (Collins, 1990).

Proponents of the knowledge construction approach to learning support an environment where students work in groups or teams, share the information they find, and discuss solutions to problems (Dwyer, 1996; Slavin, 1993). Students participating in collaborative, small-group experiences are able to share information, and teach other students new skills and concepts. The active and self-directed learning experiences provide students with opportunities to explore, create, and utilize higher-order thinking processes as opposed to traditional classroom activities such as listening, taking notes, and memorizing passages of material. Hands-on activities are stressed. Students often select the resources and tools necessary to develop and/or complete projects (Bransford & Vye, 1989). The emphasis learning by doing through active engagement in meaningful tasks and learning experiences.

David (1994) also believes that computer technology can serve as a vehicle for significantly changing what happens in classrooms by diversifying how and what a student learns. Bennett (1997) adds: "What technology does do is allow us to alter the learning environment in ways we have never imagined, which has staggering implications for the future of education" (p. 1). The integration of computer technology into the teaching and learning environment supports a learner-centered inquiry approach to learning that is supported by theories from cognitive and social psychology and educational research findings challenging traditional beliefs about how students learn (Barron & Golden, 1994; Knapp & Glenn, 1996). Honey and Moeller (1990) found that teachers with a high level of computer technology implementation tended to allow students use computers and computer applications as tools for thinking and exploring more deeply into a subject. More classroom time was devoted to an inquiry-based approach that helped students develop critical thinking skills. When the group of teachers with low-level computer technology implementation did use computers, the primary purpose was to reinforce basic skills or boost motivation rather than enhance the curriculum.

Computer technology may also allow educators to better address the needs of certain special populations of students. Integrating technology with instruction appears especially compelling since its visual nature seems perfectly suited to students who benefit from this learning style. From results of a project/study in a partnering experience between Western Pennsylvania School for the Deaf, Duqesne University, and Carnegie Science Center, Bernauer (1996) reported that not only did computer technology offer a way to improve teaching and learning, but also affected changes in teacher roles and curriculum planning. Lead teachers in a high school setting participated in the training program each year, with the newly trained lead teachers becoming lead teachers themselves the following year. Anecdotal records and formal evaluation results of the project/study were generally positive in terms of measured student and teacher outcomes, and extremely positive in terms of the development of, and capacity for, delivering technology-infused curriculum. The most important result, however, may have been student enthusiasm for computer technology. Another project/study conducted by the International Society for Technology in Education to establish a set of recommendations on the role of computer technology in restructuring the United States educational system supported these findings. One of five major conclusions from their study described computer technology as being particularly effective with at-risk students (Braun, 1993).

While research provides support for the use of computers in the classroom to bolster the kind of activities in which educators believe student should be engaging, research also demonstrates that the educational system, for a number of reasons, has not fully embraced computer technology in a manner to support these types of learning environments. Computers are used in the United States secondary schools primarily to teach students computer skills rather than to teach other subjects. With the exception of drill and practice programs for repetitive practice of basic arithmetic algorithms and reading and writing skills, more than 50% of computer time in secondary schools during the 1980's and early 1990's was devoted to teaching students how to use a computer, rather than embedding or applying computer capacity in ongoing teaching and learning activities in content areas. And although substantial fractions of high school English, math, and science teachers were using software with their students by 1989, most computer use in subject matter classes was irregular and infrequent. Computers when used only occasionally can demonstrate to students the value of the computer as a learning tool, but only regular and sustained use will make the computer an integral part of a student's educational experience. These results come from three national surveys conducted to learn what computer resources schools have, and how computers are being used (Becker, 1993).

Teacher Practices

The goal behind integrating computer technology into the classroom should be to improve teaching and learning. Computer technology can be used to shape what is taught, how it is taught, and how learning is assessed (Bernauer, 1996). Educational technology can also aid teachers in screening (to identify children who are potentially exceptional in some way) and classification (to provide special services to children who are exceptional in some way), instructional planning, and evaluating academic programs. The use of computer technology to assist in assessment for the purpose of instructional planning helps teachers identify the level of achievement at which a student is currently performing, and suggests strategies for instructing the student at the optimal level. Assessment data provided through educational software applications can assist teachers not only in planning instruction, but also in developing interventions for individual learners. Furthermore, this educational software provides teachers and students access to individual student learning activities prescribed as intervention strategies (Bahr & Bahr, 1997).

Computer technology does not avert the task at hand for a teacher in the classroom, but rather, can be utilized to transform how it is performed. While the ultimate goal is the same, computer technology's assistance increases speed and ease of delivery of, and access to, information. At the same time, computer technology decreases drudgery for both teachers and students. Teachers must, however, be able to change their attitudes and practices in order to take advantage of the benefits offered by computer technology. This change often meets with initial resistance from both teachers and students. Teachers may worry about getting enough software tools and equipment to function comfortably, enough time to retool and reorganize their methods of delivery, and enough training in mechanics and methods to feel in control (Rutherford & Grana, 1995).

The range of opportunities for educational activities increases with the implementation of computer technology into the classroom (Office of Technology Assessment, 1988). Computer technology provides educators with tools to (a) address equity and access issues, (b) accelerate students' linguistic and conceptual development, and (c) create authentic and meaningful learning experiences (Tipton, Bennett, & Bennett, 1997). When computer technology is used to support research-based, effective teaching practices and learning activities, it can become "a catalyst for change; a tool for creating, implementing, managing, and communicating a new conception of teaching and learning" (David, 1994, p. 172).

When teachers use computers as a teaching and learning tool, the learning process tends to become more active, and less dependent on lectures and authority. As a result, students learn to function independently and think critically. The instructor becomes a facilitator, rather than a deliverer, in the learning process. The growth of the available knowledge base and the increase in availability of information sources brought about by technology also demands change in the educational process. Utilization of the positive aspects of computer technology, however, involves taking risks, and overcoming fears and uncertainties caused by change. Computer technology necessitates that individual teachers, and teachers as supportive groups, adapt attitudes and remodel current practices to incorporate the benefits of computers into the teaching and learning process (Rutherford & Grana, 1995).

Studies show that teachers do make changes to the student learning environment when they use computer technology in the classroom as a teaching and learning tool. Dywer (1996) found that teachers tend to become learning guides rather than deliverers of knowledge, and begin to share responsibilities for the learning process with students when they become comfortable with using computers as a teaching and learning tool. In a study conducted concerning the use of lead teachers to assist other teachers in using computers in the classroom, teachers reported that with the use of computer technology, their former role of being center-stage and directing instruction changed. The use of computer technology aided them in being able to move around the classroom and assist students individually. Teachers reported that most of their work occurred in the planning stage. The use of multimedia integrated with instruction required teachers to spend a great deal of time "setting the stage" so their students would have problems to solve that required using print materials and electronic media. "We are convinced that the achievements, enthusiasm, and positive attitudes shown by the faculty and students have created an environment where technology serves as a powerful tool for creating a better teaching and learning environment" (Bernauer, 1996, p. 73).

Other recent studies support proponents of instructional technology in claims that the use of computer technology in classrooms leads to changes in teachers' methods.

Bissette (1998) utilized a pre- and post-survey design, open-ended questionnaires, interviews and classroom observations to investigate the integration of computer technology in a rural school district in northern New Mexico and to examine changes that occurred in a cohort group of twenty-one graduate education students/teachers enrolled in a four-semester technology integration graduate program. From the results of what amounted to a case study of the teachers involved in the program, along with results from three pre- and post-test survey instruments, Bissette concluded that teachers tend to move away from the traditional, teacher-centered paradigm towards more innovative, student-centered modalities when computer technology is incorporated into the teaching and learning environment.

Hoffman (1996) used both quantitative and qualitative methods in an attempt to confirm and extend studies demonstrating that the use of instructional technology in classrooms leads to changes in teachers' methods, away from the traditional, teacher-centered paradigm towards more innovative, student-centered modalities. The results of the study supported the hypothesis that teachers who use computers are more likely to use innovative teacher methods. The study was conducted using the survey method, followed by telephone interviews with 23 of the surveyed teachers. Data was summarized using case and cross-case analyses. The results suggested that causality works in both directions. Changing teaching methods appeared to lead teachers to consider the role computers might play in their curriculum. Likewise, adopting computer technology into their classrooms often led teachers to alter teaching methods. Teachers who worked in technology infused environments were more likely to think that computers were driving their changes in teaching methods.

Summary

"All children learn more and better when they have access to technology in an intelligently designed environment" (Braun, 1993, p. 2). To exploit the benefits of computer technology, however, the classroom environment, and the school environment as a whole, must be restructured in dramatic ways. This restructuring involves the adoption of new roles by both teachers and students. Through the use of computer technology, the teacher's role as gatekeeper and deliver of knowledge shifts in direction as they become counselor, research associate, mentor, resource allocator, and adviser. Students have more opportunities to participate as active, rather than passive, learners (Braun, 1993).

In order to harvest the unprecedented opportunities offered by computer technology as a teaching and learning tool, teachers as advocates and implementers must take risks, and overcome fears and uncertainties caused by change. Computer technology both mandates and assists active learning. The ultimate goal of utilizing computers in the classroom should be to prepare students to function independently and think critically. But the process is neither simple nor easy to those involved: "More than tweaking teaching with technology but less than using the wrecking ball for total demolition, retrofitting involves considerable turmoil" (Rutherford and Grana, 1995, p. 86).

CHAPTER 3

METHODOLOGY

Introduction

This chapter describes the research design of this study, the development of the survey used, the selection of subjects, results of pilot testing, and procedures used in data collection and analysis. Selected scales from a survey developed by Lowe (1998) to measure factors affecting the implementation of computer technology as an evaluation of the Apple Classrooms of Tomorrow Teacher Development Center were modified for this study. The "Development of Instrument" section presents information regarding the development of the original survey, along with details about modifications made to the original instrument for purposes of this study. The "Adapted Instrument" section provides a summary description of the instrument used in this study, as well as survey uses and limitations.

Research Design

The design of this study was non-experimental. The population from which subjects were selected was secondary (grades 9-12) classroom teachers in public schools in northeast Louisiana. Schools were selected using systemic random sampling. Every other teacher on an alphabetical listing at each selected school was asked to complete a survey. The survey was used to measure factors that affect the implementation of computer technology and the impact that computer technology use had on student learning experiences and teacher practices. The survey was composed of checklists, rubrics, and scales designed to measure motivational and environmental factors associated with computer implementation, to measure degree of implementation of computer-related activities in terms of hours, and to measure the impact that computer use had on student activities and teacher practices.

The four independent variables in the study were represented as follows: (a) The independent variables *teacher motivation* and *curriculum integration support* were represented by Likert-type scales; (b) the independent variable *teacher personal use of computers* was represented by a list of options which allowed teachers to indicate whether they had access to a computer at home, the frequency with which they used a computer at home, and the nature of that computer use; and (c) the independent variable *curriculum integration training* was represented by a rubric which allowed teachers to choose from intervals indicating the approximate number of clock hours of curriculum integration training in which they had participated each year over the past three years.

The five dependent variables were represented as follows: (a) The dependent variable *implementation* was represented by a rubric which allowed teachers to indicate the number of hours in a thirty-hour week their students used computers technology in four categories of student learning experiences; (b) the three dependent variables, *collaborative learning, self-directed learning,* and *active learning*, were represented by scales which allowed teachers to indicate the frequency with which students participated in certain activities while using computer technology; and (c) the dependent variable *teacher practices* was represented by a scale which allowed teachers to indicate from a list of options how, and to what extent, the use of computer technology had affected their personal teaching practices.

Development of Instrument

This section describes the process Lowe (1998) used to develop the original scales that were adapted for the purposes of this study, and changes this researcher made to the original instrument to better suit the sample and purposes of this study. The resources used by Lowe (1998) to develop the scales, subscales, and stimulus items are also identified.

Scale and Checklist Development

Lowe (1998) developed the scales and subscales through an extensive literature search for information on factors that affect the implementation of computer technology. The existing scales and checklists from which stimulus items were selected follow: (1) Telecommunications and K-12 Educators (Honey & Henriquez, 1993); (2) The Troubleshooting Checklist (Manning, 1976); (3) Use of Classroom and School Environment Scales in Evaluating Alternative High Schools (Williamson, 1986); (4) Baseline Survey of Testbed-Participating Schools (Becker, 1995); (5) Commonalties and Distinctive Patterns in Teachers' Integration of Computers (Hadley and Sheingold, 1993); (6) A Computer for Every Teacher (Rockman et al., 1992); (7) Technology Making a Difference (Wilson, 1994); (8) San Jose Education Network Survey (Vinson, 1996); (9) Motivated Strategies for Learning Questionnaire (MSLQ) (Pintrich et al., 1991), and (10) Self Assessment Questionnaire (O'Neil et al., 1992). Other areas reviewed by Lowe included educational and systemic change and the adoption of innovations.

Changes made to the original instrument by this researcher followed an extensive literature review in the following areas: (a) environmental and motivational factors which have been shown to facilitate or constrain implementation of computer technology, (b) contemporary uses of computer technology in the classroom, and (3) review of changes in the classroom environment regarding student learning experiences and teacher practices that have been associated with use of computers as a teaching and learning tool. Changes to the original instrument were made under advice from a panel of secondary and post-secondary educators, some with, and some without extensive computer technology experience. The panel was made up of three secondary level teachers, three principals, two technology coordinators at school sites, two technology coordinators at the parish level, and four university faculty members.

Description of Instrument and Modifications

The survey used in this study was composed of checklists, rubrics, and scales which were used to examine environmental factors, motivational factors, degree of computer implementation, impact of the use of computer technology on student learning experiences and teacher practices, and participant profile data. The following section gives a general overview of each part of the survey, including how each checklist, rubric, or scale relates to the review of literature. Some checklists and rubrics are original to this study, while some represent a modified version of scales developed by Lowe (1998).

Environmental Factors

Teacher Personal Use of Computers. The *teacher personal use of computers* checklist was developed by the researcher through a review of literature, as well as input from the panel consulted throughout the development of this instrument. In a special report regarding the use of computer technology in the classroom, the National Education Association (1988) recommended that teachers have access to a computer at home. In the following decade, a number of studies identified positive relationships between teacher computer use at home and use of computers for instructional purposes. Simmons (1995) found a relationship to exist between the amount of non-instructional computer use away from school and the amount of instructional computer use at school. Lecuyer (1997) likewise found teacher access to a computer at home to facilitate the implementation process at school. Scigliano (1997) found considerable agreement among teachers themselves that as their personal computer skills increased, so did their use of computers in instruction.

Teacher personal use of computers was examined using a series of checklists through which teachers indicated if they had access to a personal computer at home, the frequency with which they used a computer at home, and the purposes of use. The options for frequency of use were (a) *daily*, (b) *several times a week*, (c) *several times a month*, (d) *several times a semester*, or (e) *not at all*. The options for purpose of use were (a) *on-line resources*, (b) *e-mail*, (c) *preparing tests*, (d) *preparing handouts/other classroom materials*, and (e) *other* (See Appendix D, p. 131).

Curriculum Integration Training. The *curriculum integration training* checklist was also developed by the researcher after an extensive review of literature, and under advice of the panel consulted throughout the development of this instrument. The review of literature revealed the following regarding teacher training in the use of computer technology: (a) The use of computer technology must be built on significant and meaningful curricula, and efforts to integrate computer technology into schools must be combined with professional development for teachers relating to effective curriculum design and instruction (Herman, 1994); and (b) logistical challenges relating to acquiring, installing, and scheduling access to computers merely set the stage for the second set of implementation tasks, that of helping teachers integrate a new technology into their curriculum and accustomed teaching style. The second stage requires a different and more subtle set of knowledge and skills than the logistical focus (Wilson, 1988).

Teacher training was examined by asking teachers to indicate the approximate number of hours of curriculum integration training they had received per year over the past three years (See Appendix D, p. 132). When computers were initially introduced into the classroom, teacher training often focused on the basic skills required to operate computer hardware and software. While this type of training did give teachers experience and confidence in basic computer operations, it did not give them any model to follow for utilizing technology in the classroom as a teaching and learning tool. The teacher training checklist was added after the review of literature revealed a need for training focusing on curriculum integration. Curriculum integration training is directed at helping teachers incorporate computer technology into their individual curricular areas rather than treating the technology as an "add-on" to existing curricula. Teacher training which focuses on the basic skills necessary for operation of computer hardware and software was not addressed in this study.

Curriculum Integration Support. The stimulus items on the *curriculum integration support* scale were taken directly from the original instrument developed by Lowe (1998). Two stimulus items, however, were changed to better meet the needs of this study. The stimulus item *teacher or principal on site* was separated into two response items, *teacher on site* and *principal on site*. *TDC coordinator* was omitted since it did not apply to the current study. The option *N/A* was eliminated, and scale options were changed to range from *on a weekly basis* to *not at all*. These changes were made under advice of the panel who were consulted throughout the process of adapting the survey.

The curriculum integration support scale is based on consistent and persistent findings that continued support and assistance by resource personnel are key elements in the implementation of an innovation (Braun, 1993; Fullan, 1985; Lecuyer, 1997; McLaughlin, 1990; Office of Technology Assessment, 1995). Assistance following training has long been considered a key change variable that leads to high levels of implementation of an innovation. Strong support leads to practice mastery and stabilization of the use of the innovation. Support activities have strong, positive, and direct effects on long-term project outcomes, teacher change, and the continuation of project methods and materials (Fullan, 1985; McLaughlin, 1990).

The *curriculum integration support* scale examined curriculum support teachers had received from resource personnel during the implementation process. Examples of curriculum integration support include assistance with lesson planning and recommendations of appropriate software. The scale was designed to identify which resource persons offered support to teachers, and to measure how often resource personnel helped teachers with issues pertaining to integrating computer technology into the curriculum. A five-point Likert-type scale ranging from *On a Weekly Basis* to *Not at All* measured how often teachers received assistance from resource personnel. Examples of stimulus items were: (a) teachers on site, and (b) district mentor or resource teacher (See Appendix D, p. 133).

Motivational Factors

One modification was made to the *teacher motivation* scale developed by Lowe (1998). The five-point response scale developed by Lowe (1998) with options ranging from *agree* to *disagree* was modified to a six-point Likert scale ranging from *strongly agree* to *strongly disagree*. Stimulus items were not changed.

Stimulus items on the teacher motivation scale were selected through a review of factors related to task choice and self-efficacy (Lowe, 1998). Task choice stimulus items relate to: (a) personal preference for the task, (b) utility value, and (c) importance of the task (Pintrich et al., 1993). Stimulus items associated with learning and performance goals are also included (Pintrich et al., 1993). Stimulus items regarding self-efficacy relate to perceived ability and effort, which in this context can be translated into how confident the teacher feels in terms of his/her ability to implement technology-related activities into the curriculum. The degree to which the teacher is willing to persist when problems are encountered was also examined. Self-efficacy has been shown to influence not only the amount of effort an individual is willing to expend, but also persistence in the task when obstacles or aversive experiences are encountered (Bandura, 1993).

The teacher motivation scale was used to assess factors that motivate teachers to implement technology activities and projects. Examples of motivational items are: (a) task choice: I am very interested in working with technology, (b) goal value: Learning to use technology is a personal goal, and (c) self-efficacy: I keep working even when there are problems with the technology (See Appendix D, p. 132).

Degree of Implementation

Modifications in format were made to the five-point *technology implementation* scale developed by Lowe (1998). The five-point Likert-type scale utilized by Lowe (1998) consisted of four major categories of activities with stimulus items regarding each type of activity. The scale was converted to a rubric designed to measure the approximate number of hours in an average week students participated in each category of activities while using computer technology. The wording of the stimulus items on the original scale was not changed. Rather than being used as stimulus items on a Likert-type scale as in the original instrument, stimulus items were listed as examples under each major category to aid teachers in differentiating among categories (See Appendix D, p. 133).

The degree to which teachers are implementing computer-related activities and projects into the curriculum was measured by asking teachers to indicate, in terms of a 30-hour week, how, and how often, students used computer technology in the classroom to accomplish curricular objectives. Activities were divided into four major categories with examples given to help teachers categorize student activities. The four categories were (a) curriculum supplement, (b) research, (c) data organization, and (d) composition. Examples from each category include (a) curriculum supplement: Practice of basic skills, (b) research: Use a CD to gather information, (c) data organization: Create a spreadsheet, and (d) composition: Publish a story, report, or newsletter.

Impact Scales

The final set of scales was designed to measure the impact of computer technology on teacher practices and student learning experiences. Stimulus items focus on the type of learning experience in which students are participating, and changes in teacher practices associated with the use of computer technology as a teaching and learning tool. Student learning experience stimulus items are supported by research regarding the knowledge construction approach to learning and research regarding students learning by doing--by becoming actively engaged in meaningful tasks and learning experiences (Blumenfeld et al., 1991; Bransford & Vye, 1989; Dwyer, 1996; Piaget, 1977; & Slavin, 1993). The collaborative learning experience stimulus items focus on the degree to which students work in small groups, share information, and teach other students new skills and concepts. Self-directed learning is examined in terms of student independence in task selection and completion. Active learning is examined in terms of students participating in the development of projects and hands-on learning activities.

The teacher practices stimulus items focus on how teachers change their methods of delivery and interaction with students when they use computers in the classroom as a teaching and learning tool. Dywer (1996) found that teachers tend to become learning guides rather than deliverers of knowledge and begin to share responsibilities for the learning process with students when they become comfortable with using computers as a teaching and learning tool.

Student Activities. Stimulus items from the original five-point response scales used by Lowe (1998) to measure the frequency with which collaborative, self-directed, and active learning experiences occur in the classroom were not altered for this study. Options regarding frequency of participation in learning experiences on the original five-point scales ranged from *not at all* to *often*. These options were changed to range from *not at all* to *daily* on the instrument used in this study. This change was suggested by the panel consulted throughout the adaptation process. Examples of stimulus items from the scales include: (a) collaborative learning: Assisted each other with problems, (b) self-directed learning: Selected the media which presents their work, and (c) active learning: Participated in the development of a project (See Appendix D, p. 134).

Teacher Practices. Stimulus items from the original five-point response scale developed by Lowe (1998) to measure the extent to which computer technology has increased teachers' opportunities to change methods of delivery and interaction with students were not altered for this study. The original instrument had headings for only the first and last options on the five-point scale. The range on the scale was *not at all* to *significantly*. Teachers completing the survey circled the number that most closely represented the extent to which computer technology had increased their opportunities to do each stimulus item. Under the advice of the panel consulted during the process of adaptation of the instrument for purposes of this study, headings were added above each number with the range remaining the same. The stimulus item *spend less time lecturing* was changed to read *decrease time spent lecturing*, and the stimulus item *change the way you teach* was omitted. These changes were made under the advice of the panel consulted during the adaptation process. Examples of stimulus items are (a) interact with students in small groups, and (b) rely on students for information (See Appendix D, p. 134).

Profile Data

Background information about each participant including gender, age, ethnicity, highest degree earned, years of teaching experience, and current teaching assignment was collected. Teachers were asked to describe their computer experience by indicating the number of years they have used a computer, the number of years they have used computers in teaching, and their technology level of confidence (See Appendix D, p. 131).

<u>Summary</u>

The innovation examined in this study was the implementation of computers and computer peripherals into the classroom as teaching and learning tools. A survey was developed to measure environmental and motivational factors that affect the degree of implementation of computer technology into classroom activities, and changes in student learning experiences and teacher practices associated with the use of computer technology. Selected portions from an instrument developed by Lowe (1998) to measure factors effecting implementation of computer technology as an evaluation of the Apple Classrooms of Tomorrow Teacher Development Center were modified to better suit the purposes of this study. Since the instrument was modified to better address the sample and purpose of this study, the instrument was pilot tested.

<u>Uses.</u> The data collected through the survey used in this study identified factors that have facilitated the implementation of computer technology for the teachers in northeast Louisiana. The data collected also identified educational changes that have occurred as a result of computer implementation. The results from this study can be used as a tool to help local leaders develop future plans for continued training and support of teachers involved in the implementation process.

<u>Limitations.</u> The scales used in this study are based on existing scales. Some items were used exactly as stated on other instruments and checklists, while others were modified to more specifically relate to the local innovation and purposes of this study.

Since the survey has not been used extensively in either experimental or field studies, it should not be used alone for decision-making purposes.

Pilot Test Results

The survey used by Lowe (1998) was revised to better suit the population and purposes of this study. The revised survey was pilot tested with 5% of the total population. Those involved in the pilot study were asked to highlight directions that were ambiguous or confusing, and any individual items that were confusing or difficult to answer. Participants in the pilot study provided written and oral feedback regarding the survey. The suggestions made by teachers who completed the survey allowed changes to the pilot survey instrument for the purpose of improving the overall content and readability of the instrument.

The following statistical analyses of the data gathered with the pilot study were employed: (a) Kruskal-Wallis One-way Analysis of Variance by Ranks, (b) Mann-Whitney U-Test, and (c) Pearson Product-Moment Correlation. Results of analyses of pilot data with regard to each of the eight hypotheses follow:

Hypothesis one states that there is no significant ($p \leq .05$) difference in degree of implementation of computers between teachers who are highly motivated and teachers who are moderately motivated to use computer technology as a teaching and learning tool. With 25 cases reporting in the pilot study, teachers discriminated themselves as follows: 19 teachers identified themselves as being moderately motivated, and six teachers identified themselves as being highly motivated. A Mann-Whitney U-Test supported the null hypothesis. No significant difference was found between teachers who are highly motivated and teachers who are moderately motivated to use computers with regard to degree of implementation.

Hypothesis two states that there is no significant ($p \leq .05$) difference in degree of implementation of computers between teachers who frequently use and teachers who do not frequently use computers at home. With 25 cases reporting in the pilot study, teachers discriminated themselves as follows: 22 teachers identified themselves as frequent users and three identified themselves as infrequent users. A Mann-Whitney U Test supported the null hypothesis.

Hypothesis three states that there is no significant ($p \leq .05$) difference in degree of implementation of computers among teachers who have received much curriculum integration training, a moderate amount of curriculum integration training, and little curriculum integration training. Curriculum integration training (CIT) is defined in this study as training that assists teachers in learning to integrate computers into the curriculum, as opposed to training that emphasizes basic operation of computer hardware and software. With 25 cases reporting in the pilot study, teachers discriminated themselves as follows: 11 teachers received little curriculum integration training (0-10 hours) per year over the past three years, four received moderate curriculum integration training (11-20 hours), and ten received much curriculum integration training (21 to more than 30 hours). A Kruskal-Wallis One-way Analysis of Variance by Ranks demonstrated a significant difference at the $p \leq .05$ level between teachers who received little curriculum integration training and each of the other two groups, teachers who received a moderate amount of curriculum integration training and teachers who received much curriculum integration training. This analysis supports rejection of the null hypothesis. The results indicate that teachers who receive either a moderate amount of CIT or much CIT use computers in the classroom with students for activities that include curriculum support, research, data organization, and composition more hours per week than do teachers who receive little CIT.

Hypothesis four states that there is no significant ($p \leq .05$) difference in degree of implementation of computers among teachers who receive much curriculum integration support, a moderate amount of curriculum integration support, and little curriculum integration support during the implementation process. Curriculum integration support refers to support teachers receive from other teachers, technology coordinators, principals, and other resource persons as they attempt to integrate computers into the curriculum. With 25 cases reporting in the pilot study, teachers discriminated themselves as follows: 14 teachers identified themselves as receiving little curriculum integration support, seven as receiving moderate curriculum integration support, and four as receiving much curriculum integration support. A Kruskal-Wallis One-way Analysis of Variance by Ranks showed no significant difference among teachers who received much curriculum integration support, a moderate amount of curriculum integration support, and little curriculum integration support during the implementation process. The data analysis supported the null hypothesis.

The absence of significant relationships between degree of implementation and teacher motivation, degree of implementation and curriculum integration support, and degree of implementation and frequency of computer use may be attributable to the small number of cases included in the pilot study. A significant body of research suggests that a significant relationship does exist between the dependent variable implementation and each of the independent variables, teacher motivation, frequency of computer use at home, curriculum integration training, and curriculum integration support. Further investigation with a greater number of cases will be conducted.

Data analysis in the form of a Pearson Product-Moment Coefficient of Correlation was used to analyze hypotheses five through eight as shown in Table A1. Hypothesis five states that there is no significant ($p \leq .05$) relationship between degree of implementation of computers and the use of computer technology for collaborative learning. A positive correlation of .58, significant at the $p \leq .01$ level, was found to exist between implementation and collaborative learning. This data analysis supports rejection of the null hypothesis. These results demonstrate that students in classrooms where computers are implemented into the curriculum a greater number of hours per week participate in collaborative learning activities more often than do students in classrooms where computers are implemented fewer hours per week..

Hypothesis six states that there is no significant ($p \leq .05$) relationship between degree of implementation and the use of computer technology for self-directed learning. A positive correlation of .47, significant at the $p \leq .05$ level, was found to exist between degree of implementation and self-directed learning. This data analysis supported rejection of the null hypothesis. The results show that students in classrooms where computers are implemented into the curriculum a greater number of hours per week participate in self-directed learning experiences more often than do students in classrooms where computers are implemented fewer hours per week.

Hypothesis seven states that there is no significant ($p \leq .05$) relationship between degree of implementation of computers and the use of computer technology for active learning. A strong positive relationship of .61, significant at the $p \leq .01$ level, was found to exist between implementation and active learning. The data analysis supports rejection of the null hypothesis. The results show that students in classrooms where computers are implemented into the curriculum a greater number of hours per week participate in active learning experiences more often than do students in classrooms where computers are implemented fewer hours per week.

Hypothesis eight states that there is no significant ($p \leq .05$) relationship between degree of implementation and change in teacher practices. A positive correlation of .50, significant at the $p \leq .05$ level, was shown to exist between degree of implementation and teacher practices. The data analysis supports rejection of the null hypothesis. The results show that teachers who implement computers into the curriculum a greater number of hours per week report an increase in opportunities to change their methods of delivery and interactions with students so that these activities become more facilitative, and less directive, in nature.

Other relationships among variables were found in the analysis of data. Moderately strong to strong positive relationships at the $p \leq .05$ and $p \leq .01$ levels of significance were found between curriculum integration training and collaborative learning (.45 at the $p \leq .05$ level of significance), curriculum integration training and self-directed learning (.54 at the $p \leq .01$ level of significance), curriculum integration training and active learning (.59 at the $p \leq .01$ level of significance) and curriculum integration training and teacher practices (.62 at the $p \leq .01$ level of significance). These results indicate that training which focuses on helping teachers implement computers into the curriculum as a teaching and learning tool does impact both student learning experiences and teacher practices in the classroom. As the amount of curriculum integration training in terms of hours increases, student learning experiences become more active, collaborative, and self-directed in nature, while teacher practices become more facilitative in nature.

A strong positive relationship was found to exist between curriculum integration support and collaborative learning (.97 at the $p \leq .01$ level of significance), curriculum integration support and active learning (.83 at the $p \leq .01$ level of significance), and curriculum integration support and teacher practices (.87 at the $p \leq .01$ level of significance). These results indicate that teachers who receive more curriculum integration support during the implementation process are more likely to make authentic changes regarding student learning experiences and teacher practices as they incorporate the use of computers into teaching and learning activities.

A strong positive relationship of .74 at the $p \leq .05$ level of significance was also found between curriculum integration training and curriculum integration support. This indicates that teachers who receive more hours of training also tend to receive more support for incorporating computers into the teaching and learning environment. It could also indicate that teachers who receive more support are encouraged by the support to participate in more training.

Subjects

The population for this study was secondary classroom teachers (grades 9-12) in public schools in northeast Louisiana (Region 8). Region 8 includes Caldwell, Catahoula, Concordia, East and West Carroll, Franklin, Jackson, Lincoln, Morehouse, Ouachita, Richland, Tensas, Madison, Union, and Monroe City school systems. The number of schools selected for the survey sample was determined using the table developed by Krejcie and Morgan (1970) for determining sample size for a given population. The participating schools were randomly selected using the Louisiana School Directory 1999-2000, Bulletin 1462. Principals or other contact persons at selected schools were asked to assign an instrument to every other teacher on an alphabetical listing of teachers at that school.

Participating teachers completed the survey regarding demographic data, curriculum integration training received, individual teacher motivation to use computer technology, curriculum integration support received, and the number of hours per week computers were being used in their classrooms as teaching and learning tools. Teachers also indicated the type of activity, such as research and data organization, for which computers were being used. Through the survey, teachers also provided data concerning the impact of implementation of computers on student learning experiences and teacher practices.

A variety of inservice training opportunities have been provided for teachers at state, regional, and local levels to help teachers learn to use computers and integrate computer technology into the curriculum. For the purposes of this study, teachers were asked only about training that focused on curriculum integration. Likewise, teachers were also asked to indicate curriculum, rather than technical, support that they had received during the implementation process, as well as from whom they received the support.

Data Collection

The sample for this study was selected using purposeful sampling from a population of high school teachers (grades 9-12) in Region 8 in northeast Louisiana. The number of high schools in Region 8 was determined to be 48 using the Louisiana School Directory 1999-2000, Bulletin 1462. The number of schools selected to participate in the study was determined using the table developed by Krejcie and Morgan (1970) for determining sample size for a given population. According to the table, 44 out of 48 schools should be selected to participate in order that the sample proportion would be within .05 of the population proportion with 95% accuracy. The participating schools were selected using a table of random numbers. Principals or other contact persons at each participating school were asked to give a survey to every other teacher on an alphabetical listing.

Once the sample was selected, a letter requesting permission for teachers in that district to participate was mailed to the superintendent in each district. Superintendents were contacted by phone prior to receiving the letter so that the researcher could briefly explain the study and to encourage immediate response for permission to begin the study. Following approval at the district level, principals were contacted by phone to request their cooperation and assistance in the collection of data. The name of a contact person was sought at each school in the event that questions arose and contact with the researcher was needed. After contacting each principal by phone, information explaining the survey, instructions for distributing the survey to teachers, and a packet containing surveys for each teacher, was mailed to each principal with attention to the contact person. The letter requested that surveys be distributed to every other teacher in grades 9, 10, 11, and 12, using an alphabetical listing of teachers at that school. A form was provided for the contact person to code teacher names with code numbers for follow-up purposes. A stamped, addressed envelope was provided so that the follow-up response form could be returned to the researcher. Participants were assured that results of the survey would be confidential, and that the coding system would be used only to facilitate follow up.

Each teacher packet contained a letter of introduction and explanation of the study, the survey form, and a stamped, addressed envelope for return of the survey form to the researcher. Two weeks after the initial mailing of survey packets, the response follow-up form was utilized to send teacher packets (including a follow-up letter, a survey, and a stamped, addressed envelope) to teachers at each school who had not responded. The contact person was again asked to disseminate the teacher packets. This same procedure was utilized for a third and final mailing of packets for teachers who did not respond to the first two requests.

Two of the 44 schools selected chose not to participate in the study. In the remaining 42 schools that chose to participate, six hundred thirty-nine teachers were given surveys, and four hundred forty-five responded for a 70% response rate. Six surveys were eliminated from data analysis due to insufficient data.

Data Analysis

The independent variable *teacher motivation* was divided into two groups for the purpose of analysis: (a) teachers who identified themselves as being *highly motivated* to use computer technology, and (b) teachers who identified themselves as being *moderately motivated* to use computer technology. The original thinking concerning the division of the teacher motivation scale for purposes of analysis was that teachers should be categorized into three groups: teachers who were highly motivated, teachers who were moderately motivated, and teachers who were poorly motivated. Pilot study results, however, showed that no teachers identified themselves as being poorly motivated. Preliminary analysis of 426 cases from the larger study showed that only four teachers discriminated themselves as being poorly motivated. Because of this extreme distribution across groups, the low group was merged with the moderately motivated group.

The independent variable *personal use of computers* was divided into two groups according to the frequency with which each teacher reported using a computer at home: (a) Teachers who reported using a computer at home *daily* to *several times a month* were categorized as *frequent* users, and (b) teachers who indicated that they used a computer at home from *several times a semester* to *not at all* were categorized as *infrequent* users. The independent variable *curriculum integration training* was divided among teachers according to the amount of training they received per year over the past three years: (a) Teachers who reported receiving 21 or more hours of training were categorized as receiving *much curriculum integration training;* (b) teachers who reported receiving from 11-20 hours of training were categorized as receiving *moderate curriculum integration training*; and (c) teachers who reported receiving from 0-10 hours of training were categorized as receiving *little curriculum integration training*.

The independent variable *curriculum integration support* was divided among teachers according to the frequency with which they received support for implementation from resource persons: (a) Teachers who reported receiving support on a *weekly* or *a monthly basis* were categorized as receiving much support, (b) teachers who reported receiving support *several times during a semester* were categorized as receiving a moderate amount of support, and (c) teachers who reported receiving support from *several times during the year* to *not at all* were categorized as receiving little support.

Mann-Whitney U Test

Hypothesis one states that there is no significant ($p \leq .05$) difference in degree of implementation of computers between teachers who are highly motivated and teachers who are moderately motivated to use computer technology as a teaching and learning tool. A Mann-Whitney U test was used to determine the relationship of teacher motivation to degree of implementation. The Mann-Whitney U test is an alternative to the *t* test of the difference between means of two independent samples. Mann-Whitney U is one of the most powerful of the nonparametric tests, and is a useful alternative to the parametric *t* test when the researcher is unable to meet assumptions of the *t* test (Seigel, 1956).

Hypothesis Two states that there is no significant ($p \leq .05$) difference in degree of implementation of computers between teachers who frequently use and teachers who do not frequently use computers at home. A Mann-Whitney U test was utilized to determine the relationship of teacher personal use of computers to degree of implementation.

Kruskal-Wallis One-way Analysis of Variance by Ranks

Hypothesis three states that there is no significant ($p \leq .05$) difference in implementation of computers among teachers who have received much curriculum integration training, a moderate amount of curriculum integration training, and little curriculum integration training. Kruskal-Wallis One-way Analysis of Variance by Ranks was utilized to determine the relationship of degree of implementation to curriculum integration training. Kruskal-Wallis One-way Analysis of Variance by Ranks is a tool for determining whether the sum of ranks are so disparate that they are not likely to have come from samples which were drawn from the same population. In the computation of the Kruskal-Wallis test, each of the *N* observations are replaced by ranks. All of the scores from all of the *k* samples combined are ranked in a single series, and the sum of the ranks for each sample or column is found.

Hypothesis four states that there is no significant ($p \leq .05$) difference in implementation of computers among teachers who receive much curriculum integration support, a moderate amount of curriculum integration support, and little curriculum integration support during the implementation process. Kruskal-Wallis One-way Analysis of Variance by Ranks was utilized to determine the relationship of degree of implementation to curriculum integration support.

Correlations

Hypothesis five states that there is no significant ($p \leq .05$) relationship between degree of implementation of computers and the use of computer technology for collaborative learning. Hypothesis six states that there is no significant ($p \leq .05$) relationship between degree of implementation of computers and the use of computer technology for self-directed learning. Hypothesis seven states that there is no significant ($p \leq .05$) relationship between degree of implementation of computers and the use of computer technology for active learning. Hypothesis eight states that there is no significant ($p \leq .05$) relationship between degree of implementation of computers and change in teacher practices.

A Pearson Product-moment Correlation matrix was used to determine the relationships among the independent variables, teacher motivation, teacher personal use of computers, teacher curriculum integration training, and teacher curriculum integration support; and the dependent variables, implementation, collaborative learning, self-directed learning, active learning, and teacher practices. The Product-moment Correlation Coefficient is a statistic descriptive of the degree or magnitude of the relationship among variables. This statistical analysis relates to all eight hypotheses, but was utilized as the primary form of analysis only for hypotheses five through eight.

Multiple Regression Analysis

A multiple regression analysis was used in post-hoc analysis to determine how the independent variables, teacher motivation, teacher personal use of computers, curriculum integration training, and curriculum integration support, relate to or predict the value of the dependent variables, implementation, collaborative learning, self-directed learning, active learning, and teacher practices. Multiple regression analysis is used when researchers wish to predict values of one variable from values of other variables (Crowl, 1996). This statistical analysis relates to hypotheses one through eight.

Descriptive Statistics

Descriptive statistics consisting of numbers and percentages were determined and reported in a discussion of all demographic data and computer experience data.

CHAPTER 4

FINDINGS

Overview

The purpose of this study was to examine motivational and environmental factors (teacher motivation, curriculum integration training, curriculum integration support, and teacher personal use of computers) that have been demonstrated through research as likely to constrain or facilitate the implementation of computer technology into the curriculum. The study further examined changes to the learning environment in terms of student learning experiences and teacher practices that may also be associated with the implementation of computer technology into the curriculum.

Population and Sample

The population from which subjects were selected was secondary classroom teachers (grades 9-12) in public schools in northeast Louisiana. Participating school systems were Caldwell Parish, Catahoula Parish, Concordia Parish, East Carroll Parish, Franklin Parish, Jackson Parish, Lincoln Parish, Madison Parish, Morehouse Parish, Ouachita Parish, Richland Parish, Tensas Parish, Union Parish, West Carroll Parish, and the City of Monroe system. A list of the number of surveys mailed and returned from each school district in this study is shown in Table 1.

Table 1

Number of Participating Schools, Surveys Assigned, and Surveys Returned by District

School District	Number of Participating Schools	Number of Surveys Assigned to Teachers	Number of Responses
Caldwell Parish	1	24	8
Catahoula Parish	4	27	18
Concordia Parish	3	39	18
East Carroll Parish	2	19	15
Franklin Parish	2	25	25
Jackson Parish	4	33	23
Lincoln Parish	4	69	49
Madison Parish	2	23	18
Morehouse Parish	2	52	38
Ouachita Parish	4	152	123
Richland Parish	2	20	15
Tensas Parish	2	25	19
Union Parish	5	34	27
West Carroll Parish	3	40	24
City of Monroe	2	57	22
Unknown			3
Totals:	42	639	445

Forty-four of 48 schools were randomly selected to participate in the survey. Teachers in forty-two schools chose to participate in the study. Using an alphabetical listing, surveys were assigned to every other teacher at each participating school. The number of teachers given surveys and the number of responses by school system is shown in Table 1. Six hundred thirty-nine teachers were assigned surveys, and four hundred forty-five responded for a 70% response rate from the 42 schools. Six surveys were eliminated from data analyses due to insufficient data.

Tables 2 through 10 contain demographic data describing the teachers who participated in this study. Variables of gender, age, ethnicity, highest degree earned, years of teaching experience, major teaching assignment, years of computer experience, years of computer use in teaching, and grade level taught are provided.

Table 2 shows that 296 (67.4%) of the teachers who responded to the survey were female. One hundred twelve (25.5%) respondents were male. Thirty-one respondents did not provide data regarding gender.

Table 2

Number and Percentage of Participating Teachers by Gender

Gender	Number of Teachers Surveyed	Percentage of Teachers Surveyed	Cumulative Percentage
Female	296	67.4	67.4
Male	112	25.5	92.9
No Response	31	7.1	100.0

The number and percentage of teachers by age group are shown in Table 3. Teachers ages 46 to 53 years made up the largest group. Teachers ages 21 to 25 years made up the smallest group.

Table 3

Number and Percentage of Participating Teachers by Age Group

Age Groups	Number of Teachers Surveyed	Percentage of Teachers Surveyed	Cumulative Percentage
21-25 years	17	3.9	3.9
26-30 years	39	8.9	12.8
31-35 years	68	15.5	28.3
36-40 years	51	11.6	39.9
41-45 years	63	14.3	54.2
46-53 years	125	28.5	82.7
Over 54 years	70	15.9	98.6
No Response	6	1.4	100.0

Table 4 shows the number and percentage of teachers who participated in this study by ethnicity. Three hundred thirty-three teachers (75.9%) who responded to the survey were Caucasian. The other three groups combined made up 22% of the sample.

Table 4

Number and Percentage of Participating Teachers by Ethnicity

Ethnicity	Number of Teachers Surveyed	Percentage of Teachers Surveyed	Cumulative Percentage
African-American	88	18.2	18.2
Asian	11	2.5	20.7
Caucasian	333	75.9	96.6
Hispanic	3	.7	97.3
Other	1	.2	97.5
No Response	11	2.5	100.0

The data in Table 5 show that the highest degree earned by almost half (46.9%) of the teachers was a bachelors degree. The percentage of teachers holding a masters degree was 44.4%. A specialist degree was held by 2.7% of participating teachers, and 1% had obtained a doctoral degree.

Table 5

Number and Percentage of Participating Teachers by Highest Degree Earned

Degree Earned	Number of Teachers Surveyed	Percentage of Teachers Surveyed	Cumulative Percentage
Bachelors	206	46.9	46.9
Masters	195	44.4	91.3
Specialist	12	2.7	94.0
Doctorate	4	1.0	94.9
No Response	22	5.0	100.0

As shown in Table 6, 143 (32.6%) of the teachers had more than 20 years of teaching experience. Eighty-nine teachers (20.3%) had taught for less than five years. Sixty-seven teachers (15.3%) had six to ten years of experience, 56 teachers (12.7%) had 11-15 years of experience, and 57 (13%) had from 16 to 20 years of experience.

Table 6

Number and Percentage of Participating Teachers by Years of Teaching Experience

Years Teaching Experience	Number of Teachers Surveyed	Percentage of Teachers Surveyed	Cumulative Percentage
1-5 years	89	20.3	20.3
6-10 years	67	15.3	35.6
11-15 years	56	12.7	48.3
16-20 years	57	13.0	61.5
Over 20 years	143	32.6	93.9
No Response	27	6.1	100.0

The numbers and percentages of teachers participating in the study according to major teaching assignment are identified in Table 7. Teachers from other major teaching assignments included (a) four ROTC/military science teachers, (b) five librarian/library science teachers, (c) nine foreign language teachers, (d) ten health and physical education teachers, (e) 13 gifted or special education teachers, (f) one band teacher, (g) nine art teachers, (h) two music teachers, (i) one study skills teacher, and (j) one speech teacher. Twenty teachers who selected the "other" category did not identify their major teaching assignment.

Table 7

Number and Percentage of Participating Teachers by Major Teaching Assignment

Content Area Taught	Number of Teachers Surveyed	Percentage of Teachers Surveyed	Cumulative Percentage
English/Language Arts	100	22.8	22.8
Math	63	14.3	37.1
Science	45	10.3	47.4
Social Studies	62	14.1	61.5
Vocational	80	18.2	79.7
Other	75	17.1	96.8
No Response	14	3.2	100.0

Responses from participating teachers to the question "How many years of computer experience do you have?" are provided in Table 8. One hundred seventy-eight (40.5%) teachers indicated having over five years of computer experience. Nearly 60% (57.7%) reported having computer experience of five years or less: (a) 100 teachers (22.8%) indicated having three to five years of computer experience, (b) 92 participants (21%) reported one to two years of experience, and (c) 61 (13.9%) indicated having under one year of computer experience.

Table 8

Number and Percentage of Participating Teachers by Years of Computer Experience

Computer Experience	Number of Teachers Surveyed	Percentage of Teachers Surveyed	Cumulative Percentage
Under 1 year	61	13.9	13.9
1-2 years	92	21.0	34.9
3-5 years	100	22.8	57.7
Over 5 years	178	40.5	98.2
No Response	8	1.8	100.0

Data in Table 9 from participating teachers represent the following question: "How many years have you used computers in teaching?" Only 98 (22.3%) of the teachers surveyed indicated having used computers in teaching for over five years. Almost 30% (27.6%) of those surveyed indicated having used computers in teaching for less than a year. Over 50% (54.3%) indicated having used computers in teaching for two years or less. Nearly 80% (76.6%) of participating teachers indicated having five years or less experience using computers as a teaching and learning tool.

Table 9

Number and Percentage of Participating Teachers by Years of Computer Use in Teaching

Used Computer in Teaching	Number of Teachers Surveyed	Percentage of Total Surveyed	Cumulative Percentage
Under 1 year	121	27.6	27.6
1-2 years	117	26.7	54.3
3-5 years	98	22.3	76.6
Over 5 years	98	22.3	98.9
No Response	5	1.1	100.0

The number of participating teachers by grade level taught is identified in Table 10. The total represents a duplicated number since most secondary teachers teach more than one grade level.

Table 10

Number of Participating Teachers According to Grade Level Taught

Grade Level	Number of Teachers Surveyed
Ninth Grade	314
Tenth Grade	337
Eleventh Grade	348
Twelfth Grade	321
Total	1320*

*Note. This number represents a duplicated count.

Instrumentation

Selected scales from a teacher survey developed by Lowe (1998) were utilized in the development of the teacher survey used in this study. Changes made to the original instrument by this researcher followed an extensive literature review of factors shown to facilitate or constrain the implementation of computer technology, contemporary uses of computer technology in school settings, and changes in student learning experiences and teacher practices associated with use of computers as a teaching and learning tool.

The survey utilized in this study included checklists, rubrics, and scales which examined (a) environmental and motivational factors associated with the use of computers in the classroom, (b) the degree of implementation of computer technology into the curriculum (c) the impact of the use of computer technology on student learning experiences and teacher practices, and (d) participant profile data (See Appendix D).

Data Analysis

The study sought to determine the relationship between each of the independent variables, *teacher personal use of computers, teacher motivation, curriculum integration training,* and *curriculum integration support,* and the dependent variable, *degree of implementation* of computers. The study further sought to determine the relationship between *degree of implementation* and each of the following: *collaborative learning, self-directed learning, active learning,* and *teacher practices.*

A Mann-Whitney U test was used the determine the relationship between *teacher motivation* and *degree of implementation.* The relationship between *teacher personal use of computers* and *degree of implementation* was also examined using a Mann-Whitney U-test. The Mann-Whitney U test is one of the most powerful of the nonparametric tests, and is a useful alternative to the parametric *t* test when the researcher wishes to avoid the *t* test's assumptions (Seigel, 1956).

Kruskal-Wallis One-way Analysis of Variance by Ranks was utilized to determine the relationship between *curriculum integration support* and *degree of implementation*, as well as the relationship between *curriculum integration training* and *degree of implementation*. The Kruskal Wallis One-way Analysis of Variance by Ranks is a useful test for determining whether the differences between or among groups signify genuine population differences or whether they represent merely chance variations such as are expected among several random samples from the same population (Seigel, 1956).

Pearson Product-Moment Coefficient of Correlation was applied to determine the relationship of *degree of implementation* to each of the following: (a) *collaborative learning*, (b) *self-directed learning*, (c) *active learning*, and (d) *teacher practices*. Multiple regression analysis was used in post hoc analysis to determine how the variables *teacher motivation*, *teacher personal use of computers*, *curriculum integration training*, *curriculum integration support*, *collaborative learning*, *self-directed learning*, *active learning*, and *teacher practices* relate to or predict the value of the dependent variable, *degree of implementation*. Multiple regression analysis is used when researchers wish to predict values of one variable from values of another variable (Crowl, 1996).

Analyses of Hypotheses

Figure 1 shows the theoretical model for hypotheses one through four. Based on a review of literature, the four constructs *teacher motivation*, *teacher personal use of computers*, *curriculum integration training*, and *curriculum integration support*, have been shown to have a significant impact on the *degree of implementation* of computers into the curriculum. The theoretical model was developed through this review of literature, and a teacher survey developed by the researcher was utilized to collect data regarding each of the independent variables and the dependent variable.

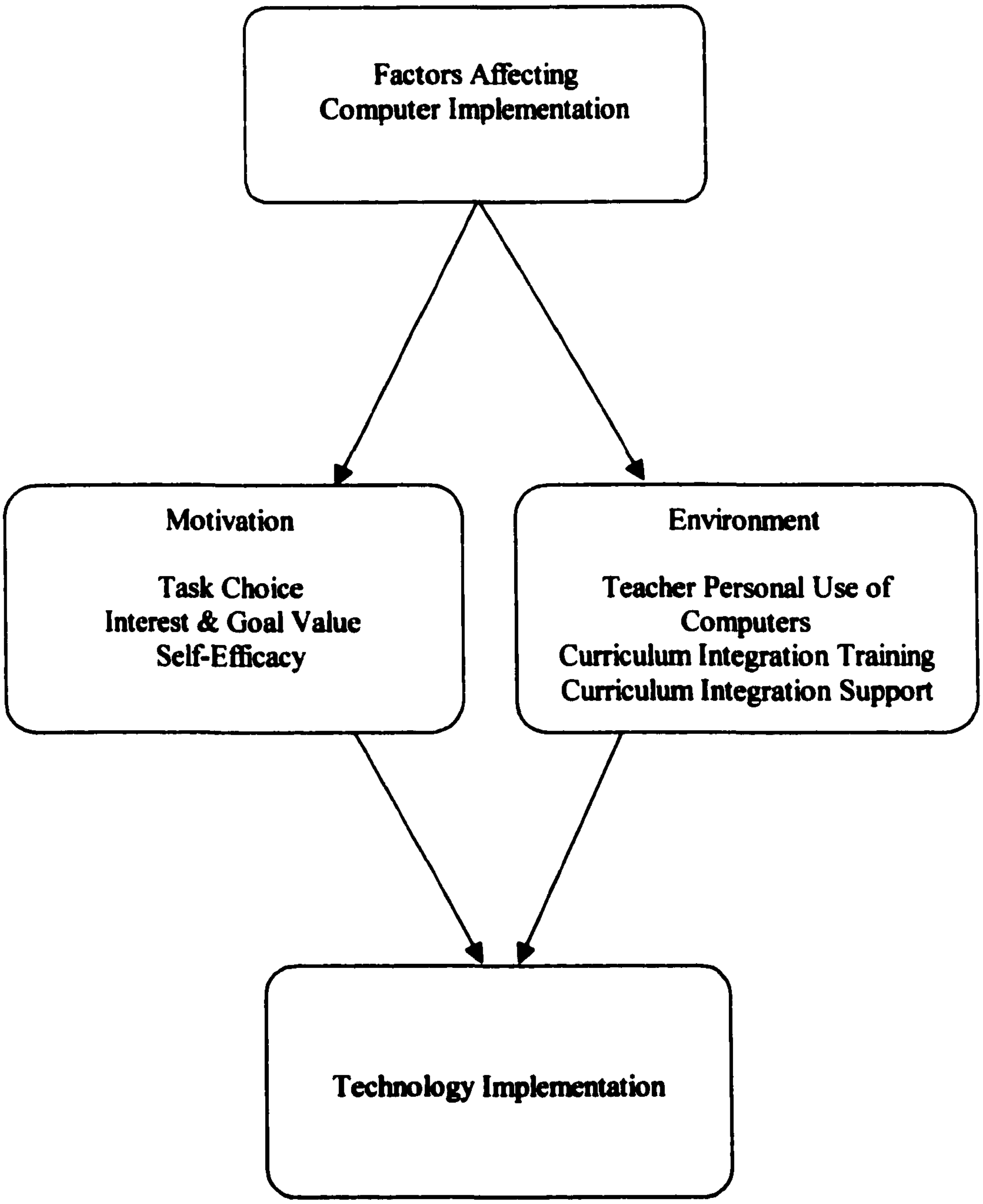

Figure 1. Theoretical Model for Hypotheses One Through Four

Hypothesis One: There is no significant ($p \leq .05$) difference in degree of implementation of computers between teachers who are highly motivated and teachers who are moderately motivated to use computer technology as a teaching and learning tool. A Mann-Whitney U test was utilized to determine the relationship of the independent variable *teacher motivation* to the dependent variable *degree of implementation*. The Mann-Whitney U test is an alternative to the *t*-test of the difference between means of two independent samples. Mann-Whitney U is one of the most powerful of the nonparametric tests, and is a useful alternative to the parametric *t* test when the researcher wishes to avoid the *t* test's assumptions (Seigel, 1956). It derives from the probability of obtaining a sum of ranks for one distribution that differs from the expected sum of ranks (under the hypothesis of equality of the two distributions) by more than a given amount (Minium & Clark, 1982).

For the purpose of analysis, teachers were divided into two groups based on responses to 11 stimulus items on the six-point teacher motivation scale: (a) teachers who were moderately motivated, and (b) teachers who were highly motivated to use computer technology as a teaching and learning tool. Table 11 shows that 230 teachers identified themselves as being highly motivated, while 209 identified themselves as being moderately motivated.

The Mann-Whitney U test demonstrated no significant difference between teachers who were highly motivated and teachers who were moderately motivated to use computer technology as a teaching and learning tool. A nonsignificant *p* value (as shown in Table 11) indicates that the mean ranks of the two groups of teachers are not significantly different. The null hypothesis of no significant difference is therefore accepted. When actual group means were calculated, the group mean for teachers who identified themselves as being highly motivated was 12.13 hours of computer implementation, while the group mean for teachers who identified themselves as being moderately motivated was 11.34 hours of implementation. Table 11 shows that the mean rank for teachers who were moderately motivated was 212.80. The mean rank for teachers who were highly motivated was 226.54. When corrected for ties, *z* was equal to -1.1383. The equation for determining *z* ratio is reported in Appendix B.

Table 11

Mann-Whitney U Test for Degree of Implementation with Regard to Teacher Motivation

Teacher Motivation	Number of Cases	Mean Rank	*2-Tailed *p*
Moderately Motivated	209	212.80	.26
Highly Motivated	230	226.54	

*Corrected for ties

Hypothesis Two: There is no significant ($p \leq .05$) difference in degree of implementation of computers between teachers who frequently use and teachers who do not frequently use computers at home. A Mann-Whitney U test was utilized to determine the relationship of *teacher personal use of computers* to *degree of implementation.* Teachers were divided into two groups according to frequency of computer use at home. Teachers who reported using a computer at home from *several times a month* to *daily* were categorized as frequent users. Teachers who reported using a computer at home from *several times a semester* to *not at all* were categorized as infrequent users. Three hundred eighty-seven teachers identified themselves as frequent users, while 51 teachers identified themselves as being infrequent users of a computer at home.

The Mann-Whitney U test demonstrated a significant difference at the $p \leq .0001$ level between teachers who frequently used a computer at home and teachers who did not frequently use computers at home with regard to degree of implementation of computers into the curriculum. The null hypothesis was rejected. When the actual means were calculated, the mean use was 12.74 hours of implementation of computers into the curriculum for frequent users, and 4.39 hours for infrequent users. This analysis supports the findings of the Mann-Whitney U test that there was a significant difference between frequent and infrequent users with regard to hours of implementation. Table 12 shows that the mean rank for frequent users was 229.55. The mean rank for infrequent users was 143.23. When corrected for ties, *z* was equal to -4.5983. The equation for determining *z* ratio is reported in Appendix B.

Table 12

Mann-Whitney U Test for Degree of Implementation with Regard to Teacher Personal Use of Computers

Personal Use of Computers	Number of Cases	Mean Rank	*2-Tailed *p*
Infrequent Users	51	143.23	.0001****
Frequent Users	387	229.55	

*Corrected for ties

****$p \leq .0001$

Hypothesis Three: There is no significant ($p \leq .05$) difference in degree of implementation of computers among teachers who have received much curriculum integration training, a moderate amount of curriculum integration training, and little curriculum integration training. Teachers were grouped for purposes of analysis according to the number of clock hours of curriculum integration training (CIT) they reported receiving per year over the past three years. Teachers who identified themselves as receiving from zero to ten hours of training were categorized as receiving little CIT. Teachers who identified themselves as receiving from 11-20 hours of CIT were categorized as receiving a moderate amount of training, and teachers who identified themselves as receiving from 21 hours to more than 30 hours of CIT were categorized as receiving much training.

Kruskal-Wallis One-way Analysis of Variance by Ranks was utilized to determine the relationship of *degree of implementation* to *curriculum integration training*. The Kruskal-Wallis One-way Analysis of Variance by Ranks is a useful tool for determining whether independent samples are from different populations. In the computation of the Kruskal-Wallis test, each of the N observations are replaced by ranks. All of the scores from all of the k samples combined are ranked in a single series. When this is done, the sum of the ranks in each sample or column is found. The Kruskal-Wallis test determines whether these sums of ranks are so disparate that they are not likely to have come from samples which were drawn from the same population (Seigel, 1956).

The mean rank for each group of teachers resulting from the Kruskal-Wallis One-way Analysis of Variance by Ranks is shown in Table 13. The mean rank for teachers receiving little CIT was 207.88, the mean rank for teachers receiving a moderate amount of CIT was 230.31, and the mean rank for teachers receiving much CIT was 259.54. The Kruskal-Wallis One-way Analysis of Variance by Ranks demonstrated a significant difference at the $p \leq .004$ level between teachers who received little curriculum integration training and teachers who received much curriculum integration training with regard to degree of implementation. This analysis supports rejection of the null hypothesis.

Table 13 shows that 306 teachers reported receiving little curriculum integration training, 53 reported receiving a moderate amount of training, and 80 reported receiving much training. When the actual means were calculated, the mean use for teachers who reported receiving little CIT was 11.78 hours of computer implementation per week. The mean use for teachers who reported receiving moderate CIT was 10.21 hours. The mean use for teachers receiving much training was 12.66 hours of implementation per week. This supports the findings of the Kruskal-Wallis One-way Analysis of Variance by Ranks that there is a significant difference in degree of implementation between teachers who received a moderate amount of curriculum integration training and teachers who received a greater amount of curriculum integration training.

A Chi-square table was utilized for determining the value of *H*. The Chi-square approximation must be utilized in the analysis for larger values of *k* (number of groups) and *n* (members of groups). The quantity *H* was found to be equal to 10.92. When corrected for ties, the value of *H* was 11.01. The equation for determining *H* is reported in Appendix C.

Table 13

Kruskal-Wallis One-way ANOVA by Ranks of Degree of Implementation with Regard to Curriculum Integration Training

Categories	Number of Cases	Mean Rank	*Significance
Little Training (0-10 hours)	306	207.88	.004**
Moderate Training (11-20 hours)	53	230.31	
Much Training (21 or more hours)	80	259.54	

*Corrected for ties

**$p \leq .01$

Hypothesis Four: There is no significant ($p \leq .05$) difference in degree of implementation of computers among teachers who receive much curriculum integration support, a moderate amount of curriculum integration support, and little curriculum integration support during the implementation process. Teachers were divided into three groups according to the frequency with which they received support for integrating computer technology into the curriculum. Teachers who reported receiving assistance from *several times a year* to *not at all* were categorized as having received little curriculum integration support (CIS). Teachers who reported receiving assistance *several times during a semester* were categorized as having received a moderate amount of CIS. Teachers who reported receiving assistance *on a monthly basis* or *on a weekly basis* were categorized as receiving much CIS.

Kruskal-Wallis One-way Analysis of Variance by Ranks was used to determine the relationship of ***degree of implementation*** to ***curriculum integration support.*** Table 14 shows the number of teachers in each group and the mean rank for each group. Two hundred seventy teachers reported receiving little curriculum integration support, 131 reported receiving a moderate amount of support, and 38 reported receiving much support. Table 14 shows that the mean rank for those receiving little support was 185.96, the mean rank for those receiving moderate support was 268.65, and the mean rank for teachers receiving much support was 294.14.

The Kruskal-Wallis One-way Analysis of Variance by Ranks found a significant difference at the $p \leq .0001$ level between teachers receiving little curriculum integration support and teachers receiving much curriculum integration support regarding degree of implementation of computers in terms of hours. This analysis supports rejection of the null hypothesis. When actual group means were calculated, the actual mean use for teachers receiving little CIS was 7.28 hours of computer implementation, for teachers receiving a moderate amount of support, 16.64 hours of implementation, and for teachers receiving much CIS, 26.68 hours of implementation. This supports the findings of the Kruskal-Wallis One-way Analysis of Variance by Ranks that there was a significant difference in degree of implementation between teachers who received little curriculum integration support and teachers who received much curriculum integration support.

A Chi-square table was utilized for determining the value of H. The Chi-square approximation must be utilized in the analysis for larger values of k (number of groups) and n (members of groups). The quantity H was found to be equal to 51.68. When corrected for ties, the value of *H* was 52.14. The equation for determining *H* is reported in Appendix C.

Table 14

Kruskal-Wallis One-way ANOVA by Ranks of Degree of Implementation with Regard to Curriculum Integration Support

Categories	Number of Cases	Mean Rank	*Significance
Little Support	270	185.96	.0001****
Moderate Support	131	268.65	
Much Support	38	294.14	

*Corrected for ties

****$p \leq .0001$

Hypotheses five through eight were tested utilizing the Pearson Product-Moment Coefficient of Correlation using a two-tailed analysis. Correlational methods are used to determine the extent to which two or more variables are related among a single group of people. The most frequently used measure of correlation is the Pearson Product-Moment Correlation Coefficient, which is symbolized by *r*. The value of *r* may range from +1.00 (perfect positive correlation) to -1.00 (perfect negative correlation). Correlation coefficients are measures of the degree of relationship between variables, with the strongest degree relationship expressed as +1.00 or -1.00, and the weakest degree by zero. The closer the measure is to +1.00 (or -1.00), the stronger the degree of relationship between the variables and the more likely the relationship is statistically significant. The larger the sample size, the smaller the correlation coefficient can be and still be statistically significant. To interpret a correlation coefficient meaningfully, it is helpful to determine how much variability in one variable is accounted for by the variability of the other variable. The measure of variability used is called the variance and the amount of shared variance between two variables is equal to r^2 (Crowl, 1996).

Figure 2 shows the theoretical model for hypotheses five through eight. Based on a review of literature, the degree of implementation of computers has a significant impact on student learning experiences and teacher practices. According to the review, an increase in the number of hours of computer implementation should relate to an increase in collaborative, self-directed, and active learning experiences for students and an increase in opportunities for teachers to change methods of delivery and patterns of interaction with students. Teacher practices should become more facilitative in nature.

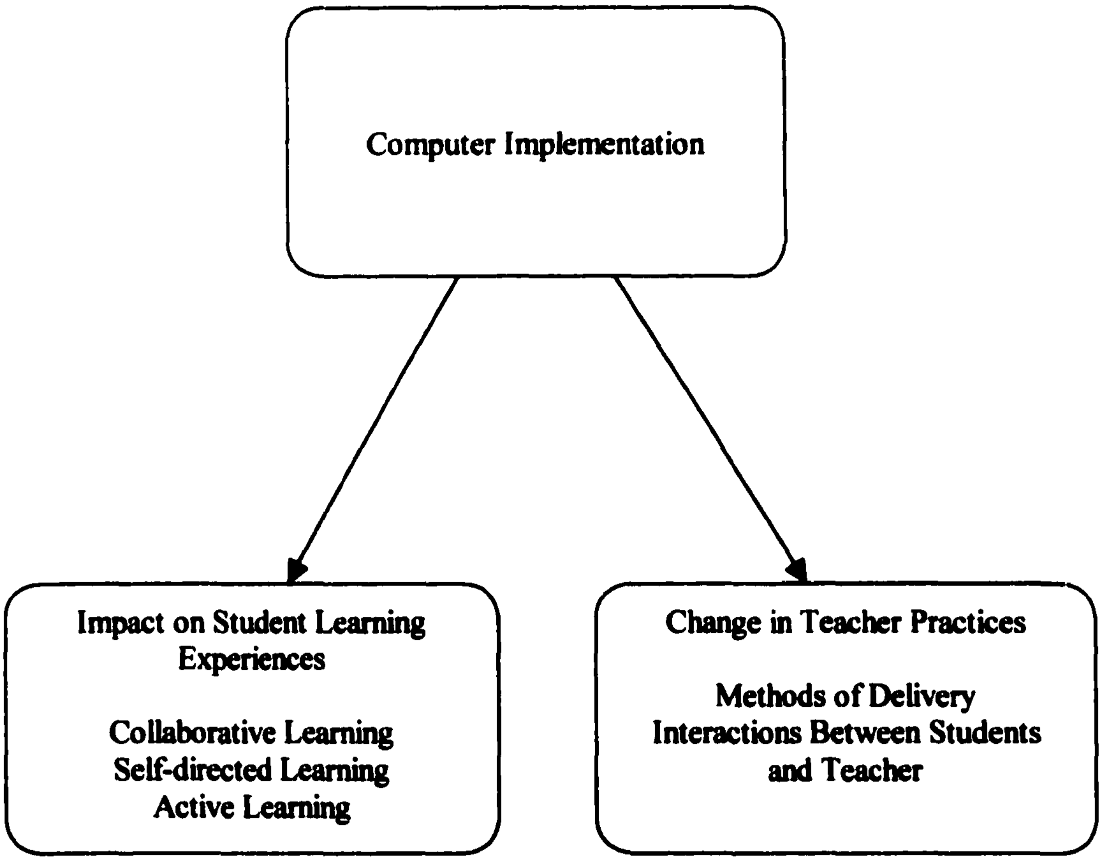

Figure 2. Theoretical Model for Hypotheses Five Through Eight

Hypothesis Five: There is no significant ($p \leq .05$) relationship between degree of implementation of computers and the use of computer technology for collaborative learning. Table 15 shows that a positive correlation of .34, significant at the $p \leq .01$ level, was found to exist between *degree of implementation* and *collaborative learning* experiences. The amount of variance shared between the two variables is approximately 12%. This data analysis supports rejection of the null hypothesis. The results show that students in classrooms where computers are implemented into the curriculum a greater number of hours per week participate in collaborative learning experiences more often than do students in classrooms where computers are implemented fewer hours per week.

Hypothesis Six: There is no significant ($p \leq .05$) relationship between degree of implementation of computers and the use of computer technology for self-directed learning. Table 15 shows that a positive correlation of .40, significant at the $p \leq .01$ level, between *degree of implementation* and *self-directed learning* experiences. The amount of variance shared between the two variables is approximately 15%. This data analysis supports rejection of the null hypothesis. The results indicate that students in classrooms where computers are implemented into the curriculum a greater number of hours per week participate in self-directed learning experiences more often than do students in classrooms where computers are implemented fewer hours per week.

Hypothesis Seven: There is no significant ($p \leq .05$) relationship between degree of implementation of computers and the use of computer technology for active learning. Table 15 shows that a positive correlation of .36, significant at the $p \leq .01$ level, exists between *degree of implementation* and *active learning* experiences. The amount of variance shared between the two variables is approximately 13%. This data analysis supports rejection of the null hypothesis. The results show that students in classrooms where computers are implemented into the curriculum a greater number of hours per week participate in active learning experiences more often than do students in classrooms where computers are implemented fewer hours per week.

Hypothesis Eight: There is no significant ($p \leq .05$) relationship between degree of implementation of computers and change in teacher practices. Table 15 shows that a positive correlation of .39, significant at the $p \leq .01$ level, was found to exist between *degree of implementation* and change in *teacher practices*. The amount of variance shared between the two variables is approximately 15%. The null hypothesis of no significant relationship can be rejected. The results show that teachers who implement computers into the curriculum a greater number of hours per week report an increase in opportunities to change methods of delivery and student/teacher interactions so that the teacher role becomes more facilitative, and less directive, in nature.

Table 15

Correlation Coefficients for Implementation, Collaborative Learning, Self-directed Learning, Active Learning, and Teacher Practices

	Implementation	Collaborative Learning	Self-Directed Learning	Active Learning	Teacher Practices
Implementation	1.000	.34**	.40**	.36**	.39**
Collaborative Learning	.34**	1.000	.74**	.81**	.68**
Self-directed Learning	.40**	.74**	1.000	.82**	.65**
Active Learning	.36**	.81**	.82**	1.000	.68**
Teacher Practices	.39**	.68**	.65**	.68**	1.000

**$p \leq .01$

Post Hoc Analysis of Data

Multiple regression analysis was used to determine how the independent variables *teacher motivation, teacher personal use of computers, curriculum integration training, curriculum integration support, collaborative learning, self-directed learning, active learning,* and *teacher practices* relate to or predict the value of the dependent variable, *degree of implementation.* Multiple regression is an appropriate method of analysis when the research problem involves a single dependent variable hypothesized to be related to one or more independent variables. This analysis is used when researchers wish to predict values of one variable from values of another variable (Crowl, 1996). The objective of the multiple regression analysis is to predict the changes in the dependent variable in response to changes in the several independent variables (Hair, et al., 1995).

A Stepwise Multiple Regression Analysis was used to determine the significance of the relationships between the independent variables *teacher motivation, teacher* *personal use of computers, curriculum integration training, curriculum integration support, collaborative learning, self-directed learning, active learning,* and *teacher practices* and the dependent variable *degree of implementation.* The conventional level of significance p≤.05 was chosen. The multiple regression analysis was used to identify the independent variables that appeared to have a direct relationship to *degree of implementation.* Table 16 shows the analysis of the variables in the multiple regression.

Table 16

Analysis of Variables in the Multiple Regression

Variable	B	Beta	*t*	Sig. Level
Self-directed Learning	.97	.23	2.97	.0032**
CIS	.65	.17	3.62	.0003***
Teacher Practices	.43	.18	2.72	.0068**
Teacher Motivation	-.22	-.07	-1.49	.1362
CIT	-.74	-.08	-1.88	.0609
Personal Use	-.67	-.05	-1.14	.2571
Collaborative Learning	.01	.004	.05	.9595
Active Learning	-.006	-.001	-.01	.9892

**p≤.01 ***p≤.001

Table 17 shows the analysis of the significant variables in the multiple regression. The first variable which loaded into the regression equation was *self-directed learning* which correlated at .40 with the dependent variable *degree of implementation.* The relationship between self-directed learning and implementation was at the p≤.0001 level of significance. In Step 2, *curriculum integration support* was loaded into the equation, increasing the multiple *R* to .44. The relationship between *curriculum integration support* and *degree of implementation* was at the $p \leq .0001$ level of significance. *Teacher practices* was loaded into the equation in Step 3, increasing the multiple *R* to .46. The relationship between *teacher practices* and *degree of implementation* was at the $p \leq .0001$ level of significance. The multiple regression equation following Table 17 shows that *self-directed learning*, *curriculum integration support*, and *teacher practices* are significant contributors to the multiple *R* and account for .46 of the variance among the variables loaded into the multiple regression analysis.

Table 17

Analysis of Significant Variables in the Multiple Regression

Variable	B	Beta	*t*	Sig. Level
Self-Directed Learning	.96	.23	4.10	.0001****
CIS	.61	.16	3.41	.0007***
Teacher Practices	.40	.17	2.85	.0046**
Constant	-8.53		-3.96	.0001****

**$p \leq .01$ ***$p \leq .001$ ****$p \leq .0001$

The multiple regression equation was as follows:

$$Y = .96\,X_1 + .61\,X_2 + .40\,X_3 - 8.53$$

Y = Degree of Implementation
X_1 = Self-Directed Learning
X_2 = Curriculum Integration Support
X_3 = Teacher Practices

Summary

Survey results from 445 secondary teachers (grades 9 -12) in northeast Louisiana public schools demonstrated significant relationships between the following variables: (a)

A significant relationship was shown to exist between *degree of implementation* and the frequency with which teachers use computers at home (*personal use of computers*), (b) a significant relationship was shown to exist between *degree of implementation* and *curriculum integration training,* and (c) a significant relationship was shown to exist between *degree of implementation* and *curriculum integration support. Teacher motivation* had no significant relationship to *degree of implementation.* A significant relationship was also found to exist between *degree of implementation* and (a) *collaborative learning*, (b) *self-directed learning*, (c) *active learning*, and (d) *teacher practices*. Multiple regression analysis showed *self-directed learning, curriculum integration support*, and *teacher practices* to be significant predictors of *degree of implementation.*

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The RAND Report (McLaughlin, 1990) suggested that a revolution in schooling could be brought about by the integration of computer technology into the classroom. The report identified numerous studies pertaining to specific applications of computer technology that demonstrated improvements in student performance, student motivation, and teacher satisfaction, as well as additional benefits such as students developing problem-solving capabilities and practicing collaboration. As a teaching and learning tool, the computer can be a useful medium for achieving both long-standing and contemporary educational goals. The power of the computer can be utilized to activate passive courses, to bring learning to a more personal level for each learner, to give access to education for those without access, and to better serve special needs populations.

The use of computers to support teaching and learning activities, however, can only be successful if teachers are willing to accept the implied modifications. The most "innovative solutions to practical problems, the best packages of materials, can have no effect on practice if they are not diffused to the level of the practitioner" (Guba, 1968, p. 292). The integration of computers into the curriculum comes at a high cost to teachers involved. Teachers are expected to change their personal approach to teaching, and perhaps some of their basic beliefs regarding teaching and learning. They are asked to throw away proven and trusted techniques for unknown ones.

Access to computer technology, therefore, does not necessarily translate into teachers expending the time and effort to accomplish changes in current practices necessary for computers to be used to their fullest potential to accomplish educational goals. It is when teachers themselves experience the benefits of computer technology and come to appreciate the value of computers in their own lives that they become the evangelists who "pull" computers into the classroom. Making computers an integral part of individual classrooms requires passion and relentless energy that comes only from teachers who are "sold" on the value of computers through personal experience.

Technological changes challenge educators to reconfigure instructional skills and reformat instructional delivery as they assist students in integrating the tools of technology with learning. Equipping teachers with the skills to promote the effective use of technological tools constitutes the first step in achieving this reconfiguration. Research shows, however, that teachers often do not have the training and support necessary to facilitate the transformation process. Sustained training in a curricular context with attention to instructional change is necessary to foster the integrated use of computers. Assistance following training is also a key variable in obtaining high levels of implementation. Strong support activities lead to practice mastery and stabilization of the use of an innovation, and have strong, positive, and direct effects on longer-term project outcomes and teacher change.

The use of computer technology promotes change in both teacher practices and student learning experiences. Teachers have traditionally served as gatekeepers of information, controlling the terms and facts of the subject matter addressed in the classroom. In recent years the emphasis in the classroom has shifted from teaching to learning, with learning experiences becoming more active and less authority-dependent. Educational strategies that require more active engagement of students (i.e., case studies, cooperative learning, debates, peer projects, and other collaborative activities) are pushing the lecture method aside. Computer technology both mandates and assists these modes of learning which are recommended by educational leaders for enhancing the student learning process.

The purpose of this study was to examine motivational and environmental factors (teacher motivation, curriculum integration training, curriculum integration support, and teacher personal use of computers) that have been demonstrated through research as likely to constrain or facilitate the implementation of computer technology into the curriculum. The study further examined changes to the learning environment in terms of student learning experiences and teacher practices that have been associated with the implementation of computer technology into the curriculum.

Forty-four schools in northeast Louisiana were randomly selected to participate in the study. Secondary teachers (grades 9-12) were asked to respond to a survey. Six hundred thirty-nine teachers were given surveys, and 445 responded for a 70% response rate from the 42 schools that provided data. Six surveys were eliminated from data analyses due to insufficient data. Teacher responses to the survey developed by the researcher provided quantitative data that were statistically analyzed. Table 18 shows a summary of the analyses results of the eight null hypotheses that were tested.

Analysis of data provided by teachers who participated in this study showed no significant relationship to exist between *teacher motivation* and *degree of implementation*. The original thinking concerning the division of the teacher motivation scale was that teachers should be categorized into three groups: teachers who were highly motivated, teachers who were moderately motivated, and teachers who were poorly motivated. Pilot study results, however, showed that no teachers identified themselves as being poorly motivated. Preliminary analysis of 426 cases from the larger study showed that only four teachers identified themselves as being poorly motivated. These results indicate that while teachers in northeast Louisiana are motivated to use technology, their motivation is not a contributing factor to degree of implementation.

A significant relationship was found to exist between *teacher personal use of computers* and *degree of implementation* (Table 18). If teachers themselves experience the benefits of computer technology, they become evangelists (Soloway, 1996), demanding more computers in their classrooms. Instead of leadership "pushing" computers into the classroom, teachers "pull" them there once they appreciate the value of computers in their own lives. Numerous studies over the past two decades have established a connection between a teacher's personal use of computers with the use of computer applications in the classroom to support teaching and learning activities (Hiatt, 1999; Lecuyer, 1997; Scigliano, 1997; & Simmons, 1995). Making computers an integral part of individual classrooms requires passion and relentless energy that comes only from teachers who are "sold" on the value of computers through personal experience.

Results of analyses also demonstrated a significant relationship between *curriculum integration training* and *degree of implementation* of computers (Table 18).

Curriculum integration training is defined in this study as training in a curricular context focusing on the development of activities through which computers will be used as a tool to support or enhance teacher practices and student learning experiences. The results of this analysis support research demonstrating that continued training offered in a curricular context is necessary to foster the integrated use of computers. Any productive reform requires *sustained* attention to curricular and instructional change, and these changes must be grounded in effective theories that can be put into action. The use of computer technology should be built on significant and meaningful curricula, and efforts to integrate computer technology into schools should be combined with ongoing professional development for teachers relating to effective curriculum design and instruction (Herman, 1994; Hope, 1997; Winches, 1996).

A significant relationship was also found between *curriculum integration support* and *degree of implementation* (Table 18). Assistance following training has long been considered a key change variable that leads to high levels of implementation of an innovation (Fullan, 1985; McLaughlin, 1990). Fullan (1985) emphasized that no matter how much advance training occurs, people have the most specific concerns and doubts when they actually try to implement new approaches. It is extremely important that resource personnel be available to problem-solve and provide support during implementation. Support efforts should help teachers adapt methods and materials to their own situation, and can aid teachers in understanding and applying complex strategies in ways that training cannot do effectively. Well-conducted support activities reinforce the contribution of training. The quality of the support is also critical. Resource providers should be highly credible, having classroom experience with the innovation and experience in working with adult learners (Loucks & Zacchei, 1983).

Analyses of data also showed a significant relationship between constructivist, student-centered classroom practices (both in terms of student learning experiences and teacher practices) and degree of implementation of computers into the curriculum (Table 18). A significant relationship was found to exist between *degree of implementation* and three kinds of student learning experiences: *collaborative, self-directed,* and *active* learning experiences. Results of analyses showed that as the number of hours of computer implementation increased, so did student participation in collaborative, self-directed, and active learning experiences. A significant relationship was also found to exist between *degree of implementation* and *teacher practices*. As the number of hours of implementation of computers into the curriculum increased, teachers also reported an increase in opportunities to change methods of delivery and student/teacher interactions so that the teacher role became more facilitative and less directive in nature.

These findings support a body of research demonstrating that computers support constructivist, student-centered, active learning environments (Braun, 1993; Cartwright, 1993; Lippman, 1998). Computers provide students and teachers not only access to information, but also the tools for digesting, manipulating, and processing information. Computers provide tools for more individualized instruction according to student needs and learning styles. Computers aid individuals and groups of students in becoming interactive users, allowing them to modify, experiment with, and customize information. Because of the potential benefits of using computers as a teaching and learning tool, many educators consider the use of computers as an essential element in any intelligent plan to restructure schools.

Table 18

Summary of Analyses Results of Hypotheses

Hypothesis	Accept	Reject
Hypothesis One	X	
Hypothesis Two		X
Hypothesis Three		X
Hypothesis Four.		X
Hypothesis Five		X
Hypothesis Six		X
Hypothesis Seven		X
Hypothesis Eight		X

Summary of Research Findings

The following research questions were formulated regarding this study:

1. Does a significant relationship exist between teacher motivation to use computers and degree of implementation of computers into the curriculum?

Teachers who responded to the survey indicated that they were either moderately motivated or highly motivated to use computer technology in the classroom. No significant relationship, however, was found between *teacher motivation* and *degree of implementation* of computers. While other studies have shown a relationship to exist between teacher motivation and degree of implementation (Lowe, 1998), teacher motivation did not have a significant impact on degree of implementation with the teachers who participated in this study.

2. Does a significant relationship exist between a teacher's personal use of computers and degree of implementation of computers into the curriculum?

Previous studies have shown that teachers are more likely to implement computers into the classroom as teaching and learning tools when they personally experience the benefits of computer technology. Confidence in their personal ability to use computer technology has been shown to be a prerequisite to confidence in using computers in the classroom as a teaching and learning tool. The findings of this study support this growing evidence that there is a link between teacher personal use of computers and implementation of computers into the curriculum. A significant relationship was found between *teacher personal use of computers* and *degree of implementation.* Teachers who reported using computers more frequently at home also reported incorporating computers into student learning experiences a greater number of hours per week than did teachers who were infrequent users.

3. Does a significant relationship exist between teacher training and degree of implementation of computers into the curriculum?

Curriculum integration training was the only type of training addressed in this study. A significant relationship was found to exist between *curriculum integration training* and *degree of implementation.* The findings of the study also showed that even though a considerable amount of computer technology training has taken place over the past three years, the need for training in the area of curriculum integration is still great.

Three hundred six (almost 70%) teachers who participated in this study indicated that they had only received from zero to ten hours of curriculum integration training per year over the past three years. Fifty-three teachers (about 12%) reported receiving a moderate amount of training (11-20 hours), and only 80 teachers (about 18%) reported receiving more than 30 hours of curriculum integration training.

4. Does a significant relationship exist between curriculum integration support and the degree of implementation of computers into the curriculum?

A significant relationship was found to exist between *curriculum integration support* and *degree of implementation*. Teachers who reported receiving support for integrating computers into the curriculum in such areas as lesson planning and selection of software also reported using computers a greater number of hours per week with their students in the classroom. This finding supports a large body of research that establishes support as a key ingredient in any authentic change process.

5. Does the integration of computer technology into teaching and learning activities influence patterns of student/teacher interactions?

A significant positive relationship was found to exist between *degree of implementation* and *teacher practices*. These findings suggest that the integration of computer technology into teaching and learning activities does influence patterns of student/teacher interactions. Teachers reported that the use of technology increased opportunities for them to (a) interact with students in small groups, (b) work individually with students, and (c) accommodate different learning styles. Teachers reported a decrease in time spent lecturing when technology was incorporated into the curriculum. Implementation of computer technology also brought changes in traditional student/teacher roles: Teachers reported an increase in opportunities to learn from students and an increase in reliance on students for information.

6. Does the integration of computer technology into teaching and learning activities tend to create a more constructivist, student-centered, active learning environment?

A significant positive relationship was found between *degree of implementation* of computers into the curriculum and *collaborative, self-directed,* and *active learning* experiences. Constructivist teaching strategies emphasize the learner's direct experience and the dialogue of the classroom as instructional tools while deemphasizing lecturing and "telling." Collaborative, self-directed, and active learning experiences encourage more thinking and problem solving by requiring learners to use personal sources of knowledge to actively construct interpretations and meanings rather than acquiring understanding by giving back knowledge organized in the form in which it was told (Borich, 1996). These types of learning experiences are considered constructivist, student-centered, and active in nature. Therefore, one could say that the results of this study indicate that the integration of computer technology into teaching and learning activities tends to create a more constructivist, student-centered, active learning environment. A significant positive relationship was also found between *degree of implementation* and *teacher practices.* In constructivist, student-centered, active learning environments, teacher tend to become facilitators rather than directors in the teaching and learning process. The results of this study indicate that the teachers' role does change with the implementation of computer technology so that the learning environment becomes more student-centered.

Conclusions

Findings of this study support the growing body of research which has previously found the three environmental factors addressed in this study (*teacher personal use of computers, curriculum integration training,* and *curriculum integration support*) to have a significant relationship to the *degree of implementation* of computers into the curriculum. Although previous research also identified *teacher motivation* as having a significant relationship to the *degree of implementation* of computers into the curriculum (Honey & Henriquez, 1993; Lowe, 1998; McLaughlin, 1990; & Spencer, 1995), no relationship was found between teacher motivation and degree of implementation in the sample that responded to the survey. Teachers who participated in this study indicated being either moderately or highly motivated to use computer technology as a teaching and learning tool, but the results show that their motivation to use computers was not a significant distinguishing factor in contributing to the degree to which individual teachers implemented computers into the curriculum.

Results of this study also support a body of research indicating that student learning experiences change with the implementation of computers. It was hypothesized that no significant relationship existed between *degree of implementation* and *collaborative, self-directed,* and *active learning* experiences. A significant positive relationship was found to exist between *degree of implementation* and (a) *collaborative learning* experiences, (b) *self-directed learning* experiences, and (c) *active learning* experiences. Results of this study indicate that as the number of hours of implementation of computers increase, so does student participation in collaborative, self-directed, and active learning experiences.

Evidence that teacher practices change with the implementation of computers into the curriculum is also supported by this study. A significant positive relationship was found to exist between *degree of implementation* and *teacher practices.* Results of this study suggest that as the number of hours of implementation of computers into the curriculum increase, so do opportunities for teachers to (a) interact with students in small groups, (b) work individually with students, and (c) accommodate different learning styles. Results also suggest changes in traditional student/teacher roles such as a decrease time spent lecturing, an increase in opportunities for teachers to learn from students, and an increase in reliance on students for information.

Implications of the Study

A teacher's personal use of computers significantly impacts the degree to which that teacher implements computers into the curriculum. Teachers need access to computers outside the school setting so that they can personally experience the benefits of computer technology and gain confidence in using computers. Some school systems are using computers as incentives to encourage teachers to participate in technology training. When teachers participate in training programs, they earn a computer that they can take home with them. Sometimes the benefit package includes free or discounted access to the Internet. Systems that cannot furnish all teachers with a computer at home might consider providing lap top computers that could be "checked out" by teachers for use at home. School systems that wish to encourage teachers to use computers in the classroom should identify some venue for making computers available to teachers who do not have access at home.

Curriculum integration training and curriculum integration support also impact the degree to which computers are implemented into the curriculum. When considering teacher training, school systems should focus on training that helps teachers integrate computers into the curriculum, not as an add-on unit, but as an integral part of the teaching and learning process. If teachers are expected to change their personal approach to teaching and basic beliefs regarding teaching and learning, if they are asked to throw away proven and trusted techniques for unknown ones, then they need the training and support necessary to facilitate this degree of change. The process of change calls for more than a "one-shot" approach to teacher development, and training beyond basic skills needed for operating computer hardware and software. Sustained training in a curricular context is necessary to foster the integrated use of computers.

Assistance following training is also a key variable in obtaining high levels of implementation. No matter how much advance training occurs, people have the most specific concerns and doubts when they actually try to implement new approaches. It is extremely important that resource personnel be available to problem-solve and provide support during implementation. Support efforts should help teachers adapt methods and materials to their own situation, and aid teachers in applying strategies to reinforce the contribution of training. This training should be paired with the support that teachers need during the implementation process.

Results of this study also show that even though the teacher training opportunities have been made available at local, regional, state, and national levels, the need for curriculum integration training remains. Only 80 teachers (18%) who participated in this study reported having received more than 21 hours of training per year over the past three years. Fifty-three teachers (12%) reported receiving a moderate amount of training (between 11 and 20 hours). The remaining 306 teachers (70%) reported receiving ten or fewer hours of training. The Louisiana K-12 Educational Technology Guidelines approved by the Board of Elementary and Secondary Education (Louisiana Department of Education, 1999) illustrate great expectations that technology should be "integrated in all aspects of the curriculum" (p. 1). The guidelines are "designed to reflect the conviction that technology is best understood and taught in a realistic and integrated setting in a variety of curriculum areas (p. 1). What is not stated explicitly, but certainly implied, is that *all teachers* in *all content areas* should be utilizing technology as a tool to accomplish educational goals as outlined in the Louisiana State Content Standards on which the guidelines are based. According to the results of this study, however, more than half of the teachers in northeast Louisiana are either ill-prepared, or not prepared at all, to accomplish these tasks. Teachers with little or no training may well not be able to satisfy the objectives of the performance indicators (tasks that students should be able to perform using technology, by grade level) associated with the guidelines themselves, much less guide their students in doing so.

A similar situation exists with curriculum integration support. Two hundred seventy teacher participants (61%) reported receiving little curriculum integration support, 131 (30%) reported receiving a moderate amount of support, and only 38 (9%) reported receiving much support. Since a significant relationship was found to exist between degree of implementation and curriculum integration support, and curriculum integration support was shown to be a significant predictor of degree of implementation in a multiple regression analysis, schools and schools systems that expect teachers to implement technology into the curriculum as a teaching and learning tool must provide teachers with appropriate support during the implementation process.

The Board of Elementary and Secondary Education (Louisiana Department of Education, 1999) recently approved expanded course offerings in the Computer Education course of study for grades 9-12. This expansion will directly impact the districts, schools, administrators, and teachers who participated in this study. The twelve course offerings include Computer Applications, Computer Architecture, Computer/Technology Literacy, Computer Science I and II, Computer Science and Networking I and II, Desktop Publishing, Digital Graphics & Animation, Multimedia Productions, Web Mastering, and Independent Study in Technology Applications. Computer Science certification is required to teach Computer Science I and II. School districts and individual schools are responsible for ensuring that their teachers have the appropriate and demonstrated technology knowledge and skills to teach the other courses.

Results of this study demonstrate that the degree of implementation of computers into the curriculum impacts both student learning experiences and teacher practices. These findings have important implications for schools and school systems that are interested in bringing about authentic change in educational practices to improve the educational process. According to Gardner (1991), students who participate in traditional types of learning experiences often do not understand the concepts they learn in school, and therefore lack the capacity to take knowledge that has been learned in one setting and apply it effectively in a different setting. When students become actively engaged in meaningful tasks and learning experiences, however, when they have the opportunity to learn by doing, they are able to construct their own set of knowledge from these experiences rather than simply filing or memorizing what they have been told. Computers support this kind of learning environment better than any other existing medium (Collins, 1990).

"What technology does do is allow us to alter the learning environment in ways we have never imagined, which has staggering implications for the future of education" (Bennett, 1997, p. 1). When computer technology is integrated into effective teaching and learning practices, it can help restructure classrooms, moving from a teacher-centered lecture approach to a more learner-centered inquiry approach (Knapp & Glenn, 1996). This educational shift is supported by theories from cognitive and social psychology and educational research findings challenging traditional beliefs about how students learn (Barron & Golden, 1994). Based on the results of this study, teachers in northeast Louisiana need training and support, as well as access to computer technology outside the school setting, if they are expected to make such extensive changes to the classroom as are implied by this and other studies regarding the use of computer technology as a teaching and learning tool to support meaningful learning experiences.

Recommendations

Schools and school systems that are sincere about reform efforts aimed at improving the teaching and learning process through the use of computer technology to accomplish educational goals and objectives must address, and provide means of support for, curriculum integration teacher training, on-going curricular support for implementation, and access for teachers to computers at home if reform efforts are to meet with success. The results of this study led to the following recommendations for schools and school systems as a whole, and specifically for administrators and school board members who are responsible for decision-making processes that address funding, training, and support for teachers in their districts.

1. Having shown that curriculum integration support is significantly related to degree of implementation, schools and school systems should identify the resource persons (i.e., teachers on site, school-level technology coordinators, district personnel) whose support correlates most closely with degree of implementation. Having identified these resource person(s), funding and allotment of time for support efforts should be addressed to accommodate teacher needs.

2. Having shown that curriculum integration support is significantly related to degree of implementation, schools and school systems should identify the activities in which resource persons engage which best support the integration of computers into the curriculum. After identifying appropriate activities, steps should be taken to provide resources to facilitate the activities.

3. Having shown that teacher personal use of computers is significantly related to degree of implementation, identify components of the teacher's personal use (computer-related activities in which teachers engage) that correlate most closely with degree of implementation in the classroom. Determine feasible strategies for providing teacher access to computers at home, as well as strategies to encourage teacher personal use of components that correlate most closely with degree of implementation in the classroom.

4. Having shown that curriculum integration training is significantly related to degree of implementation, identify specific teacher skills acquired through training that correlate with degree of implementation. Seek available training opportunities and

encourage teacher participation or provide training opportunities which address the identified skills.

The following are recommendations for further research regarding the use of technology as a teaching and learning tool:

5. Examine the relationship between the number of years that teachers have used computers in teaching and change in student learning experiences and/or teacher practices. Examine the nature of this change across time.

6. Add a qualitative component in addition to the quantitative data collected in this study to examine individual differences between teachers who implement computers a larger number of hours per week, and teachers who implement computers fewer hours per week through interview and observation methods to explore other factors, or a combination of factors, that facilitate or constrain the degree of implementation of computers into the curriculum.

7. Research the hypotheses presented in this study with teachers in feeder schools (middle and/or elementary schools).

8. Survey students to measure the types of computer technology activities they perceive themselves to be involved with and have them identify the impact that computer technology has had on their learning experiences.

9. Study the potential negative impact of computers on student learning experiences and teacher practices.

10. Identify attitudes of and/or activities engaged in by superintendents and/or boards of education that correlate with degree of implementation.

APPENDICES

APPENDIX A

PEARSON PRODUCT-MOMENT CORRELATIONAL MATRIX: ANALYSIS OF PILOT DATA

Table A1

Correlation Coefficients for Variables in Analysis of Pilot Data

	IMP	CL	SDL	AL	TP	CIT	CIS
IMP	1.0000	.58**	.47*	.61**	.50*	.42*	.55
CL	.58**	1.000	.57**	.60**	.79**	.45*	.97**
SDL	.47*	.57**	1.000	.75**	.73**	.54**	.63
AL	.61**	.60**	.75**	1.000	.63**	.59**	.83**
TP	.50*	.79**	.73**	.63**	1.000	.62**	.87**
CIT	.42*	.45*	.54**	.59**	.62**	1.000	.74*
CIS	.55	.97**	.63	.83**	.87**	.74*	1.000

*$p \leq .05$ **$p \leq .01$ n=25

Table Key: IMP - degree of implementation
CL - collaborative learning (student activities)
SDL - self-directed learning (student activities)
AL - active learning (student activities)
TP - change in teacher practices
CIT - curriculum integration training
CIS - curriculum integration support

APPENDIX B

EQUATION FOR *Z* RATIO: MANN-WHITNEY U TEST

$$z = \frac{|R_1 - \bar{R}_1| - \frac{1}{2}}{\sqrt{\frac{N_1 N_2}{N(N-1)} \left(\frac{N^3 - N}{12} - \Sigma T \right)}}$$

APPENDIX C

EQUATION FOR *H* RATIO: KRUSKAL-WALLIS ONE-WAY ANALYSIS OF VARIANCE BY RANKS

$$H = \frac{\frac{12}{N(N+1)} \sum_{j=1}^{k} \left(\frac{R_j^2}{N_j} \right) - 3(N+1)}{1 - \frac{\Sigma T}{N^3 - N}}$$

APPENDIX D

SURVEY

Northeast Louisiana Technology Survey

Purpose: The purpose of this survey is to determine factors related to your use of technology in the classroom.

Directions: Consider your own classroom and school when you respond to these statements and questions. In this survey, technology is defined as computers and peripherals used in conjunction with computers.

Demographic Information

Please complete the following background information by placing a check in the appropriate box.

Gender	❑ Female	❑ Male			
Age	❑ 21-25	❑ 26-30	❑ 31-35	❑ 36-40	❑ 41-45
	❑ 46-53	❑ Over 54			
Ethnicity	❑ African-American	❑ Asian	❑ Caucasian	❑ Hispanic	❑ Other
Highest Degree	❑ Bachelors	❑ Masters	❑ Specialist	❑ Doctorate	
Teaching Experience	❑ 1-5 years	❑ 6-10 years	❑ 11-15 years	❑ 16-20 years	❑ Over 20 years
Major Teaching Assignment (Select one.)	❑ English/ Language Arts	❑ Math	❑ Science	❑ Social Studies	❑ Vocational ❑ Other ________
Grade Level Taught: 9 10 11 12 (Circle all that apply.)					

Computer Experience and Access

Please complete the following items regarding your computer experience by placing a check in the appropriate box.

Computer Experience	Access/Use of Computer at Home
How many years of computer experience do you have? ❑ Under 1 year ❑ 1-2 years ❑ 3-5 years ❑ Over 5 years **How many years have you used a computer(s) in teaching?** ❑ Under 1 ❑ 1-2 years ❑ 3-5 years ❑ over 5 years **Technology Level of Confidence:** How would you rate your confidence in your ability to use technology in teaching? ❑ None ❑ Low ❑ Moderate ❑ High	**Do you have a computer at home?** ❑ Yes ❑ No **Respond to the following only if you answered "Yes" to the above:** **Frequency of Use:** How often do you use a computer at home for school-related purposes? Choose one of the following. ❑ Daily ❑ Several times a week ❑ Several times a month ❑ Several times a semester ❑ Not at all **Purpose of Use:** Check as many as apply. ❑ On-line resources ❑ E-mail ❑ Preparing tests ❑ Preparing handouts/other classroom material ❑ Other ________________

Section A

Please indicate the approximate number of **clock** hours of **curriculum integration training** you have received **per year, over the past 3 years** by placing a check in the box that applies. In this study, curriculum integration training is defined as training which focuses on the development of activities through which technology can be used as a tool to support or enhance teaching and learning activities in the classroom. This does not include basic skill training where the only purpose is for the participant to learn to use software. (Curriculum integration training gives teachers specific examples of how technology can be used in his/her content area to support/enhance teaching and learning activities.)

❑ 0-5 hours ❑ 6-10 hours	❑ 11-15 hours ❑ 16-20 hours	❑ 21-25 hours ❑ 26-30 hours	❑ More than 30 hours

Section B

Please read each statement and circle the number in the range of 6-1 that most closely represents how you generally think or feel about each statement:

	Strongly Agree	Agree	Tend to Agree	Tend to Disagree	Disagree	Strongly Disagree
1. **Using technology enhances student learning.**	6	5	4	3	2	1
2. I don't have any use for technology in my classroom.	6	5	4	3	2	1
3. **I believe that using technology with students is important.**	6	5	4	3	2	1
4. Learning how to use technology is a personal goal.	6	5	4	3	2	1
5. **I like to use technology to be respected by my colleagues.**	6	5	4	3	2	1
6. I like to use technology because it excites and empowers my students.	6	5	4	3	2	1
7. **I do not find working with technology interesting.**	6	5	4	3	2	1
8. I don't feel confident in my ability to use technology.	6	5	4	3	2	1
9. **I expect my technology activities to be successful.**	6	5	4	3	2	1
10. I don't put a lot of effort into implementing technology activities/projects.	6	5	4	3	2	1
11. **I keep working even when there are problems with technology.**	6	5	4	3	2	1

Section C

On the following scale, please circle the number on the scale that most closely represents the frequency in which you have received help with technology integration in the form of curriculum or instructional support. (Examples of curriculum support could include assistance in the development of specific activities to enhance teaching/learning activities in your curricular area, help with lesson planning, and/or software recommendations.)

	On a Weekly Basis	On a Monthly Basis	Several Times During Each Semester	Several Times During the Year	Not at All
12. Teachers on site	4	3	2	1	0
13. Principal on site	4	3	2	1	0
14. Teachers at other sites	4	3	2	1	0
15. Site technology coordinator/aide	4	3	2	1	0
16. District mentor or resource person	4	3	2	1	0
17. On-line resource	4	3	2	1	0
18. Other:____________	4	3	2	1	0

Section D

Assuming a 30-hour week, please indicate in the **blank to the right of each major category** the approximate number of hours in an average week students in your classroom use technology to accomplish the following activities. **Note: Total hours must equal no greater than 30 hours.**

Approximate Hours of 30 Hours:

Curriculum Supplement ______
Examples: Practice basic skills (drill & practice, e.g., Plato); Participate in simulations (e.g., Oregon Trail); Play educational games; Explore curriculum supplement using CD; View software for whole-group lessons.

Research ______
Examples: Use CD to gather information; Collect data using the Internet for a report or project; Communicate with others on-line to collect data; Participate with others in on-line research project.

Data Organization ______
Examples: Develop a database to organize information; Create a spreadsheet; Produce a graph; Make a chart or table.

Composition ______
Examples: Draw a picture; Make a poster, sign, card; Publish a story, report, newsletter; Write journal entries; Create a presentation or other multi-media project (e.g. PowerPoint); Design a Web Page.

Total Hours (Should not exceed 30) ______

Section E

Please indicate how often your students have done the following activities while using technology over the last semester by circling the number that most closely represents student activities as they occur in your classroom:

Collaborative Learning	Not at All	Several Times a Semester	Once or Twice a Month	Weekly	Daily
19. Worked in small group activities	1	2	3	4	5
20. Made presentations to other students	1	2	3	4	5
21. Assisted each other with problems	1	2	3	4	5
22. Shared information with other students or adults	1	2	3	4	5
23. Taught other student another skill and/or concept	1	2	3	4	5

Self-Directed Learning	Not at All	Several Times a Semester	Once or Twice a Month	Weekly	Daily
24. Selected the media which presents their work	1	2	3	4	5
25. Set their own standards to judge their own work	1	2	3	4	5
26. Solved problems without teacher assistance	1	2	3	4	5
27. Selected resources/tools to complete their work	1	2	3	4	5
28. Organized their project timelines	1	2	3	4	5

Active Learning	Not at All	Several Times a Semester	Once or Twice a Month	Weekly	Daily
29. Participated in the development of a project	1	2	3	4	5
30. Continued to work when experiencing difficulties	1	2	3	4	5
31. Used a variety of resources/tools to complete their work	1	2	3	4	5
32. Created their own inventions	1	2	3	4	5

Section F

Please indicate the extent to which technology increased your opportunities to do each of the following by circling the number within the range that most closely represents teaching activities as they occur in your classroom:

	Not at All	Very Little	Some-what	Very Much	Signifi-cantly
33. Decrease time spent lecturing	1	2	3	4	5
34. Interact with students in small groups	1	2	3	4	5
35. Learn new skills or knowledge from students	1	2	3	4	5
36. Provide activities where students work on different tasks	1	2	3	4	5
37. [illegible]	1	[illegible]	3	[illegible]	[illegible]
38. Work individually with students	1	2	3	4	5
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

APPENDIX E

PERMISSION TO USE SURVEY

March 2, 2000

To Whom It May Concern:

This letter grants full permission to Ruth Bonner-Thompson to use the instruments from my dissertation "Factors Which Affect Technology Implementation: An Evaluation of the Apple Classrooms of Tomorrow Teacher Development Center." Ruth may adapt the instruments in anyway necessary to support her research study.

I would like to request a copy of Ruth's instruments and the findings of her study once completed. Please do not hesitate to contact me for further information.

Sincerely,

C. Elaine Lowe
1519 NW Miller Road
Portland, Oregon 97229
(503) 203-2677
loweelaine@aol.com

APPENDIX F

LETTERS OF CORRESPONDENCE

Date

«JobTitle» «FirstName» «LastName»
«Company»
«Address1»
«City», «State» «PostalCode»

Dear «JobTitle» «LastName»:

I am requesting permission to survey teachers in grades 9-12 at the following schools in your district:

(school names)

I am conducting this research in partial fulfillment of requirements for the Louisiana Education Consortium doctoral program in which I am currently enrolled. The study will investigate factors related to the implementation of technology, as well as the impact of technology on teaching and learning.

The results of the study may be used by school systems and individual schools to improve current training and support practices related to the implementation of technology. The results should prove encouraging to teachers and administrators who currently support the use of technology as a teaching and learning tool, and may also prove useful for future grant-writing proposals aimed at funding technology. The results of the study will be reported as aggregate data so that no particular school or school district will be identified. Each principal, however, may receive a summary of the research results upon request.

Each principal/site technology coordinator at the selected schools above will receive a packet of surveys to distribute to high school teachers, grades 9-12. Each teacher will return the survey in a self-addressed, stamped envelope. The survey will take approximately 10 minutes to complete.

Please indicate your willingness to participate at the bottom of this letter, and return your answer at your earliest convenience in the self-addressed, stamped envelope provided. With your approval, the survey will be distributed during the spring semester of the 1999-2000 school year.

Thank you for your time and consideration.

Sincerely,

Ruth Bonner-Thompson

______ Yes, the schools named above may participate in the survey.

______ No, this system will not participate in the survey.

______________________________ ______________________________
Superintendent Signature Date

Date

«FirstName» «LastName», «Title»
«Company»
«Address1»
«City», «State» «PostalCode»

Dear «Title» «LastName»:

With the approval of Superintendent (last name), I am requesting your assistance in surveying teachers in grades 9-12 at your school. This survey investigates factors related to the implementation of technology into the curriculum, as well as the impact of technology on student learning activities and teacher practices.

The results of this research will be useful to school systems and individual schools alike in their efforts to improve current training and support practices related to the implementation of technology. The results should prove encouraging to teachers and administrators who support the use of technology as a teaching and learning tool, and may provide data for future grant-writing proposals to obtain funding for technology. Principals in participating schools may receive a summary of the results of the study upon request to share with teachers and other stakeholders.

Enclosed are survey packets for teachers (grades 9-12 only) at your school. Please assign a packet to every other teacher at your school using an alphabetical listing of teachers. A Response Follow-up Form is enclosed to facilitate follow-up procedures. Please complete the response form as you assign surveys to teachers. Each teacher is provided a letter of explanation, a copy of the survey, and a self-addressed, stamped return envelope in which he/she will return individual surveys to me. The survey takes approximately 10 minutes to complete.

Again, please record the teacher's name beside the corresponding code number on the enclosed Response Follow-up Form for each teacher who receives a survey packet. Please return the Response Follow-up Form to me in the self-addressed, stamped envelope provided as soon as possible. All survey responses are confidential. Individual surveys are identified only to facilitate follow-up for non-respondents.

Your assistance is essential to the success of this research. I realize that you are extremely busy with the daily operations of the school, and sincerely appreciate your prompt attention and cooperation in this matter. Please encourage you teachers to respond in a timely manner.

Sincerely,

Ruth Bonner-Thompson

Date Code #:_______

Dear Classroom Teacher:

With the approval of your superintendent and principal, I am gathering information for a study entitled "Factors Affecting Computer Implementation and Impact on Teaching and Learning in Northeast Louisiana." The purpose of the study is to examine factors related to the implementation of computers into the classroom as a teaching and learning tool, and the impact on student learning experiences and teacher practices. I believe the results of this study will provide vital information regarding the use of computers as a teaching and learning tool, and may also prove helpful to teachers and administrators in future grant-writing proposals for the funding of technology projects.

By completing the attached survey, you are agreeing to participate in this study. Your participation is voluntary, however, and your individual responses will be confidential, identified only by the code number on the form. Please answer each item to the best of your ability and understanding. After completing the survey, please mail the survey in the self-addressed, stamped envelope provided. If you are interested in receiving a summary of the results of the study, your principal may request this information for your school.

As a full-time business education teacher, I am well aware of the demands upon your time. The enclosed survey will require approximately 10 minutes to complete. I would be very grateful for your time, your participation, and the knowledge that will be gained from your taking time to complete the survey. Please try to complete the survey within 5 days from when you receive it, as I am under time constraints to complete this project, and would very much like for your input to be included in this study.

Your prompt response is greatly appreciated.

Sincerely,

Ruth Bonner-Thompson
Business Education Teacher
Crowville High School
Questions? E-mail: browning@nls.k12.la.us

Date Code #:___________

Dear (Teacher Name)

About two weeks ago, I sent a packet of technology surveys to your school and asked that the surveys be distributed to high school teachers. I have received surveys from other teachers at your school, but have not received a survey from you. If you have not returned the survey, would you please take the time to complete the survey and return it to me as soon as possible?

I am sending another survey and self-addressed stamped envelope for your convenience. Your prompt response is greatly appreciated.

Sincerely,

Ruth Bonner-Thompson
Business Education Teacher
Crowville High School
Questions? E-mail: browning@nls.k12.la.us

Response Follow-up Form for Technology Survey

All responses to this survey will be confidential. In this study, no teacher or school will be identified by name. The purpose of the coding system is to facilitate follow-up contact to non-respondents in order to increase the response rate for the study.

Code #	Teacher
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
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20.	
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22.	
23.	
24.	
25.	
26.	
27.	
28.	
29.	
30.	
31.	
32.	

Please send a summary of the results of this study upon completion of the study so that I may share the results with teachers and other stakeholders.

- ❑ Yes
- ❑ No

Directions for Facilitator

1. Assign a survey packet to every other teacher (grades 9-12 only) using an alphabetical listing of the teachers at your school.

2. As you assign survey packets, record the name of the teacher receiving the packet next to the code number on the Response Follow-up Form provided. The code number for each survey packet can be found at the top of the teacher letter or the survey form. I am asking you to record teacher names solely for the purpose of making follow-up contact with teachers who fail to complete the survey. I will send a follow-up packet in two weeks to teachers who have not responded. Surveys are confidential. The response form will be used solely for follow-up purposes.

3. After you have made the survey packet assignments and recorded the teacher names next to the code numbers, please return the Response Follow-up Form to me in the self-addressed, stamped envelope provided.

Thanks for your help!

Questions?

Ruth Bonner-Thompson

School Phone: (318)722-3509 or (318)722-3244

Home Phone: (318)435-5340

E-mail: browning@nls.k12.la.us

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VITA

Ruth Bonner-Thompson was born in Winnsboro, Louisiana. She attended elementary and secondary schools in Louisiana and Mississippi, and graduated from Charleston High School in Charleston, Mississippi. She received her B. S. degree from Northeast Louisiana University in 1986 as a Business Education major with a minor in English. In 1995 she received her M. Ed. from Northeast Louisiana University with a major in Secondary Education and minor in Computer Science. She received her Doctor of Education degree in August of 2000 with Curriculum and Instruction as her major area of study and a cognate in Educational Leadership.

During her 13-year teaching career, Ruth has taught numerous business education, computer, and English language arts courses. She has also served as sponsor of an active chapter of the Future Business Leaders of America, a student organization which promotes participation in community service projects and development of leadership skills and qualities, and which provides students with opportunities to compete at district, state, and national levels in business and technology-related fields of study.

Ruth currently serves as Technology Coordinator for her school, and is a member of the Franklin Parish Technology Council. She has presented and co-presented numerous technology-related training sessions for teachers and administrators at local, regional, and state levels. She developed a cross-curricular, standards-based Web Quest project with two colleagues in 1998 and 1999 following participation in the Teaching, Learning, and Technology Institute hosted by the Louisiana Center for Educational Technology in the summer of 1998. Along with the two other developers, Ruth presented in-service training for teachers utilizing the Web Quest format for the purpose integrating computers into all curricular areas. The project remains on-line for teacher use, and has been referred to by Louisiana Center for Educational Technology as a model promoting the integration of computers into the curriculum. Ruth has participated in a variety of technology-related grant-writing projects targeting teacher development, equipment and software, and Internet access for public and private schools in Franklin Parish.

Ruth is a member of the Louisiana Vocational Association, the Louisiana Association of Business Educators, and the American Vocational Education Research Association. She has also been named Who's Who Among America's High School Teachers.