An investigation of the perceptions of teachers regarding the role of principal leadership in the effective implementation of technology

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In this study, the views of teachers were sought regarding elementary principals’ leadership style and teachers’ implementation of technology, related to the state required Intech program. Sixty participants responded to a Level of Technology survey (LoTi). Teachers’ views of their level of technology implementation in the classroom were described, with statistically significant differences present between those teachers trained in Intech and those teachers who have not been trained in Intech. A multiple regression procedure revealed that consideration and grade level were significant predictors of current instructional practices. The model indicated that the lower the consideration score and the lower the grade level reported, the higher the score obtained on the current instructional practices variable. No statistically significant relationship was yielded between the state-required Intech program and teachers’ reported use of technology, as
measured by the Loti framework. The findings from this study add to the current body of knowledge in several ways. Elementary principals' leadership style was found to be related to implementation of technology in the classroom setting. In addition, teachers trained in the Intech model differed in their technology practices within the classroom setting. Practitioners and researchers alike may find the results of this study useful.
AN INVESTIGATION OF THE PERCEPTIONS OF TEACHERS REGARDING
THE ROLE OF PRINCIPAL LEADERSHIP IN THE EFFECTIVE
IMPLEMENTATION OF TECHNOLOGY

A DISSERTATION
SUBMITTED TO THE FACULTY OF CLARK ATLANTA UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF EDUCATION

BY
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CHAPTER I

INTRODUCTION

Technology, applied well, can enhance and reinvigorate education, making schools richer and more exciting interactive communities of learning for students and teachers alike. We must do more, however, than put technology in schools; we must empower teachers to use it effectively. Securing a positive return on rising national investments in hardware and connectivity requires a heightened focus on how these resources are used. (CEO Forum on Education and Technology, 1999)

There are powerful forces both within and outside the field of education compelling educators to initiate innovations in order to prepare students for the advancement of a technological society. The digital age poses a whole new set of challenges and questions to America's schools. The quality of our nation's political, social and economic future will depend on the ability of young people to become functioning members of society who understand how to access information, manipulate data, draw independent rational conclusions and communicate findings. Yet American schools are not utilizing teaching practices to meet the demands of this technological society. Students today need to be equipped with information processing skills in order to function effectively.
Over the past 20 years, Americans have enthusiastically supported spending billions of dollars on school technology projects to implement what many educators, government leaders, corporate executives, and parents see as the new panacea for the nation's schools. President Clinton challenged the nation in his 1996 State of the Union Address to ensure that every classroom is connected to the information superhighway with computers and good software and well trained teachers. In explicit acknowledgement of the challenges facing the educational community, President Clinton and Vice President Al Gore announced the Technology Literacy Challenge envisioning a 21st century where all students are technologically literate. The challenge was placed before the nation as a whole, with responsibility for its accomplishment shaven by local communities, states, the private sector, educators, parents, the federal government and others. The challenge was more than a vision. At its heart were four goals for technology in schools designed to lead to technological literacy:

1. All teachers in the nation will have the training and support they need to help students learn using computers and the information superhighway.

2. All teachers and students will have modern multimedia computers in their classrooms;

3. Every classroom will be connected to the information superhighway; and

4. Effective software and online learning resources will be an integral part of every school's curriculum (TLC, 1996).
Achieving these goals will be essential to the future technological literacy of our nation’s young people. The school administrator becomes critical in providing leadership in accomplishing this task.

Since *A Nation at Risk*, the federal government has emphasized the federal role educational technology should play in public education. Because of the state of our nation described in *A Nation At Risk*, a National Education Summit was convened in Charlottesville, Virginia in 1989 (Robinson & Schwartz, 2000). The nation’s governors and President Bush reached agreement that unless the nation established clear educational goals and all citizens worked to achieve them, the United States would be woefully unprepared to face the technological, scientific, and economic challenges of the 21st century (Goals 2000: Educate America Act, 1994). This resulted in the passage of HR 1804 Goals 2000 Educate America Act. As a result of this national law, goals were adopted to meet provisions of the law. These goals set high expectations for educational performance for learners from preschool to adulthood (Goals 2000: Educate America Act, Sec. 102). The federal government has emphasized the federal role educational technology should play in public education. Between 1995 and 2000 the federal government allocated over 8 billion dollars to the states to purchase technological equipment for schools and to fund educational technology programs. That initiative, released through the National Education Technology Plan, provided the nation with five technology goals:

1. All teachers and students will have access to information technology in their schools.
2. All teachers will use technology effectively to help students achieve high academic standards.

3. All students will learn technology and information literacy skills.

4. Research and evaluation will improve the next generation of technology applications for teaching and learning.

5. Digital content and networked applications will transform teaching and learning. (TSSA, 2001)

Sustained state and local community leadership will be required to meet the nation’s technology goals.

State Initiatives

Since the enactment of Goals 2000 (1994) legislation, Georgia has created its Statewide Education Technology Plan (1997) for the purpose of “improving student performance and enhancing teaching and learning through the effective use of technology” (p. iii). Georgia’s technology plan is funded largely from the Georgia Lottery for Education. The Statewide Education Technology Plan (1997) not only recognizes the need for hardware and software but also technology integration training. Every public school in Georgia has increased the amount of equipment and technology available to the students, including computers, automation of media centers, and other technology equipment” (Dolan, Jones, & Henry, 1996, p. 2, cited in Sirmons, 2001).

When the Georgia Lottery for Education was established, it was decided that instructional technology would be one of the primary initiatives that would benefit from lottery revenues. Nearly $150 million in lottery money and regular state funds has gone
into instructional technology for Georgia's public schools. During the 1993-1994 school year the lottery provided more than $85 million for technology in schools and libraries, including $32.9 million for computers, software and networking capabilities for Georgia's elementary, middle and high schools and $30.7 million to automate school media centers. In addition, $12 million was allocated to purchase and install satellite dishes in every public school and other educational facilities, enabling teachers and students to tap into the state's developing distance learning network (GDOE, 2001).

In the 1994-1995 school year, another $61.6 million from the lottery was earmarked for technology in the public schools including additional computers in classrooms and assistive technology for students with disabilities. In FY 1997, Governor Miller included in his budget a request for $28 million to put even more instructional technology into Georgia's public schools (GDOE, 2001).

The development and funding of fifteen regional Technology Training Centers throughout the state has been a major component of the state's instructional technology initiative. These centers provide teachers, paraprofessionals and administrators the opportunity to learn about, use and experiment with new technologies. The centers have delivered courses to more than 75,000 educators (GA DOE, 2001).

A major emphasis has been placed on getting computers into our schools. There has been a large amount of funds both at the state and local level spent on technology. Not enough has been done to examine how technology is being implemented and the role of leadership in its effective implementation.
In 1999, Georgia’s Education Reform Commission looked at ways to improve its schools. The results from this commission produced the A Plus education Reform Act of 2000. Out of this act was a technology initiative that impacts teachers. The act mandates that renewable teaching certificates would not be granted unless the candidate demonstrated the following:

Satisfactory performance on a test of oral and written communication skills, a test of computer skill competency, and an assessment to demonstrate satisfactory on the job performance appropriate to the applicants field of certification. Successful completion of the phase one InTech training model at a state educational training center or by a State Board of Education approved redelivery team shall be acceptable for certificate renewal purposes. (p. 65)

As a commitment to technology, Georgia has developed a framework for integrating technology. This professional development model, appropriately called InTech is grounded in the premise that technology training for educators and school support personnel will ultimately improve schools and achievement of students (GA ETTC, 2001). The curriculum is shaped by a view of how Georgia’s schools will be structured and how teaching and learning will take place in the 21st century. Principal leadership becomes essential if teachers are to succeed with successful technology integration in the classroom.

Integrating Technology (InTech) is a 50-hour technology professional development program referenced in the A Plus Education Reform Act of 2000 as one
acceptable path for meeting the Special Georgia Technology Requirement. The InTech course objectives are correlated to the Georgia Technology Standards for Educators and a state adoption of the International Society for Technology in Education's National Education Technology Standards (ISTE NETS, cited in GA ETTC, 2001).

Integrating Technology (InTech) is designed to meet the professional development needs of entry-level technology users. InTech training is intended to build skills and improve performance in five critical areas of instructional proficiency:

1. Quality Core Curriculum Content Standards.
2. Use of Modern Technologies.
4. Improved Classroom Management, and
5. Enhanced Pedagogical Practices. (GA ETTC, 2001)

Integrating technology is a difficult task for teachers. As our society becomes increasingly dependent on technology, there are still those who resist change. It is a paradox of sorts; people realize that the world is changing but they refuse to change with it. This is perhaps the toughest barrier to overcome in technology integration (Jefferies, 2000).

Technology and its Impact on Student Achievement

The greatest promise of the rapid development of technology is that it can change teaching and improve student learning if suitable conditions are in place. For this to occur, teachers should be versed in educational technology including the use of computers and other technologies for instruction and student evaluation (Howery, 2001).
Student achievement must be improved in order to prepare students to succeed in the global economy. Many observers liken the need for a world class, high-quality educational system to a national security issue. The United States can only remain a leading power in the global economy if it continues to ensure students will be prepared to thrive in the future. Currently, American students rank in the middle compared to international counterparts. In a recent survey of eighth grade students from 38 industrialized nations, the United States scored 18th in science and 19th in mathematics. In addition, other countries are expanding the integration of communication and information technologies to enhance student learning. Our nation must not rest complacently on our position as a world leader. There must be a national commitment to improve student achievement in order to ensure students are prepared to thrive in the digital age (CEO Forum, 1999).

Education technology can help improve student achievement. Studies and research indicate that the impact of technology proves most powerful when focused on specific, measurable educational objectives, such as improved literacy. In addition, students demonstrate higher levels of motivation and engagement when using technology, which also contributes to improved achievement (CEO Forum, 1999).

Recent studies have found strong links among technology, academic achievement, staff development, and classroom instructional practices. Using test scores from the 1996 National Assessment of Educational Practices (NAEP), for example, Wenglinsky (1998) found that:
• Eighth graders whose teachers used computers mostly for simulations and applications—generally associated with higher order thinking performed better on NAEP than did students whose teachers did not.

• Fourth graders whose teachers used computers mainly for math or learning games scored higher than did students whose teachers did not (ISTE, 1999). Middleton (1998) found a statistically significant difference between student performance on standardized test scores and how teachers were implementing technology in the classroom. When teachers used higher levels of technology to augment instruction, their students had significantly better scores on the Metropolitan Achievement Test than students whose teachers used little or no technology in class (ISTE, 1999).

Training and Preparation

Teacher Training and the knowledge and skills it produces have been empirically demonstrated to be a key factor in the adoption of computers in schools. Carss, Grice, Galbraith, and Warry (1994) found that training is a significant variable in helping teachers relate to technology. In order for teachers to prepare students for today’s world, it is important that they are appropriately trained. Teachers must receive staff development as the district is buying hardware and software and making network connections. Hands-on access during staff development for technology, as well as reasonable access to the same technology when teachers return to their classrooms, helps to transfer skills more readily into effective teaching practices and ultimately results in better student outcomes (Vojtek & Vojtek, 1998, cited in Howery, 2001). Hall and Hord
(1987) argued the need for teacher training but cautioned it must be done incrementally to match the emerging concerns of teachers as they adopt and use an innovation.

The Role of the Principal

"While schools make a difference in what students learn, principals make a difference in schools" (Lipham, 1981, p. 1 cited in Myers, 2001). Administrators are held responsible for the teaching and learning process that occurs in school. Legislators suggest that educational technology is an important element of educating public school students for the 21st century. As such, it is only logical that an administrator should be held responsible for integrating the new communication media into curriculum.

The research literature on educational change and implementation indicates that principals influence the acceptance or rejection of any initiative within a school. It is they who hold the critical role at the school level in determining the success or failure of implementation (Fullan, 1982; Hall, Hord, & Griffin, 1980; Leithwood & Montgomery, 1986 cited in Woodard, 1998). When teachers see that the principal is excited about computer technology, they are more likely to adopt his or her attitude (SEIR-Tec, 1999). Even when teachers are using the computers, leadership remains an important ingredient in the change process.

Recent literature on educational leadership has sharpened the focus on technology issues facing educational administrators. The number one issue in the effective integration of educational technology into the learning environment is not the preparation of teachers for technology usage, but the presence of informed and effective leadership. Confirmation of this statement can be found in the literature regarding technology
standards for administrators. The question, “What should administrators know and be able to do to ensure successful integration of technology in P-12 schools?” is being addressed by the Collaborative for Technology Standards for School Administrators (Gibson, 2000).

In his keynote address to the Expert forum on Technology Standards for Administrators (Denver, 2000), Latham, and Director of Assessment for Teacher Universe suggested that the key to the technology vision was leadership (Gibson, 2000). “The Collaborative for Technology Standards for School Administrators (TSSA) has facilitated the development of a national consensus on what P-12 administrators should know and be able to do to optimize the effective use of technology” (TSSA, 2001, p. 1). These standards are indicative of what educational stakeholders believe to be effective leadership of technology in schools. “Administrators who recognize the potential benefits of technology understand that leadership has a responsibility to ensure digital equity” (TSSA, 2001, p. 1).

The Collaborative for technology Standards for School Administrators recommends six standards. The initiative to develop these standards focuses on the critical role administrators play in the whole equation. The focus on administrators is needed, because they are ultimately responsible for coordinating technology efforts for their schools. The following describes the standards along with basic performance indicators.
1. **Leadership and Vision:** Educational Leaders inspire a shared vision for comprehensive integration of technology and foster an environment and culture conducive to the realization of that vision.

2. **Learning and Teaching:** Educational Leaders ensure that curricular design, instructional strategies, and learning environments integrate appropriate technologies to maximize learning and teaching.

3. **Productivity and Professional Practice:** Educational Leaders apply technology to enhance their professional practice to increase their own productivity and that of others.

4. **Support, Management, and Operations:** Educational Leaders ensure the integration of technology to support productive systems for learning and administration.

5. **Assessment and Evaluation:** Educational Leaders use technology to plan and implement comprehensive systems of effective assessment and evaluation.

6. **Social, Legal, and Ethical Issues:** Educational Leaders understand the social, legal, and ethical issues related to technology and model responsible decision-making related to these issues.

An underlying assumption to these standards is that administrators should be competent users of information and technology. Strong leadership is needed for initiation, implementation and institutionalization of technology integration. Principals must be aware of the factors that impede technology integration and address issues by
creating a school culture and environment that encourages and supports teachers’ efforts (SEIR-TEC, 1999).

Fully implementing an effective professional development program requires support from school administrators and leaders. Administrators must have a clear vision of technology to support student learning and an understanding of the roles that all school staff must play in achieving that vision. They must be visionaries who see beyond the daily routine to a vision of what is possible through the use of technology (Byrom, 1998; Guskey, cited in Lockwood, 1999 in Killion, 2000).

It is the principal who needs to assume the role of catalyst to implement meaningful change. The quality of building level leadership can facilitate classroom teachers to commit them to meet the expectations of the school and the community in their service of education to our children (Lipham, 1981; Whaley, 1994). Barth (1990 cited in Myers) in his book *Improving Schools from Within*, strongly emphasizes the importance of the principal’s role in the following statements:

- The principal is the key to a good school. The quality of the educational program depends upon the school principal.
- The principal is the most important reason why teachers grow—or are satisfied on the job.
- The principal is the most potent factor in determining school climate.
- Show me a good principal, and I’ll show you a good school. (p. 64)

The principal, as the administrative and instructional leader, has the responsibility as well as the influence to create an environment of direction, support and resources for
teachers. Principal leadership has been identified as a significant factor affecting the effective use of technology in classrooms. Principals who exhibit leadership are instrumental in modeling the use of technology in classrooms. They understand how technology supports instruction and provides teachers with guidance for its use (NCES, 2000). In our nation’s schools, teachers often receive little administrative guidance. For some teachers, lack of principal leadership may prove to be a barrier to their effective use of technology (NCES, 2000).

Technology has the power to transform the teaching and learning process. Teachers using technology-based lessons can guide students as they pursue their own inquiries and access information from multiple sources.

“One thing is clear. We don’t have the option of turning away from the future. No one gets to vote on whether technology is going to change our lives” (Gates, 1995, p. 74). This statement is as true for educators as it is for those in the corporate sector. Technology is available in our classrooms, and it is changing the way educators think about teaching and the way students think about learning. Computers are becoming universal in America’s classrooms. It is important for teachers to have a good understanding of ways these technologies can be integrated best into the curriculum to meet the needs of diverse student populations. The full promise of instructional technology has yet to be realized because technology integration requires systemic reform, which must be supported by school leadership.
Statement of the Problem

Technology is reaching most classrooms, but “the gap between technology presence in schools and its effective use is still too wide” (CEO Forum on Education and Technology, 1999, p. 1). As teachers participate in technology training, they must move beyond the training classes to apply teaching methods that facilitate technology integration in their classrooms. Herein lies the challenge to principals as leaders and supervisors. It is they whose commitment and influence need to be examined.

Research Questions

The framework for this study will address the following research questions:

1. What are teachers’ perceptions of their own level of technology implementation based on the LoTi framework?

2. Is there a relationship between elementary principals’ leadership style and teachers’ implementation of technology?

3. Is there a relationship between the state required technology program, InTech, and teachers’ use of technology as measured by the LoTi framework?

Purpose

Educational change does not occur as a result of an introduction of a new innovation, it occurs as the result of implementing the innovation in the classroom (Hall & Hord, 1987 cited in Piper, 2000). Certain variables exist that influence, either positively or negatively, teachers practices of using computers in the classroom. The purpose of this study was to investigate the effectiveness of principal leadership, as
perceived by teachers in the implementation of a state technology program (InTech).

Given the complexity of the process of technology implementation, this study focuses on how administrative support from the principal impacts the overall success of a technology professional development program.

Significance of the Study

According to the Office of Technology Assessment (U.S. Congress, 1995), making the connection between teachers and technology could be one of the most important steps the nation can take to make the most of past and continuing investments in educational technology. The role of the principal, along with that of other educational leaders, is of utmost importance in making this connection.

For education to serve society effectively, computer technology must become integrated into its daily classroom practices. Teachers must be prepared adequately to provide students with the advantages that technology can bring (ISTE, 2000b). Staff development becomes a crucial vehicle for reaching this goal. Research has been conducted in an effort to determine which factors are necessary for technology to be infused into the curriculum so that integration can occur.

The undertaking of technology integration into schools has generated considerable research that focuses on the implementation of technology integration initiatives on both the state and local levels. The Congress in Washington, D.C. has developed goals in the area of technology and has made a commitment to getting technology into all classrooms.
As part of the Strategic Plan, the school district being studied herein has implemented a comprehensive technology program. The keystone of the plan is to meet President Clinton’s Technology Literacy Challenge as set forth in Goals 2000 (U.S. Department of Education, 1994), and to create technology-rich learning environments for students. Because of this, the school system is placing emphasis on teacher training and support, increasing the presence of computers in classrooms.

Research is replete with information regarding the importance of the principal’s role in implementing instructional technology. Previous research confirms that the principals play a key role in determining the extent of technology use in their schools. This study is designed to examine the perceptions of elementary teachers regarding the role of the principal in the integration of the state’s instructional technology program (InTech), and to examine the extent to which principal leadership in this particular school system impacts the process of technology integration.

This study is significant because of the increasing amount of money being spent on placing technology into schools. Federal, state, and local government are making technology in the schools a priority. States are beginning to incorporate technology into their subject area minimum standards. Businesses are demanding that students be technologically literate when they enter the work force. This study is significant, also, because of the increased scrutiny being given the principal in the accountability movement.

It is hoped that this study will yield information that may provide insight on factors that influence the effective implementation of the school system’s instructional
technology program and may add to the growing body of knowledge on factors related to technology integration. This effort may provide information and provide insights that may be generalized to the process of integrating technology in schools across the nation. Finally, policymakers at the local school level and administrators can use the findings as they seek to narrow the gap referenced earlier in the research.

Summary

Computer technologies have been widespread in U.S. schools for at least a decade, and reform efforts have been underway for just as long. Within the past five years, national, state, and local agencies have made substantial investments in educational technology. Yet, teachers and administrators continue to struggle to create meaningful learning environments for their students. Technology integration is a challenge. The most effective teaching that technology supports may require reexamining the way teachers conduct their classes and administrators run their schools.

Chapter I contains an introduction and problem statement that establishes the background for looking at the role of principal leadership in implementing a technology professional development program. A statement of purpose is included that offers specific research questions to examine technology in a large metropolitan school district. The conclusion of chapter I focuses on the educational significance of the study. It emphasizes the importance of looking at the progress of the school system’s instructional technology initiatives and makes a case for using the findings to facilitate the progress of technology integration.
CHAPTER II

REVIEW OF RELATED LITERATURE

... by the year 2010 we can expect that the computer will be one of the dominant educational delivery systems in many parts of the world. (Bork, 1991)

If Bork is accurate then there is little time for school leaders to waste in implementing strategies to guarantee its effective use as a learning tool in their schools. Principals and teachers are often required to implement new or revised programs. Many school systems usually have a process in place to develop the new programs, but the key lies in the implementation process and the principal’s ability to provide leadership to teachers toward changes in behavior and thinking.

Education is just one of the many institutions where the potential of the personal computer has been touted since its inception. Throughout the revolution, education has been slow to embrace the rapid changes brought about by the computer age. The latest rush to connect all schools to the information superhighway is just one more nudge to an institution that is often content to travel the back roads of the computer revolution (Crouse, 1997).

Technology impacts our lives on a daily basis. Society accepts technology and expects schools to prepare students for a world requiring computer literacy. It is
axiomatic in saying that students will need to become proficient in the use of technology to be successful in the 21st century. Many educational institutions are currently failing to capitalize on the myriad of learning possibilities that technology provides (Jarrett, 1988 cited in Byers & Ogle, 2000).

Teachers' attitudes and perceptions toward technology could change with proper staff development and administrative support, for teachers' feelings about technology is tied to their work environment (Chin & Hortin, 1993). Manouchehri and Goodman (1998) lend credence to these claims stating that administrative support is needed to buttress teachers' efforts and to provide encouragement to sustain educators throughout their demanding teaching schedule.

A review of the literature on curriculum and program implementation found that successful program change is dependent upon principals who believe in open communication. They should be able to recognize the distinct abilities of staff members. The principals should also make the staff aware of available resources and offer encouragement and assistance when needed. Principals, as the facilitators of change are responsible for introducing any new program in a way that will increase the probability of success.

This research study investigated teachers' perceptions of their own level of technology implementation based on the LoTi framework and teachers' perceptions regarding the role of principal leadership in the effective implementation technology. The purpose of this literature review is to examine the variables for technology implementation. It also concentrates on the current state of information technology in
schools and the role of principal leadership. In the process, some of the barriers to a more complete integration of technology into teaching practices are discussed.

The research on the role of the principal in program implementation is very limited. Studies by Virgilio and Virgilio (1984) and Hord and Hall (1987) identified the principal as the instructional leader who plays a critical role in the success of the program implementation process. It is the principal who must assume major responsibility for program change and who must exhibit a strong leadership style during the implementation stage (Woodard, 1994).

Communication among principals and teachers is critical during the implementation process. It is important that principals provide teacher training and allow teachers an opportunity to experience success in the program change. The principal must also communicate interest and excitement for the new program by encouraging teachers.

Information Technology in Schools

One feature of its importance is technology's support of school reform. In a study conducted by The Stanford Research Institute and Educational Development Corporation, researchers (1992) found technology to be a powerful tool that can support educational reform (MacNeil & Delafield, 1998). Researchers have also indicated that the application of technology in teaching has positive effects on student learning. More importantly, "successfully integrating technology into education requires basic changes to our current model of school" (Kinnaman, 1994, p. 11). Therefore, "building principals are key players in the educational change process" (Ross & Bailey, 1996, p. 3) and
should know technology's importance for improving school management and instruction (MacNeil & Delafield, 1998).

Our public school's key mission is to prepare students for our ever-changing global society. New technologies have made a significant impact in our society. Consequently in this recent decade our public schools have been trying to infuse these technologies into their curriculum. The 20th century focus of educational technology was print media to communicate ideas, access information or learn about the world. The basic tools were paper, pens, books and chalk. As we approached the 21st century a transformation from print media to electronic media emerged. The basic tools became word processing, e-mail, fax modems, video, CD ROMs, multimedia and the Internet (Picciano, 1998 cited in Hudanich, 2002). As Picciano explains, technology is becoming the tool of choice for communicating in, accessing, and learning about our world. According to the U.S. Department of Education over 90% of schools have access to the Internet and more than half of U.S. schools provide at least 90% of their teachers with an e-mail account.

Communities throughout our country are requiring school leaders to become more perceptive and forward thinking. The expectations and demands for administrators include new skills for them to implement technology effectively in their schools and communities in order to contribute significantly to both education and the economy in the twenty-first century.

The role of the principal is important because the principal is the interface between technology implementation and localized change. Therefore, how principals
perceive their role will have a large influence on what is taught in the local schools. There is little argument that enormous amounts of money have been spent on computers and computer technology in schools. A more controversial issue is the educational effectiveness of its integration into the normal classroom as a teaching and learning tool. It has been suggested in the literature that the role of the principal is crucial to its successful introduction and use. This view is supported by research reported by Sandholtz (1997) who concluded that one of the key factors on whether teachers integrate technology into their classrooms was the level of support they received from school administrators.

Technology presents new opportunities to change how we function and leaders need to model the use of technology to change and improve the environment in which educators function. As we plan for technology implementation, we must keep two issues in mind:

- Technology has the potential to change how we work, teach, and learn in our school districts; and
- This potential will only be realized if leaders assume the lead role in realizing this potential.

In April 1995, the Office of Technology Assessment released a survey that addressed the issue of how technology should change and improve education. The report, Teachers and Technology: Making the Connection had a central theme: “We will never effectively realize the potential of technology to change education unless we address the issue of involving our staff in the use of technology” (p. 51). If we are going
to effectively address this concern, then we must reconsider our leadership role in promoting and defining the use of technology by our staff.

Research consistently finds that leadership is a key to successful implementation of technology. For example, Mergendoller (1994) states that the role of the principal is crucial in promoting school technology use. Similarly, for technology to become implemented, leadership by the principal is critical. These findings are supported by the organizational change research, which has consistently found that change efforts do not succeed without active administrative leadership, particularly by principals. Research has shown that leaders perform three important tasks: (a) providing direction, (b) obtaining resources, and (c) encouraging staff. Educational leaders should provide leadership in addressing the necessary issues to realize the potential of technology.

As stated by Christene Bennet (1996), "Computers and related information technologies are forging fundamental changes in the way we communicate on personal, national, and global levels, yet the U.S. education system seems to be making little progress toward incorporating technology into school classrooms" (p. 57). Lack of leadership at the school level is responsible for this problem. More specifically, before schools will experience success with the use of technology for administrative and instructional practices, the principal must become a technology advocate and model skills that are exemplary use of technology. This belief is supported by the Office of Technology Assessment. As cited in an article by Don Ritchie (1996), The Office of Technology Assessment has found that administrators who are informed and comfortable with technology become key players in leading and supporting technology in schools.
This belief is further supported by the importance being placed on the development of Technology Standards for School Administrators by the Technology Standards for School Administrators Collaborative.

The underlying assumption to the TSSA standards is explicitly stated. Administrators should be competent users of information and technology tools that are common to information-age professionals.

Leadership

Many authors have written about the importance of the principal in the school. Leadership is the basis of all change. The challenge is to have the skills and qualities to be a successful leader (Kouzes & Posner, 1995). Technology leaders are no different. To successfully lead teachers toward technology proficiency and integration, technology leaders need to have the necessary leadership qualities and skills.

Educational leadership occurs at many levels and is key to successful innovations. The literature indicates the growing importance of administrators in the success of technology innovations. According to Jonjegan (1990):

It is the lack of realization that school administrators control policy making, financial allocation, and program implementation within schools. Thus, administrators must be educated about the use of technology in schools and sold on the value of implementing technology in their schools.

(p. 9)
The actions, interests, and priorities of the building principal have a significant impact on effective and ineffective implementation of program change (Berman & McLaughlin, 1978, U. S. Congress, 1995).

Leadership studies have defined a number of different types of leader characteristics (Gardner, 1990). In the past, leadership abilities were defined as natural abilities (Bass, 1985). Now it is understood that leadership is a process that may be learned by any person with the desire, a reasonable level of cognitive abilities, and the flexibility to deal with circumstances that may or may not be constantly changing (Kouzes & Posner, 1995). Leadership would then be dependent on the relationships of the leaders, followers, and the context in which they operate.

There are many other definitions of leadership that move beyond the definable and into the realm of the ambiguous. Patton defined leadership “as the art of getting your subordinates to do the impossible” (Cohen, 1990, p. 215). Leaders are able to motivate others to take action towards a shared vision or goal. Cohen gives us his definition: “Leadership is the ability to help people do things that they didn’t know they could do or didn’t know needed to be done” (Cohen, 1990, p. 215).

Leadership can be generally defined as the relationship between an individual and a group built around some common interest wherein the group behaves in a manner directed or determined by the leader (Aquino, 1985 cited in John & Taylor, 1999). Leadership in a school setting is the result of the way principals use themselves to create a school climate that is characterized by staff productivity, student productivity, and creative thought (Ubben & Hughes, 1997 cited in John & Taylor, 1999). As a result, the
principal’s qualities and behavior determine to a large degree how the teachers feel about the organization (Eblen, 1987 cited in John & Taylor, 1999). A particular leadership style may either foster or hinder teacher commitment.

Kouzes and Posner’s (1995) research into leadership practices in business, government, and education has identified five practices that enable leaders to get things done: leaders challenge the process by seeking and accepting challenges, inspire a vision shared by all, enable others to act as a part of the vision, provide a model for the vision, and encourage others to strive towards the vision (John & Taylor, 1999). The research into leadership practices provides technology leaders with an understanding of the need for the skills and qualities to effectively lead and motivate teachers.

A number of studies have explored the relationship between the leadership style of principals and teacher’s commitment to technology implementation. Findings indicate that in order to encourage strong teacher commitment, principals must impart strong, directive leadership in setting and developing school goals, creating a unity of purpose, facilitating communication, and managing instruction (Cruz, 1995 cited in John & Taylor, 1999).

Hill (1999), Wilsmore (1999), and Sergiovanni (1996) also emphasize the development of staff and community members to ensure successful leadership with the adoption of any innovation. Sergiovanni argues that schools should not function as businesses. And school leaders should not function as owners of businesses. The theories of transforming and transactional leadership developed over past decades are recognized. In the past decades educational leadership has seen increasing changes in the context in
which it operates. Goldring (1997) suggests that the boundaries between school organizations and those outside the organizations are becoming increasingly permeable and that these have implications for school leadership and principals in particular. The increasing calls for accountability, both educational and financially also impinge on that leadership role.

Experts would agree that the success or failure of technology integration could be linked to the behaviors and ideologies of the instructional leader. In a survey of educators in the United Kingdom, 81% indicated more commitment by leaders was an important component, while 38% felt as strongly about more hardware and software (Cafolla & Knee, 1995). Innovations inherent in exemplary technology use requires more than hardware, software, and ongoing training. Successful leaders not only challenge the existing educational process and inspire a vision for meaningful change, but also provide the necessary support and modeling strategies to enable teachers to become part of a learning community. Modeling and coaching strategies make the vision clear and more attainable for teachers, and reinforce how others perceive what instructional leaders value (Hughes, 2001).

Senge (1990) states that many of the problems organizations incur can be traced to leadership or lack thereof. Advances in technology and changes in the goals of education are having dramatic effects on both people and organizations. Schools have a responsibility for preparing children to be productive, contributing members of a technological society. Senge maintains that very few schools are “learning organizations” with a shared commitment to change. His research indicates that only
when members are treated as stakeholders and actively participate in articulating a clear understanding of the current reality and a shared vision of where they would like to be will they develop a commitment to change (Hughes, 2001).

Effective leadership is evolving to encompass a broad range of opportunities for all people in the educational community to be learners. Bailey and Lumley (1997 cited in Hughes, 2001) have identified effective technology leaders as those who value technology as the primary tool that will change the way we view teaching and learning. They maintain that leaders who will successfully integrate technology must be able to model the technology, understand how technology can be used as an instructional tool across all disciplines, and continually focus on systems thinking as they assist others through the transformation of teaching and learning (Hughes, 2001).

In studying the role of the principal in managing diverse programs, Thomas (1978) concluded that many factors affect implementation, but none so much as the leadership of the principal. More recently, the Task Force on Education for Economic Growth identified the primary determining factor of excellence in public schools as the skillful leadership of the individual principal.

Research on exemplary practice has acknowledged that the principal is a central building block in improving instructional programs within the school. Targeting the principal as a leader of change, studies have focused on what effective principals do. Leithwood and Montgomery (1982) found that effective principals were proactive in nature and took steps to secure support for change efforts on behalf of their students. Stallings and Mohlman (1981) indicated that principals who were effective in program
implementation went out of their way to be helpful to teachers and staff. Effective change facilitation occurred in schools that were administered by principals who communicate expectations to teachers; model the standards they support; sanction teachers who perform well by using and allocating available resources (Hughes, 2001).

From a longitudinal study that focused specifically on identifying actions or interventions of principals and other facilitators in behalf of teachers’ implementation of change, a classification of interventions resulted. Eight classifications of interventions were used to organize the actions of principals: developing supportive organizational arrangement; training; monitoring and evaluation; providing consultation and reinforcement; external communication; dissemination; impeding; and expressing and responding to concerns. Of these eight functions, four are identified in studies of school change:

- Providing logistical and organizational arrangements
- Training
- Monitoring and evaluation
- Providing consultation/problem solving and reinforcement.

In addition, two other functions are prominent in the literature on change implementation: creating an atmosphere and culture for change, and communicating the vision.

While change research has discredited the idea of central management mandating change (Berman & McLaughlin, 1977, 1978 cited in Hoffman, 1990) leadership remains important in the change process because this is where the authority resides for establishing policy, determining structure, and allocating resources. Issues identified for
those leading change in schools include vision, providing autonomy for experimentation, encouraging peer support, and monitoring and giving feedback. Administrators play a key role in maintaining innovations through an ability to negotiate politics during the implementation crises, establishing rules, advocating curriculum reforms, setting procedures for training and socialization, revising assessment procedures, and continuing financial support (Louis, 1992 cited in Hoffman, 1990).

The type of response required of management may vary not only with the goals but also with the stage of technology implementation, so that a single management strategy will not meet different demands over time. While visionary leadership may be a key element in motivating initiating behaviors, traditional management efforts of policy-making crisis may be as an important in sustaining change (Kotter, 1990 cited in Hoffman, 1990). But management also plays an early role, determining if the benefits warrant adoption, providing commitment required for success, and establishing a plan for action including assessing ability to and resources for change, and establishing the priority for change (Noori, 1990 cited in Hoffman, 1990). Kotter (1990) suggests that leadership and management are complimentary in change efforts: leaders set direction and provide motivation and alignment, while managers push individuals in the right direction by planning, budgeting, organization and staffing, control and problem solving. He notes that while these roles can be combined, this is not always necessary.

Most studies identify at least two key roles in the change process: a top administrator who provides continuous support (the manager) and a change champion who is the active proponent of the plan (the leader). This can be further developed into a
management team effort to ensure that the ranges of activities required for
implementation are given continuous attention (Duck 1993 cited in Hoffman, 1990).

A key factor in the weak implementation of educational technology in schools all
across the nation is lack of administrative support. Research specifies that administrative
support is important to the success of technology training initiatives and subsequent
technology integration into classroom practice. Administrative leadership and support is
positively correlated to the effectiveness of educators who are implementing new
instructional practices in the classroom (Redish, 1997).

Administrators play a crucial role in the effective design and implementation of
technological change in the school. Their support or non-support can determine whether
teachers actively participate in training programs, such as InTech, equipment acquisition
and student use of the technology. The attitudes, commitment, and vision of
administrative leaders is essential in setting the tone for the school reform/restructuring
necessary to effectively integrate technology into the classroom (Bozeman & Hiatt, 1999
cited in Owens, 2000).

To promote or enhance the use of technology in schools, Hoffman (1996) points
out that teachers must be motivated and supported so that they feel comfortable using the
technology. This includes providing the necessary support as they build skills to be
successful. Meltzer and Sherman (1997) agree stating in addition to ensuring equipment
availability and scheduling time for training and skill building, principals must also
motivate and encourage teachers when preparing and designing programs, but also during
implementation phases (Owens, 2000).
In Murphy and Gunter’s (1999 cited in Owens, 2000) study of perceived administrative support and its relationship to teacher use of computers and related technology, it was found that teachers who reported the highest levels of administrative support also reported more and varied use of the technology for instructional purposes. They also concluded that principals should not isolate themselves from the process but should serve as role models for technology use. They should model the process from the beginning, learning and building their skills and assisting the teacher with actual classroom integration and implementation. Principals should know how to work the computers systems and become involved in instructional decisions surrounding their use. They should collaborate with teachers and others to research and observe the impact of computer applications in the schools.

Meltzer and Sherman (1997) have identified two issues that must be addressed at the onset of any successful school technology integration program. Principals must work with teachers and staff to develop a vision. Along with ensuring that sufficient hardware, software and supplies are in place when needed and providing adequate time and training to support teachers in skill building and curriculum, a common vision will help maintain a collective commitment to success. This process should begin with the identification of instructional priorities. Working with teachers, parents, communities, and business partners, principals should identify and articulate what teaching and learning should be like in their schools.

The National Center for Education Statistics (2000) indicates that principal leadership has been described as one of the most important factors affecting the effective
use of technology in classrooms. Additionally, principals who exhibit leadership are instrumental in modeling the use of technology in the classroom. They understand how technology can support best practices in instruction and assessment, and they provide teachers with guidance. In a study of three schools identified as successful integrators of technology, Wilburg (1991 cited in Kincaid, 2001) found in all three cases, the administrator was a strong advocate and user of computer technology. This seems to further support the notion that administrative modeling may be one key ingredient to integrating technology.

The Office of Technology Assessment (1995) found that principals who are knowledgeable about technology and technological issues are important advocates for the integration of technology into schools. Sandholtz, Ringstaff, and Dwyer (1997 cited in Kincaid, 2001) found administrative support was crucial in determining whether or not teachers would integrate technology. In the study, Sandholtz and Dwyer (1997 in Kincaid 2001) observed that administrators offered their teachers much needed emotional and moral support by showing interest in changes teachers were instituting in their classrooms. In addition, by working with their staff to create a shared vision for the future, effective administrators eased tensions among teachers and fostered teacher collaboration.

MacNeil and Delafield (1998) examined principal leadership for successful school technology implementation. This study was one of the focused research studies carried out in this area. One hundred and twelve principals and assistant principals were surveyed. Some of the important findings of the study were:
1. The main barriers to implementing technology in the classroom were lack of financial resources, poor infrastructure and lack of time for professional development and planning.

2. There needed to be a closer alignment between the amount of time given for professional development and its perceived importance.

3. At each level, finding, training and leadership issues must be addressed simultaneously if technology in the curriculum is to grow and have a significant impact on the reform of education.

4. Principals and school leaders must accept the challenge to create supportive conditions, which will foster innovative use of computers.

Information Technology will only be successfully implemented in schools if the principal actively supports it, learns as well, provides adequate professional development and supports his or her staff in the process of change.

Technology and the Significance of Leadership

Clearly, technology plays an ever-increasing role in society and education. According to Howard Gardner (2000), “The most important technological event of our time is the ascendancy of the computer” (p. 43 cited in White, 2001). Howard Gardner also stated that “In itself, technology is neither helpful nor harmful; it is simply a tool. Still, we would be ill-advised to ignore the opportunities afforded us by the sophisticated technologies of today” (p. 135). In the same text, Gardner concluded that:
In the future, education will be organized largely around the computer. Not only will much of instruction and assessment be delivered by computer, but the habits of mind fostered by computer interactions will be highlighted, while those that fall through the computational cracks may be lost. (p. 43)

Gardner later stated, “The very notion of literacy is altered. To the classic three R’s, one must certainly add various computing and programming languages. There is every reason to believe that these literacies will continue to proliferate, even as their possible interrelations are explored” (p. 54). This was confirmed by Taher Razik and Austin Swanson (2001): “Because educational institutions are an integral part of the information industry, the advances in information and communication technologies hold enormous potential for revolutionizing schooling” (p. 456). However, Razik and Swanson went on to declare that “To date, however, that potential is largely unrealized.” If education does not embrace and learn to successfully capture the potential of computer technology as a tool for organizational development and learning, the institution of education will lag woefully behind other societal institutions (White, 2001).

The use of new technology in schools is more likely to thrive in schools whose principals play a central, encouraging role. When principals act as instructional leaders, model discerning use and lead their staff through daily practice, the program is much more likely to succeed (Mckenzie, 2002).

The number one issue in effective integration of educational technology into the learning environment is not the preparation of teachers for technology usage, but the
presence of informed and effective leadership. Confirmation of this statement can be found in the literature on technology standards for school administrators. Further evidence that what administrators do or fail to do makes a critical difference in the effective use of technology in schools can be found in the national movement to develop technology standards for school administrators.

Don Knezek, Director of the Technology Standards for School Administrators, supported the importance of the leadership in integrating technology when he wrote that:

Integrating technology throughout a school system is, in itself, significant systemic reform. We have a wealth of evidence attesting to the importance of leadership in implementing and sustaining systemic reform in schools. It is critical, therefore, that we attend seriously to leadership for technology in schools. (TSSA Collaborative, 2001, p. 5)

The connection between the importance of principal’s leadership and the implementation of technology has been supported by several authors (Bozeman & Spuck, 1991; Ferrandino, 2001; Gibson, 2002; Mojkowski, 1986; Thomas, 2001; TSSA Collaborative, 2001). As described in a 2002 article on the principal’s role in the implementation of technology, the National Center for Education Statistics found that “... the principal’s leadership was one of the most important factors affecting the effective use of technology in classrooms” (Kincaid & Feldner, 2002, p. 2).

Researchers and practitioners have long recognized that attention to the role of the principal is a significant issue for school improvement (Barth, 1980; Glickman, 1990; Howe, 1993 cited in Severson, 2001). The principal is one of, if not the most influential
in the successful implementation and continuation of initiatives that stand a chance to improve school operations and educational opportunities for students (Fullan, 1991; Murphy & Lick, 2001; Razik & Swanson, 2001; Schwahn & Spady, 2001; Tirozzi, 2001 cited in White, 2001).

Moreover, "An understanding of technology leadership shares much with research on leadership in general and educational leadership in particular" (Kearsley & Lynch, 1992, p. 50 cited in White, 2001). In other words, just as Fullan and others found that the principal plays a critical role in the successful implementation of school initiatives and reform, the principal is the key to successful implementation of technology in a school (Ferradino, 2001; TSSA Collaborative, 2001).

The study Making Technology Happen reported schools that achieved the highest percentage and the greatest strides with technology integration have done so with the help and guidance of technology leadership, whether it was an administrator (97.6%), a champion chosen by administration (94%), or even a group of educators supported by administration (91%) (Casson, 2001). Casson identified four dominant elements of technology leaders in education:

1. **Vision** - Leaders had a strong belief about the role of technology as an agent of change in education. They also were able to communicate, act and infect others with their vision.

2. **Empowering others** - Leaders were able to get staff to buy into their vision by empowering staff to be involved with the decision making, encouraging staff
to take risks, removing barriers, and using rewards for the technology achievers.

3. **Modeling technology use** – All technology leaders were proficient users of technology, whether as administrators or educators. They modeled what they preached, how to use technology consistently and productively.

4. **Interacting** – This category was specifically for administrators and district leaders. These individuals became involved in the process of technology integration by participating in workshops themselves and/or getting the greater community involved in the change process. (Casson, 2001)

Cohen believes that leaders need to have a vision, because without a vision there is no leadership (1990). Leaders need to have the ability to develop a vision of the future that includes everyone in a role. Leaders need the ability to communicate the vision so that others understand the vision, feel a part of it, and are willing to take action to make the vision a reality. Therefore, their vision needs to be a shared vision (Cohen, 1990).

Again, we can see where this theory continues to have an effect upon how teachers, administrator and students view technology and its uses.

Leaders must be committed to their vision by modeling their beliefs to others. It is easy for a leader to identify the needs of others but it is much harder to recognize the needs in themselves (Cohen, 1990). Technology leaders need to pursue training, participate in study groups, forward articles to staff members and solicit their comments. They also should make presentations at conferences, write articles for professional
journals, engage in action research, and communicate the importance of professional growth.

Another powerful method to help teachers become a part of the vision is to empower them. Technology leaders can empower teachers by showing inspiring uses of technology that they can see themselves doing comfortably, capably and independently (Mckenzie, 1994). Technology leaders also perform the duties of mentors and coaches. This mentoring or individual relationship allows for increased confidence and gives followers understanding and ownership of decisions and consequences (Bass, 1985). Technology leaders with a thorough understanding of leadership qualities and technology skills can effectively lead teachers towards the vision of technological proficiency and integration of technology into their curriculum.

The Principal’s Role

According to Ian Gibson (2002), the principal’s role in integrating technology into the school has very little history and there is scant literature specifically speaking to this role that is now being required of principals. Joseph Slowinski (2000) concurred with Gibson’s analysis when he wrote, “As the critical issue of school computer utilization shifts from mere access to the more fundamental issue of how to effectively integrate technology into the curriculum, there has been little discussion of what role administrators should play” (p. 1).

Even though this is a relatively new field of study, Bill McCampbell (2001) eloquently stated what is known:
It is clear what administrators do or don’t do is of great importance in determining whether information technology will yield optimal benefits for students. As accountability for the consequences of investments in technology increases, the role of administrators will be under greater scrutiny. (p. 68)

Some findings are able to be drawn from the research and analytical work that is completed. These findings include facts that (a) there are specific roles that principals can and should play as a school leader working toward the implementation of technology into the school; (b) the principal must be able to model the use of technology; and (c) there are specific technology skills that the principal should learn.

As stated above, the principal plays a critical role as a school works toward the implementation and utilization of technology in the school. Only now is that role becoming more defined as researchers and experts in the field of educational technology and leadership focus their efforts toward this topic. In a study that examined the role of administrators in the integration of technology into the learning environment of three United States school districts, Ian Gibson (2002) offered specific recommendations that provide some guidance for school administrators working to become technology leaders. Gibson’s recommendations call for the administrator to focus their energies on ten technology categories: (a) existing practice, (b) planning, (c) curriculum, (d) resources, (e) staff issues, (f) communications, (g) support, (h) obstacles, (i) staff development, and (k) implementation.
In a more general, yet related, attempt to provide guidance on the role of the principal as the technology leader; some authors have described the principal’s role as a technology visionary (Bozeman & Spuck, 1991; Dede, 1993; O’Neill, 1999), technology planner (Bailey, 1997; McKamey, 2001), and teacher supporter (Cassidy, 2002; Ham, 1997; Isherwood, 1985; Kincaid & Feldner, 2002; McKamey, 2001; Meltzer & Sherman, 1997; Ravitz, 1998).

Very similar to the standard one from the Interstate School Leaders Licensure Consortium Standards (Council of Chief State School Officers, 1996), research supports the need to have a principal that is a visionary technology leader and that the vision for how technology will be used in the school must come from the principal (Riedl, 1997). However, if William Bozeman and Dennis Spuck are correct, “it is . . . rare to find a principal who can articulate a vision for the use of technology for achieving educational goals. Even a casual acceptance of this current status regarding educational leadership suggests that such a situation is unacceptable” (p. 516). This conclusion is supported by the following fact:

In schools where technology was apparent in the teaching and learning process, there was a visionary leader who understood the use of technology. In most cases this visionary leader was not found and the schools were lacking in technology applications. This research leads to a belief that if schools are going to change and embrace technology, the leader has to be the catalyst for change. (O’Neill, 1999, p. 3)
In addition to paying close attention to forming and articulating a vision for the use of technology in schools, some authors suggest that the principal must also attend to the issue of supporting teachers as they work to utilize and implement technology into the classroom for both administrative and instructional purposes. As stated by Tim McKamey (2001), “Many teachers fear that technology will undermine their control over their classes. A principal can give friendly assistance to help teachers overcome their hesitation” (p. 6). In a related discussion, Geoffrey Isherwood stated that “Principals and other school leaders must accept the challenge to create supportive conditions which would foster innovative uses of computers” (p. 6).

As with the lack of leadership by the principal in creating a technology vision, there seems to be a lack of principal support for teachers that are attempting to integrate technology into their classrooms. Donn Ritchie (1996) and Patricia Stegall (1998) believe that this lack of support is the factor most holding teachers from embracing technology as a tool for performing both administrative and instructional functions inside the classroom. In fact, Donn Ritchie identified eight variables that affect a school’s ability to effectively identify and implement educational technologies into the classroom. “Of these eight, a lack of administrative support may be the most critical; for without the commitment of a school administrator, the likelihood is increased that one or more of the other seven variables will negatively influence technology adoption and implementation” (p. 43).
With this work in mind, it behooves the principal to put energy into becoming a visionary technology leader and supporter of teachers as they work to implement technology into the classroom.

**Providing Resources and Administrative Support**

For teachers to succeed in using technology to any significant degree in their classroom, school board, district, and school site administrators must provide strong leadership (Vichoff, 1989; Hadley & Sheingold, 1993 cited in Hoffman, 1996). Leadership is important because, as Becker (1994) points out, teachers begin using technology in part because they choose to but also because they perceive their organization expects it of them. To succeed, they will need to choose to use computers on their own, but managerial expectations help start the ball rolling.

In the late 1980s the importance of administrative support began to be acknowledged. Mecklenburger’s 1989 statement summed some of the power of administrative control in school technology when he stated:

> Administrators must understand both the capabilities and limitations of technology. Only then can they plan for, budget for, purchase carefully, install properly, maintain dutifully, schedule adequately, distribute appropriately, and replace systemically the electronic technology best suited for their needs. (p. 7 cited in Ritchie, 1996)

In the years since, the importance of administrative leadership has continued to escalate. The Office of Technology Assessment has found that administrators who are...
informed and comfortable with technology become key players in leading and supporting technology into the schools (OTA, 1988; 1989; 1995; cited in Ritchie, 1996).

The principal must make sure that teachers and students are provided the resources they need to effectively integrate technology. In addition to finding the opportunity to purchase the technology, teachers need training and support. Further, the principal must work to provide teachers with the time to develop technology related lessons and assessment tools (White, 2001).

In a 1997 article on what teachers feel a principal should provide in the area of technology, Vince Ham concluded: First, teachers felt that principals should provide a clear policy, arrived at democratically, on the placement of technology in the school. Second, principals should guarantee that teachers have access to both current and new resources. Third, technical support and ongoing professional development should be provided to all teachers (White, 2001).

The principal plays a critical role in the integration of technology in a school. It is the responsibility of the principal to obtain resources, keep outside forces from hindering the integration of technology by teachers and students, and provide school policies that support teachers in their use of technology (Ham, 1997; Stevens, 1984 cited in White, 2001). Additionally, teachers must feel supported in their efforts to explore technology. Therefore, the principal must work to create a supportive, risk free climate where teachers openly experiment with technology (White, 2001).

In essence it is important for the principal to support teachers as they work to use technology. This support must represent a mandate for professional development in
instructional technology, and be backed up with resources, structures, and strategies to provide time for training, practice, and assessment (Sherry, Billig, Tavelin, & Gibson; 2000, p. 46 cited in White, 2001).

Leaders think generally about resources, and providing resources has always been accepted as a part of the leader’s role in change. They make resources available and allocate those resources accordingly.

The lack of resources has been a major barrier to sustained change efforts. Successful leaders are more effective in putting dollars where they can make a real difference. Thus, leaders make resources available and allocate those resources in ways that maximize teacher change and effectiveness. Fullan suggests that emphasis be placed on such resources as released time for planning and training. It is not only material resources that count but also time and energy demands of people.

In their review of research on improving schools, Lieberman and Miller (1981) examined the relationship of the teacher and the school. They found that the principal is significant in creating an environment for change. They stated:

Realize that the power and influence of the principal is of great importance. The principal is responsible for the day to day conditions of the school, for keeping the complex of web interactions in control, for presenting an image to the community. The principal is the critical person making change happen. (p. 583 cited in Hefner-Packer, 1999)
Further, they stated that “Teachers must be recognized for the things they do well already and supported by people and resources for the new behaviors and procedures they decide to take on” (p. 583 cited in Hefner-Packer, 1999).

Fullan (1985) investigated change processes and strategies that could be implemented in schools. He described four cases that provided insight into how successful change processes might operate at the school level. Three of the four cases revealed that principal support contributed to change success (Hefner-Packer, 1999).

Fullan stated that organizational conditions within the school make it more or less likely that the process will succeed. Additionally, he summarized that it is the principal’s role to create a climate and support mechanism to implement innovations.

Technology Implementation

Although the term implementation has been used rather loosely in reports of many educational change efforts, it does have a specific meaning and is inextricably related to the change process and the content of what is changed by the process. Implementation is the carrying into effect of an innovative idea or practice (Bell, 1988 cited in Woodard, 1994). It has often been referred to as transformation of intentions into actual change efforts. Nadler (1981 cited in Woodard) labeled it the transition state. Fullan described it as a change in practice. The literature on implementation can be categorized as that dealing with factors that influence implementation and guidelines for implementation.

The Levels of Technology Implementation (LOTi) model, developed by Christopher Moersch (1995), is a framework for measuring classroom technology use and was used in this study by participating teachers to assess their level of technology
implementation. The LoTi model was developed to assist school districts in restructuring their staff's curricular to include concept/process-based instruction, authentic uses of technology, and qualitative assessment. LoTi is aligned conceptually with the research of Dwyer, Hall, Loucks, Rutherford, and Newlove (1975) and Thomas and Knezek (1991). The levels are listed and described in Appendix A.

In the LoTi model, Moersch (1995) proposed seven discreet implementation levels teachers can demonstrate, ranging from Nonuse (Level 0) to Refinement (Level 6). Changes occur in the instructional curriculum as the teacher progresses through each level. Instructional Practices change from being teacher-centered to learner-centered. Computer technology is used as a tool that supports and extends students' understanding of instructional material through the use of technologies such as databases, telecommunications, multimedia, spreadsheets, and graphing applications. Hands-on inquiry related to problems, issues or themes gradually replace traditional verbal activities. Technology in-service training should be designed to complement the changes that occur in teacher practices as one evolves through the stages (Moersch, 1995).

Factors that Influence Implementation of Training

A review of organizational training and the educational professional development literature revealed that certain organizational factors influence the implementation of training. These practices can be organized by the broad categories of principal leadership, opportunities to use, and policies and procedures.

Research indicates that management support has an influence on the implementation of training. According to Senge (1993), the role of leadership in the
knowledge-based organization is to build a shared vision, empower people, inspire commitment, and enable good decisions to be made throughout the organization through design of a learning process. He contended that without commitment and excitement generated by genuine vision, little significant learning will occur.

Developing and Communicating the Vision

It is especially important at the school level for the principal to have a vision of what is possible through the use of technology, and be able to work with others to achieve the vision. Without this vision, and the translation of the vision into action, lasting school improvement is almost impossible.

Vision refers to mental pictures of what the school or its programs might look like in a changed and improved state—a preferred image of the future. Brandt (1987), reporting on Andrews work in 100 schools cites the principal’s role in setting vision for the school as a high priority in achieving effectiveness. However, Fullan (1992) observed that a good principal does not individually create a vision and impose it; he or she builds a vision together with the participants of the school organization.

From their case studies of six urban high schools, Louis and Miles reported that effective school leaders, those who realize change in their schools, are able to talk about their vision for the school so that others understand and believe that the vision reflects their own interests. Leaders first encourage participation in vision development and second, help people develop images of how to get there.

Communicating the purpose of the school and its vision for improvement, and demonstrating visible commitment to the vision were cited as leadership functions that
must be fulfilled in the successful implementation of technology. Effective leaders can easily articulate their vision and goals for their schools. Vision and goal setting establish the parameters for leaders' subsequent actions, giving them a clear image of their schools in order to set priorities. They use the goals as a continuing source of motivation and planning and as a basis for providing clear consistent and well-communicated policy.

Providing Training and Development

As the brief history of technology use for learning suggests, the way educators teach and students learn has not changed dramatically over the past two decades. The research on teacher change and instructional reform in general indicates that such changes in teacher practice are often slow, minimal, or even nonexistent. A number of factors contribute to the success or failure of instructional reforms. One important factor the literature has identified is principal leadership. Teachers' preparation and training to use educational technology is a key factor to consider when examining their use of computers and the Internet for instructional purposes. The 1999 FRSS survey indicates that:

- In 1999, approximately one-third of teachers reported feeling well prepared or very well prepared to use computers and the Internet for classroom instruction, with less experienced teachers indicating that they felt better prepared to use technology that their more experienced colleagues.

- Over a 3-year time period, most teachers (77%) participated in professional development activities in the use of computers or the Internet that lasted the equivalent of 4 days or less. Teachers who spent more time in professional
development activities were generally more likely than teachers who spent less time in such activities to indicate they felt well prepared or very well prepared to use computers and the Internet for instruction. (Anderson, Angeles, Cronen, Lanahan, Iannotti, & Smerdon, 2000)

A leadership function that must be satisfied in all improving schools is that of providing staff development. In her review, Boyd (1992) reports that skill building and training are part of the process of change. Learning to do something new involves initial doubts about one’s ability, incremental skill development, some successful experiences, and eventually clarity, meaning, and ownership. Effective leaders use formal and informal data to identify needs of the staff for training and development. Louis and Miles (1990) assert that training and support are master resources to help staff. Many change efforts are not successful because teachers have not been provided with the opportunities to acquire the new skills that they need.

Most principals and educators know how difficult change management is. The introductions of even well known but innovative practices are problematic at the best of times. Many principals brought up on a chalk and talk diet find coping with delegation a big enough problem. Along comes information technology, children seem to handle it with ease; young staff daily illustrate their skills. The principal, even if not techno phobic, often does not have time to grasp the complexities, let alone see to its successful implementation.

Wilsmore’s (1997) pilot study into the role of the principal in the introduction of information technology in schools pointed out the importance of modeling, knowledge,
leadership, adequate professional development, change management and the establishment of effective learning communities if change in the use of information technology was to be more then superficial. Another view that appears to draw from both of the above is suggested by Wilkinson (1997). He informs us that the following are vital for school leaders in change management: meshing, empowering, communicating, interacting, responding, developing, envisioning, focusing, ensuring, and having the patience and courage to let it happen.

Summary

As described, an effective technology leader models the use of technology, supports teachers, and attends to numerous facets of technology planning and the integration of technology into the school as both administrative and instructional tool. While learning new and emerging technologies may be an overwhelming venture, it is imperative that the educational leader be committed to the implementation of technology as a tool for work and learning in the school. From this author’s view, there are too many principals that are either avoiding or downright ignoring the importance of their leadership when it comes to the implementation of technology in the school. This avoidance may work today but it will become increasingly difficult to avoid technology in the future. Also, nonusers of technology will stand out as their productivity decreases and they are left behind (Mojkowski, 1986). Further, as additional pressure from the community, parents, businesses, and students is placed on the school to utilize technology, the principal must become the leader in sifting through the proper uses of technology and painting a vision for the future uses of technology.
It would seem important to point out (Atkin 1994; Mortimore, 1996) that the principal who ignores the school as a learning community does so at their peril. Effective change management and leadership skills are essential. It is the responsibility of the principal to be the instructional leader. In addition he or she should act as a facilitator for technology planning. Information technology will only be successfully implemented in schools if the principal actively supports it, learns as well, provides adequate professional development and supports his/her staff in the process of change.

As one focuses on the role of the administrator, Holland and Parkins (1986) contended that principals are charged with involving everyone involved in the planning and implementation of computers. Bennett (1986) stated that it is imperative that the principals create a clear vision of their mission and take the necessary steps to ensure that there is a plan in place to attain the stated goal. Creating this vision demonstrates to the staff commitment to the endeavor. The mission must be well-defined and concisely state technology’s place in the education of students. Holland and Parkins (1986) stated that changes occur in five stages: readiness, planning, training, implementation, and maintenance. Of these five stages, Bennett (1996) concurred that implementation and training are essential.

To summarize, Bennett (1996) suggested that administrators redefine their leadership roles and shift to more technological paradigm by addressing the following issues:

1. Administrators should plan and take steps to become fluent users of technology.
2. A clear technological mission is essential.

3. Teachers and others should be involved in the planning process.

4. The current status of computer and technology literacy in the school should be evaluated.

5. It should be determined if there is an existing plan that will lead to the integration of technology into the curriculum and instruction.

6. Ensure that teachers and students have adequate access to hardware and software.

7. Initiate in-service training, including adequate funding and release time for staff.

8. Determine how to evaluate teachers and their successes in integrating technology into the instructional program.

9. Be prepared to model goals for students and staff.

10. Determine what to do to network teachers and students within and outside the school.

11. Plan to assist the office staff in integrating the appropriate technology to help administrative tasks run smoothly.

12. Consider how the students' knowledge base fits into the next level of education.

13. Finance the technology and get the resources needed on a limited budget.

(Payne, 2000)
As technology becomes an increasing part of our society, education must prepare students to function successfully in this environment. It is the responsibility of teachers and administrators to become proficient in the uses of technology and impart this knowledge to students.
CHAPTER III
THEORETICAL FRAMEWORK

The purpose of this study was to investigate the effectiveness of principal leadership, as perceived by teachers in the implementation of a state technology program (InTech). Its focus is on how administrative support from the principal impacts the overall success of a technology professional development program. This chapter describes the theoretical framework of the research. It also defines and discusses the independent and dependent variables and the research hypotheses. Additionally, this chapter addresses the limitations of the study and is concluded with a summary of the theoretical framework.

Presentation and Definition of the Variables

The independent, dependent, and moderating variables are stated below. Definitions of the variables for the purpose of this study are provided. Figure 1 provides a graphical presentation of the variables.

Independent Variable

The independent variable in this study is Principal Leadership.

Dependent Variables

The dependent variables are Technology Implementation and Teachers’ Perceptions of their use of technology.
INDEPENDENT VARIABLE

Principal Leadership
Direction
Resources
Support

DEPENDENT VARIABLE

Technology Implementation
Communicating vision to Faculty and staff
Training
Site Application
Assessment

MODERATING VARIABLES
Age Gender Years of Experience

Figure 1. Relationship Among the Variables
**Moderating Variables**

The moderating variables are teachers' and principals' (a) Age, (b) Gender, and (c) Years of experience.

**Definition of Variables**

**Age:** Refers to the chronological years attained by both the principal and teacher at the time of the study.

**Gender:** Refers to classification as either male or female

**Principal Leadership:** influencing the behavior of others in efforts toward accomplishing the goals of the organization; providing direction, support, and resources

**Teachers' Perceptions of their use of technology:** Refers to the degree to which teachers take initiative and responsibility for implementing technology.

**Technology Implementation:** using a combination of technology parts, such as hardware, and software to enhance classroom curricula

**Years of Experience:** Refers to the number of years of the principal and teacher has been involved in the educational profession

**Definition of Terms**

The definitions which follow describe certain terms that are used in the study:

**Consideration:** The subject’s score on the consideration scale of the Leader Behavior Description Questionnaire. A leader with a high score is high in consideration.

**Initiating structure:** The subject’s score on the initiating structure scale of the Leader Behavior Description Questionnaire. A leader with a high score is high in initiating structure.
In-Tech: In-Tech is a 50-hour technology professional development program designed, implemented, and tested by the Educational Technology Center at Kennesaw State University. The goal of the program is to provide effective training methods and content in order to train teachers to use computer-based technology to support and enhance existing curriculum and provide a catalyst for change in the teaching and learning process (Redish, 1997).

Level of Technology Implementation: Questionnaire designed to determine the level of a classroom teachers technology implementation by generating a profile in three specific domains: LoTi, personal computer use (PCU), and current instructional practices (CIP).

Technology: the use of computers and any other computer hardware/software.

Relationship Among the Variables

For this study, there was one major assumption upon which this study was based: the quality of leadership exhibited by the principal to a great extent determines the behavior of human groups in the school. The following paragraphs discuss the development of this assumption. Furthermore, this assumption was examined by applying the social systems theory and leadership theory to formulate the theoretical framework for this study.

This investigation is based on the study of educational administration in the context of the behavior science theory. There is an increasing awareness that the success of our schools depends directly on effectively using our human resources. The
behavioral sciences provide us with a basis for such use (Getzels, 1968 cited in Myers, 2001).

Getzels and Guba (1957) posited two dimensions to the organization: the nomothetic (institutional) dimension and the idiographic (personal) dimension. It is the interaction of these two dimensions that results in the observed behavior of individuals in the organization. The principal’s responsibility is to serve as the agent for productive interaction.

Institution refers to the fact that all organizations have certain necessary functions that must be carried out, no matter what. The necessary function of the school is to provide an articulated program of studies and require all eligible children to participate in this program (Ubben & Hughes, 1997).

Roles are the official positions and offices that have been established to carry out the functions of the organization. The behaviors that are to comprise a role are called role expectations. Every role has certain normative responsibilities and these will differ by role. For each role in the structure, principal, teacher, student, etc. there are certain behavioral expectations. While everyone in the social system is an observer and holds certain expectations of how these other roles will behave, overall there is an institutional role expectation for the incumbents.

Personality in the context of the social systems model may be defined as the dynamic organization within an individual of those “needs dispositions” that govern his unique reactions to the environment. In other words, every one of us is a complex of
previous experiences that have provided us with differing orientations to life, to organizations and to people (Ubben & Hughes, 1997).

In order for the principal to understand the behavior of a teacher or other staff member, it is essential that the principal know both the role expectation of the particular job and the needs disposition of the individual. The challenge to the principal is to try to address both individual and organizational needs to achieve as much congruence as possible. In order for the school to be effective there must be congruency between the behavior of the role incumbent and expectation for that role (Ubben & Hughes, 1997).

![Diagram of Social Systems Theory]

**Figure 2: Depiction of A Social Systems Theory**
Significant to the behavior patterns of administrators is Hersey and Blanchard's theoretical model of situational leadership. This model relates closely to Getzels and Guba's social systems theory in that the two dimensions, normative and personal, are parallel to the task and relationship behaviors found in Situational Leadership. They support one another and strengthen the theoretical base for this study.

Situational Leadership is based on the interaction among (a) the leadership and direction (task behavior) an administrator gives; (b) the social and emotional support (relationship behavior) a leader provides; and (c) the readiness level the teachers' exhibit in performing and completing a specific task or objective. This model was transpired to help people undertaking leadership, regardless of their role, to be more effective in their daily interactions with others.

Situational leadership emphasizes the behavior of a leader in relation to followers. "Followers in any situation are vital, not only because individually they accept or reject a leader, but because as a group they actually determine whatever personal power the leader may have" (Hersey, 1996, p. 190, cited in Myers, 2001).

According to this model, the leadership style a person chooses depends upon the people the leader is working to influence. "In using situational leadership, one should always keep in mind there is no one best way to influence others. Rather, any leader behavior may be more effective depending on a readiness level of the person you are attempting to influence" (Hersey & Blanchard, 1996, p. 207, cited in Myers, 2001). This model is based upon classifying leader behaviors into two categories.
Task behavior, is defined as the extent to which the leader engages in spelling out the duties and responsibilities of an individual or group. These behaviors include telling people what to do, how to do it, when to do it, where to do it, and who is to do it. Relationship behavior is defined as the extent to which the leader engages in two-way communication. The behaviors include listening, facilitating, and support behaviors. (Hersey & Blanchard, 1996, p. 191, cited in Myers, 2001).

Additionally, this study roots itself in the theoretical and conceptual constructs of change theory in education. Conceptually, change does not occur in education with the introduction of an innovation; change occurs when the innovation is actually implemented (Hall & Hord, 1987, cited in Piper, 2000). In order to facilitate this change process, change facilitators need to understand what influences teachers’ practices of implementing an innovation.

Studies have identified the need for leadership and support to be present in order to achieve successful educational change (Brown, 1993; Leithwood, 1994; Schmitt, 1990, cited in Piper, 2000). These studies differ in the style of leadership that is most effective in implementing change. Some studies support the motivational tactics of Transformational Leadership to induce change (Brown, 1993, Leithwood, 1994 cited in Piper, 2000). Other studies favor the more direct style of Transactional Leadership (Fairholm & Fairholm, 1984; Schmitt, 1990).

Transactional leadership is a bargain basement approach offering to followers specified external rewards and privileges in exchange for the completion of duties and responsibilities outlined by the organization (Ubben & Hughes, 1997). Transformational
leaders use their knowledge and skills and their perceptions of changes that are needed to work both inside and outside the organization to map new directions, to secure new resources and refocus existing resources. To such leaders change is inevitable—the challenge is to make the most of it in productive ways (Ubben & Hughes, 1997).

These theories will be used as frameworks in this study to identify specific behaviors as they relate to the effective implementation of a technology professional development program.

Null Hypotheses

In fulfilling the purpose of this study, the following null hypotheses were tested:

HO1: No statistically significant relationship will exist between teachers’ completion of the In-tech program and their perceptions of the use of technology in the classroom.

HO2: No statistically significant relationship will be present between elementary principals’ leadership style and teachers’ implementation of technology.

HO3: No statistically significant relationship will exist between the state required In-tech program and teachers’ use of technology as measured by the LoTi framework.

Scope and Limitations

This study includes a sample of the total population of principals and a random sample of teachers in a large metropolitan school district. The generalizability of the findings of this study is limited for the following reasons:
1. The participants' responses on the questionnaires will be based on self-report and, therefore may show bias.

2. The study will be limited to one school system.

3. The study will be limited to elementary schools.

Summary

The main focus of this chapter was to present the variables and the different relationships between them. This study uses one independent variable and one dependent variable, both of which were described in this chapter. The null hypotheses, along with the limitations of the study, were also given.
CHAPTER IV
RESEARCH METHODOLOGY

Introduction

This study was designed to examine the perceptions of teachers regarding the role of principal leadership in the implementation of the school system's instructional technology program (InTech), and to examine the extent to which principals in this particular school system impact the process of technology integration. In May of 2003, teachers and administrators in the school system to be studied were introduced to the research project during a faculty meeting and asked to complete two research instruments: the Leader Behavior Description Questionnaire (LBDQ) and the Level of Technology Implementation (LoTi) Questionnaire. In addition to these instruments, the subjects also filled out a demographic survey.

Research Design

This study was quantitative in nature. It was designed to determine the teachers' perceptions of their own level of technology implementation based on the LoTi framework, as well as the principals' role in the effective implementation of technology. The questionnaire used was based on a Likert-type scale. By identifying and explaining the relationship between the variables, one can rationalize and have better insight into an
understanding of teachers perceptions and the role of the principals in promoting technology in their schools (North, 1998).

Description of the Sample

The subjects from this study were drawn from teaching personnel in 16 of the 33 elementary schools located within the school district being studied. Approximately 10 teachers were randomly selected from each school. This metropolitan school district is comprised of 33 elementary schools with two under construction, 12 middle schools, and 7 high schools with one under construction. Each school has technology support and teachers who have been trained in InTech, the state required technology program.

This school district was selected because of its current emphasis on technology. The teachers and administrators at all schools are involved in InTech, a state required technology staff development program.

Working With Human Subjects

Teachers were asked to participate voluntarily in the study. Their anonymity and confidentiality was ensured. No information was used to evaluate them for any other purpose other than research. Teachers who participated in this study were given two questionnaires and a demographic survey with directions for completing these instruments. They were asked to return them within one week. Permission to solicit participants’ responses was requested from the schools and the school district being studied.
Description of the Instrument

Two survey instruments and a demographic questionnaire were used to collect data for this study. According to Ary, Jacobs, and Razavieh (1985) cited in Bernal (2001), the survey is an important and frequently used process for gathering research data. Surveys sample populations in order to discover the incidence, distribution, and interrelationships among variables. The Level of Technology Implementation (LoTi) was developed by Dr. Christopher Moersch.

The Demographic questionnaire was developed by the researcher to collect data that would provide a thorough description of the sample. Questions concerning the participants' gender, age, and teaching experience were included as well as questions concerning InTech training.

The Leader Behavior Description Questionnaire (LBDQ) was selected as an instrument to measure principal leadership. It was administered to 63 teachers in the school district being studied. The LBDQ was established as a method whereby group members would be able to describe the leader behavior of designated leaders in formal organizations (Halpin, 1957; Stodgill, 1963). The instrument contained items describing the manner in which a leader might behave, along with the respondent rating of the way in which the leader is perceived to engage in each type of behavior (Halpin, 1957).

Two broadly defined dimensions of behaviors were established as encompassing a wide variety of leader characteristics. Those dimensions were Initiating Structure and Consideration (Charters, 1963; Gorton & Snowden, 1993; Halpin, 1957; Hemphill, 1955; Stodgill, 1963, 1970; Yukl, 1989). By combining these two dimensions, four leadership
styles are possible. Those who score above the mean on both consideration and structure are considered to be in Quadrant I, High Consideration/High Initiating Structure. Those who score below the mean on both dimensions fall into Quadrant III, Low consideration/Low Initiating Structure. Those who score below the mean on consideration and above the mean on initiating structure are in Quadrant II, Low Consideration, High Initiating Structure. Finally those who fall into Quadrant IV, High Consideration/Low Initiating Structure, have scored above the mean on initiating structure. Effective leader behavior is most often associated with high performance on both dimensions. Leaders, who fall into Quadrant III, weak on both dimensions, tend to be ineffective (Hoy & Miskel, 1987 cited in Woodard 1994).

Initiating Structure refers to the leader's perceived ability to clearly define the leader's role and to let followers know what is expected (Gorton & Snowden, 1993; Hemphill, 1955; Stodgill, 1963, 1970). The Initiating Structure dimension of leadership involves attempting to set well-defined patterns of organization, channels of communication, and ways of getting the job completed (Halpin, 1966; Hemphill, 1955). Initiating Structure behaviors describe leaders who are task-oriented and stress the global activities of directing, planning, coordinating, and problem solving (Bensimon et al., 1989; Gorton & Snowden, 1993; Hemphill, 1955).

The Consideration dimension of leadership behavior refers to behavior indicating friendship, mutual trust, respect, and warmth in the interactions between the leader and members of the group (Halpin, 1966; Hemphill, 1955; Stodgill, 1963). This dimension of leadership behavior is more relationship-oriented (Bensimon et al, 1989; Yukl, 1989).
The LDBQ has 40 items. Only 30 of the 40 items are scored; 15 for each of the two dimensions. The 10 unscored items have been retained in the questionnaire in order to keep the conditions of administration comparable to those used in standardizing the questionnaire. The respondents indicate the frequency with which the behavior is perceived on a 5-point scale: always, often, occasionally, seldom, and never. Numerical values were assigned and scored according to instructions in the manual for the LDBQ (Halpin, 1966 cited in Woodard, 1994). Halpin suggested that by measuring the behavior of leaders on the initiating structure and consideration dimensions, one is able to determine by objective and reliable means how leaders differ in their leadership styles (Woodard, 1994).

Halpin (1973) obtained an estimated reliability on the LDBQ by the split half method of .83 for the initiating structure scores and .92 for the consideration scores, when corrected for attenuation. Halpin also reported several other studies where the agreement among respondents in describing their respective leaders has been checked by a "between-group vs. within-group" analysis of variance, the F ratios all have been found significant at the .01 level (see Appendix B for instrument).

Validity and Reliability of the Instrument

LoTi was developed from 5 years of research and development and extensive studies of individuals in instructional computing. LoTi is aligned with the work of: the CEO Forum on Education and Technology, Apple Classrooms of Tomorrow, and other individuals involved in instructional computing. The questionnaire was tested for
reliability, internal consistency, and validity with several different samples, all of which provided confidence that LoTi accurately measures technology use.

In addition to the research and sampling, observations of successful computer-using teachers were conducted to identify behaviors and characteristics relating to technology implementation. These behaviors were categorized into levels of implementation.

For this study, the internal consistency of the LoTi was calculated, using Cronbach’s coefficient alpha. The coefficient alpha of the instrument’s scores was .9257 or .93, indicating a very high level of internal consistency. Thus, scores obtained from use of the LoTi was deemed to possess sufficient internal consistency for research purposes.

Data Collection Procedures

Prior to conducting research, permission was requested from the school district being studied. Participants were selected from the 33 elementary schools in the school district being studied. Additionally, a letter explaining the purpose of the study and confidentiality information was sent to each principal requesting his or her assistance in the research project. A one-week period was designated for completion and return of the surveys. The researcher requested questionnaires be administered in staff meetings during the survey period. Self-addressed envelopes were provided for the return of all questionnaires. Separate envelopes were provided for teachers. The researcher provided copies of the instrument to the principals through US mail. The researcher collected the completed questionnaires. All properly completed questionnaires were coded on a Likert
type scale into an Excel and SPSS database. Statistical analyses were conducted on the SPSS dataset.

Data Analysis

To provide assurances to the research questions and hypotheses posed for this study, the data were subjected to statistical analysis, using the statistical software package Statistical Package for the Social Sciences-PC (SPSS-PC). Statistical analysis procedures included descriptive statistics for all variables, the Pearson Product-Moment Correlation Coefficient (r), multiple regression, and analysis of variance. The .05 level of statistical significance was used for decision making by which to reject or fail to reject the study’s hypotheses. Frequency distributions were used to determine the population and the sample and were computed and reported in the form of percentages.

Statistical Applications

The data were analyzed using the following statistical procedures. Research question one was addressed through the use of descriptive statistics in which teachers’ views of their own level of technology implementation were examined. For this research question, inferential statistics were not appropriate. For research question two, a multiple regression procedure was conducted to determine the extent to which a relationship was present between elementary principal leadership style and teachers’ implementation of technology was present. For research question three, correlational statistics were performed to ascertain the extent to which a relationship was present between the state required InTech program and teachers’ use of technology. Analysis of variance
procedures were also conducted to determine whether differences were present in participants’ responses as a function of experience and grade level.

Summary

This chapter described the population and sample, instrumentation, data collection, and data analysis. The method provided an introduction and the purpose for the study. The research design outlined the focus of the study. The instrumentation that was used as well as the data collection procedures was presented.
CHAPTER V
RESULTS

Introduction

A review of the literature reveals that certain practices, including administrative support have an influence on teachers’ implementation of technology. The purpose of this study was to investigate teachers’ perceptions regarding the role of principal leadership in the effective implementation of technology.

Research Questions

The goal of this study was to answer the following research questions:

1. What are teachers’ perceptions of their own level of technology implementation based on the LoTi framework?

2. Is there a relationship between elementary principals’ leadership style and teachers’ implementation of technology?

3. Is there a relationship between the state required technology program, InTech, and teachers’ use of technology as measured by the LoTi framework?

Research question 1 was addressed through the use of descriptive statistics in which teachers’ views of their own level of technology implementation were examined. For this research question, inferential statistics were not appropriate.
In the correlation matrix below, the interrelationships among the variables included in the multiple regressions are depicted (Table 1). The strongest and statistically significant relationships were present between initiating structure and consideration ($r = .798$), between initiating structure and grade ($r = -.321$), between consideration and current instructional practices ($r = -.274$), and between consideration and grade ($r = -.268$).

Table 1

*Correlation Matrix for Variables Entered into Regression Equation Correlations*

<table>
<thead>
<tr>
<th></th>
<th>InTech</th>
<th>Experience</th>
<th>Grade</th>
<th>Instructure</th>
<th>Consideration</th>
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</thead>
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<td>.134</td>
<td>-.168</td>
<td>-.184</td>
<td>-.274</td>
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<td>.039</td>
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<td>Experience</td>
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<td>.099</td>
<td>.080</td>
<td>.017</td>
</tr>
<tr>
<td>Instructional Practices</td>
<td>.477</td>
<td>.208</td>
<td>.384</td>
<td>.227</td>
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</tr>
<tr>
<td>In.Tech</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Experience</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In.Structure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
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<td></td>
</tr>
<tr>
<td>Current</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Instructional Practices</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
For research question two, a stepwise multiple regression was conducted, with current instructional practices as the criterion variable and leadership style, InTech, experience, and grade level as the predictor variables. The analysis indicated that consideration (β = -.34) and grade level (β = -.26) were significant predictors of current instructional practices, $F(2, 57) = 4.57, p < .014$. These two variables combined to explain 13.8% of the total variance (adjusted $R^2 = 10.8\%$). Consideration explained 7.5% of the variance in current instructional practices and grade level explained an additional 6.3% of the variance. Using Cohen’s (1988) criteria for multiple regression models, the effect sizes pertaining to consideration and grade level were small. Combining the two variables resulted in a model with a moderate effect size. The model indicates that the lower the consideration score and the lower the grade level reported, the higher the score obtained on the current instructional practices variable. Descriptive statistics for these variables are presented in Table 2.

Table 2

**Descriptive Statistics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Instructional Practices</td>
<td>21.68</td>
<td>6.05</td>
<td>60</td>
</tr>
<tr>
<td>InTech</td>
<td>1.58</td>
<td>.50</td>
<td>60</td>
</tr>
<tr>
<td>Experience</td>
<td>1.57</td>
<td>.74</td>
<td>60</td>
</tr>
<tr>
<td>Grade</td>
<td>1.90</td>
<td>.80</td>
<td>60</td>
</tr>
<tr>
<td>Instructure</td>
<td>39.87</td>
<td>4.10</td>
<td>60</td>
</tr>
<tr>
<td>Consideration</td>
<td>36.80</td>
<td>4.14</td>
<td>60</td>
</tr>
</tbody>
</table>
To address question three, a Pearson product-moment correlation coefficient was performed to determine whether a relationship was present between the state-required InTech program and teachers' reported use of technology, as measured by the Loti framework. A Pearson $r$ of $.182, p > .05,$ was obtained between these two variables. Thus, no statistically significant relationship was yielded between the state-required InTech program and teachers' reported use of technology, as measured by the Loti framework.

The third research question concerning the relationship between the state required InTech program and teachers' use of technology, a multivariate analysis of variance procedure (MANOVA) was conducted with InTech training or not serving as the independent variable and the initiating structure and consideration responses serving as dependent variables. No statistically significant results were yielded, $ps < .05.$ Thus, teachers, whether InTech trained or not, did not differ in their responses to initiating structure or consideration. Descriptive statistics for this question are in Table 3.

Table 3

*Descriptive Statistics for InTech and NonInTech Trained Teachers on Initiating Structure and Consideration*

<table>
<thead>
<tr>
<th></th>
<th>InTech</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiating structure</td>
<td>No</td>
<td>39.68</td>
<td>4.100</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>40.00</td>
<td>4.159</td>
<td>35</td>
</tr>
<tr>
<td>Consideration</td>
<td>No</td>
<td>36.32</td>
<td>3.827</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>37.14</td>
<td>4.380</td>
<td>35</td>
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</table>
Table 3 (continued)

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III</th>
<th>Partial Eta</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dependent Variable</td>
<td>Sum of Squares</td>
</tr>
<tr>
<td>Corrected</td>
<td>Initiating Structure</td>
<td>.1493(a)</td>
</tr>
<tr>
<td>Model</td>
<td>Consideration</td>
<td>.9874(b)</td>
</tr>
<tr>
<td>Intercept</td>
<td>Initiating Structure</td>
<td>.92588.160</td>
</tr>
<tr>
<td></td>
<td>Consideration</td>
<td>.78703.208</td>
</tr>
<tr>
<td>InTech</td>
<td>Initiating Structure</td>
<td>.1493</td>
</tr>
<tr>
<td></td>
<td>Consideration</td>
<td>.9874</td>
</tr>
<tr>
<td>Error</td>
<td>Initiating Structure</td>
<td>991.440</td>
</tr>
<tr>
<td></td>
<td>Consideration</td>
<td>1003.726</td>
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</table>

Tests of Between Subjects Effects

<table>
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<tr>
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<th>Dependent Variable</th>
<th>Type III</th>
<th>Partial Eta</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Variable</td>
<td>Sum of Squares</td>
<td>Mean Square</td>
</tr>
<tr>
<td>Corrected</td>
<td>Initiating Structure</td>
<td>.1493(a)</td>
<td>.087</td>
</tr>
<tr>
<td>Model</td>
<td>Consideration</td>
<td>.9874(b)</td>
<td>.571</td>
</tr>
<tr>
<td>Intercept</td>
<td>Initiating Structure</td>
<td>.92588.160</td>
<td>5416.478</td>
</tr>
<tr>
<td></td>
<td>Consideration</td>
<td>.78703.208</td>
<td>4547.842</td>
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<td>InTech</td>
<td>Initiating Structure</td>
<td>.1493</td>
<td>.087</td>
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<td></td>
<td>Consideration</td>
<td>.9874</td>
<td>.571</td>
</tr>
<tr>
<td>Error</td>
<td>Initiating Structure</td>
<td>991.440</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>Consideration</td>
<td>1003.726</td>
<td>58</td>
</tr>
</tbody>
</table>

Note: a Exact statistic
b. Design: Intercept+InTech
Table 3 (continued)

<table>
<thead>
<tr>
<th>Source</th>
<th>Dependent Variable</th>
<th>Type III</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
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<tbody>
<tr>
<td>Total</td>
<td>Initiating Structure</td>
<td>96354.000</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Consideration</td>
<td>82268.000</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected</td>
<td>Initiating Structure</td>
<td>992.933</td>
<td>59</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Consideration</td>
<td>1013.600</td>
<td>59</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

a. R Squared = .002 (Adjusted R Squared = .016)
b. R Squared = .010 (Adjusted R Squared = -.007)

Next, a MANOVA was conducted to address the third research question in more detail, with the individual LOTI items serving as the dependent variables. Statistically significant differences were yielded on the following items: Designing instructional units that integrate HOTS is a challenge, $F(1, 58) = 9.61, p < .003$; Students design web based or multimedia presentations to showcase research, $F(1, 58) = 5.77, p < .02$; Students use peripherals to solve authentic problems, $F(1, 58) = 6.28, p < .015$; Students discover innovative ways to use computers, $F(1, 58) = 5.96, p < .018$; Qualified to train others in the use of software application, $F(1, 58) = 4.78, p < .033$; Seldom have to call someone to figure out a computer problem, $F(1, 58) = 4.40, p < .04$; Easy to design student centered units that use computers, $F(1, 58) = 5.56, p < .022$; Use student interests to solve authentic problems when planning computer related activities, $F(1, 58) = 6.09, p < .017$; Goal is for students to learn how to use multimedia, $F(1, 58) = 4.99, p < .029$;
Confidence to show others how to merge technology, $F (1, 58) = 8.89, p < .004$; Students have immediate access to all forms of technology at any time during the day, $F (1, 58) = 5.42, p < .023$; I have taken and passed online exams to become certified with a variety of tool-based applications, $F (1, 58) = 10.72, p < .002$; and, Student questions dictate both the context and content of my instruction, $F (1, 58) = 4.75, p < .033$. Descriptive statistics for these statistically significant variables are depicted in Table 4.

Table 4

**Descriptive Statistics for InTech and NonInTech Trained Teachers on Statistically Significant LoTi Items**

<table>
<thead>
<tr>
<th>InTech</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Designing instructional units that integrate HOTS is a challenge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3.20</td>
<td>1.582</td>
<td>25</td>
</tr>
<tr>
<td>Yes</td>
<td>4.54</td>
<td>1.704</td>
<td>35</td>
</tr>
<tr>
<td>• Students design web based or multimedia presentations to showcase research</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1.40</td>
<td>1.871</td>
<td>25</td>
</tr>
<tr>
<td>Yes</td>
<td>2.71</td>
<td>2.230</td>
<td>35</td>
</tr>
<tr>
<td>• Students use peripherals to solve authentic problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1.32</td>
<td>1.520</td>
<td>25</td>
</tr>
<tr>
<td>Yes</td>
<td>2.77</td>
<td>2.591</td>
<td>35</td>
</tr>
<tr>
<td>• Students discover innovative ways to use computers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2.36</td>
<td>1.729</td>
<td>25</td>
</tr>
<tr>
<td>Yes</td>
<td>3.60</td>
<td>2.075</td>
<td>35</td>
</tr>
<tr>
<td>• Qualified to train others in the use of software application</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2.12</td>
<td>1.943</td>
<td>25</td>
</tr>
<tr>
<td>Yes</td>
<td>3.34</td>
<td>2.261</td>
<td>35</td>
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<tr>
<td>• Seldom have to call someone to figure out a computer problem</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>2.60</td>
<td>1.581</td>
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</tr>
<tr>
<td>Yes</td>
<td>3.49</td>
<td>1.634</td>
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Table 4 (continued)

<table>
<thead>
<tr>
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<th>InTech</th>
<th>M</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Easy to design student centered units that use computers</td>
<td>No</td>
<td>2.56</td>
<td>1.325</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>3.60</td>
<td>1.897</td>
<td>35</td>
</tr>
<tr>
<td>• Use student interests to solve authentic problems when planning computer related activities</td>
<td>No</td>
<td>3.48</td>
<td>1.939</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>4.54</td>
<td>1400</td>
<td>35</td>
</tr>
<tr>
<td>• Goal is for students to learn how to use multimedia</td>
<td>No</td>
<td>1.88</td>
<td>1.787</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>3.03</td>
<td>2.079</td>
<td>35</td>
</tr>
<tr>
<td>• Confidence to show others how to merge technology</td>
<td>No</td>
<td>2.52</td>
<td>1.759</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>3.91</td>
<td>1.805</td>
<td>35</td>
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<tr>
<td>• I have taken and passed online exams to become certified with a variety of tool-based applications</td>
<td>No</td>
<td>1.24</td>
<td>1.451</td>
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</tr>
<tr>
<td></td>
<td>Yes</td>
<td>3.06</td>
<td>2.485</td>
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</tr>
<tr>
<td>• Students questions dictate both the context and content of my instruction</td>
<td>No</td>
<td>4.00</td>
<td>1.936</td>
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</tr>
<tr>
<td></td>
<td>Yes</td>
<td>4.91</td>
<td>1.314</td>
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Multivariate Tests (b)

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<th>Hypothesis</th>
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<th>Partial Eta</th>
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</thead>
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<td>Value</td>
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<td>df</td>
</tr>
<tr>
<td>Intercept</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pillai's Trace</td>
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<td>26.508(a)</td>
<td>50.000</td>
</tr>
<tr>
<td>Wilks' Lambda</td>
<td>.007</td>
<td>26.508(a)</td>
<td>50.000</td>
</tr>
<tr>
<td>Hotelling's Trace</td>
<td>147.267</td>
<td>26,508(a)</td>
<td>50.000</td>
</tr>
<tr>
<td>Roy's Largest Root</td>
<td>147.267</td>
<td>2763.478(a)</td>
<td>50.000</td>
</tr>
<tr>
<td>InTech</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Pillai's Trace</td>
<td>.859</td>
<td>1.100(a)</td>
<td>50.000</td>
</tr>
<tr>
<td>Wilks' Lambda</td>
<td>.141</td>
<td>1.100(a)</td>
<td>50.000</td>
</tr>
<tr>
<td>Hotelling's Trace</td>
<td>6.113</td>
<td>1.100(a)</td>
<td>50.000</td>
</tr>
<tr>
<td>Roy's Largest Root</td>
<td>6.113</td>
<td>1.100(a)</td>
<td>50.000</td>
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</table>

a Exact statistic b. Design: Intercept + InTech
<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
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</thead>
<tbody>
<tr>
<td>• Designing instructional units that integrate HOTS is a challenge</td>
<td>26.298</td>
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<td>26.298</td>
<td>9.612</td>
<td>.003</td>
</tr>
<tr>
<td>• Students design web based or multimedia presentations to showcase research</td>
<td>25.190</td>
<td>1</td>
<td>25.190</td>
<td>5.772</td>
<td>.020</td>
</tr>
<tr>
<td>• Students use peripherals to solve authentic problems</td>
<td>30.722</td>
<td>1</td>
<td>30.722</td>
<td>6.283</td>
<td>.015</td>
</tr>
<tr>
<td>• Students discover innovative ways to use computers</td>
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<td>22.423</td>
<td>5.961</td>
<td>.018</td>
</tr>
<tr>
<td>• Qualified to train others in the use of software application</td>
<td>21.808</td>
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<td>21.808</td>
<td>4.782</td>
<td>.033</td>
</tr>
<tr>
<td>• Seldom have to call someone to figure out a compute problem</td>
<td>11.440</td>
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<td>11.440</td>
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<td>.040</td>
</tr>
<tr>
<td>• Easy to design student centered units that use computers</td>
<td>15.773</td>
<td>1</td>
<td>15.773</td>
<td>5.559</td>
<td>.022</td>
</tr>
<tr>
<td>• Use student interests to solve authentic problems when planning computer related activities</td>
<td>16.474</td>
<td>1</td>
<td>16.474</td>
<td>6.089</td>
<td>.017</td>
</tr>
<tr>
<td>• Goal is for students to learn how to use multimedia</td>
<td>19.239</td>
<td>1</td>
<td>19.239</td>
<td>4.990</td>
<td>.029</td>
</tr>
<tr>
<td>• Confidence to show others how to merge technology</td>
<td>28.350</td>
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<td>28.350</td>
<td>8.889</td>
<td>.004</td>
</tr>
<tr>
<td>• Students have immediate access to all forms of technology at any time during the day.</td>
<td>20.404</td>
<td>1</td>
<td>20.404</td>
<td>5.418</td>
<td>.023</td>
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<tr>
<td>• I have taken and passed online exams to become certified with a variety of tool-based applications</td>
<td>48.154</td>
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<td>48.154</td>
<td>10.724</td>
<td>.002</td>
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<td>• Students’ questions dictate both the context and content of my instruction</td>
<td>12.190</td>
<td>1</td>
<td>12.190</td>
<td>4.753</td>
<td>.033</td>
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CHAPTER VI
FINDINGS, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Findings

This study was designed to examine the perceptions of teachers regarding the role of principal leadership in the implementation of the school system’s instructional technology program (InTech), and to examine the extent to which principals in this particular school system impact the process of technology integration. Through the use of a Likert-scale survey, the Level of Technology Implementation survey (LoTi), the views of 60 teachers regarding their level of technology implementation in the classroom was described.

Descriptive statistics concerning teachers’ views were provided in response to research question one. Regarding research question two, the null hypothesis that variables would not predict current instructional practices was rejected. A multiple regression procedure revealed that consideration and grade level were statistically significant predictors of current instructional practices. The model indicated that the lower the consideration score and the lower the grade level reported, the higher the score obtained on the current instructional practices variable.

Concerning research question three, correlational statistics were performed to ascertain the extent to which a relationship was present between the state required InTech program and teachers’ use of technology. No statistically significant relationship was
yielded between the state-required InTech program and teachers' reported use of technology, as measured by the Loti framework. Thus, the null hypothesis for this research question was accepted.

Analysis of variance procedures were also conducted to determine whether differences were present in participants' responses as a function of experience and grade level. Teachers, whether InTech trained or not, did not differ in their responses to initiating structure or to consideration. Thus, the null hypotheses for these statistical analyses were accepted.

An analysis of specific LoTi items revealed the presence of statistically significant differences between InTech trained teachers and teachers not trained in InTech. Statistically significant differences were yielded on the following items: Designing instructional units that integrate HOTS is a challenge; students design web based or multimedia presentations to showcase research; students use peripherals to solve authentic problems; students discover innovative ways to use computers; qualified to train others in the use of software application; seldom have to call someone to figure out a computer problem; easy to design student centered units that use computers; use student interests to solve authentic problems when planning computer related activities; goal is for students to learn how to use multimedia; confidence to show others how to merge technology; students have immediate access to all forms of technology at any time during the day; I have taken and passed online exams to become certified with a variety of tool-based applications; and, student questions dictate both the context and content of my instruction. In each case InTech trained teachers responded more favorably to the
integration of technology into their instructional practices than did teachers who were not trained in InTech. For these items, the null hypotheses of no difference between InTech trained teachers and nonInTech trained teachers were rejected.

Conclusions and Implications

The findings from this study add to the current body of knowledge in several ways. Elementary principals’ leadership style was found to be related to implementation of technology in the classroom setting. In addition, teachers trained in the InTech model differed in their technology practices within the classroom setting.

Of concern among these findings is that teachers are not integrating technology into their instructional practices at a high level. That is, few teachers obtained high scores on the LoTi, indicating very proficient use of technology in their teaching practices. For technology to impact at a high level on students’ learning, teachers must demonstrate higher scores on the LoTi. Thus, even though this sample of teachers, specifically the InTech trained individuals, integrated technology into their teaching practices, its integration was not at high levels so that students could benefit optimally. Rather improvement, substantial improvement is needed in this area.

Recommendations

Differences were noted between InTech trained teachers and teachers not trained in InTech. The extent to which these differences may be attributed to the state-mandated training is unknown. That is, no pre-tests were given prior to InTech enrollment. Rather this sample of educators who were InTech trained was obtained after their training. Thus,
the question remains, were the differences in technology integration the result of the state-mandated training, or were the differences present prior to InTech training? Teachers selected for InTech training may be those teachers who already possess a high level of expertise and/or interest in technology. Further research needs to be conducted in this area.

Few teachers reported that they were at a high level of technology integration in their instructional practices. This finding was present even for those teachers who had experienced the state-mandated technology training. Research needs to be conducted regarding reasons for this limited technology integration. Are barriers present that limit technology integration that can be readily addressed?

In this study, teachers’ views regarding technology integration into instructional practices were obtained. To what extent are these teachers’ views congruent with the views of their students? That is, do teachers and students agree on the extent of technology usage in the classroom? Further research needs to occur in the classroom setting in which observations of teacher and student behavior occur.

To truly harness the potential of computers to enhance student achievement, teachers and administrators alike need to link technology skills with pedagogical practices to improve the teaching and learning process. This study and a review of current research have shown that principal leadership is significant in implementing technology.

As school districts plan for technology use, they should consider the patterns of teacher use documented in the literature and supported in this study. Those who are
charged with the responsibility of planning for the implementation of technology in schools must not only consider the hardware and software demands of their schools, but the human factors as well. Therefore, districts must provide significant resources to develop and implement technology professional development plans that are adapted to their teachers' needs and the goal of facilitating technology integration.

Because technology continues to play an important role in modern industrial society, integrating technology into the schools will help prepare students to succeed in a rapidly changing world. Technology is transforming society, and schools do not have a choice as to whether they will incorporate technology but rather how well they use it to enhance learning (North Central Regional Educational Laboratory & Illinois State Board of Education, 1995). Technology integration is also important because it supports the goals of education reform. To ensure that technology is effectively integrated into the schools, educators must collaborate to create a formal technology plan. Developing a plan for using technology to support education reform means more than providing computers and software. To be successful, a technology plan must promote meaningful learning and collaboration, provide for the needed professional development and support, and respond to change.

Summary

In this study, 60 teachers provided information regarding elementary principals’ leadership style and teachers’ implementation of technology, related to the state required InTech program. Statistically significant differences were revealed in this study, with teachers trained in InTech responding more favorably to the integration of technology in
their instructional practices than teachers who had not been trained in InTech. Current instructional practices could be predicted by respondents' consideration score and grade level reported. Few teachers reported a high level of technology integration into their instructional practices. The findings from this study add to the current body of knowledge in several ways. Elementary principals' leadership style was found to be related to implementation of technology in the classroom setting. In addition, teachers trained in the InTech model differed in their technology practices within the classroom setting.
APPENDIX A

LoTi Questionnaire

Levels of Technology Implementation Questionnaire

Version 2.0

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Appendix A (continued)

**LoTi Questionnaire**

*Read each response and assign a score based on the following scale:*

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
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<tbody>
<tr>
<td>0</td>
<td>Not true of me now</td>
</tr>
<tr>
<td>1</td>
<td>Somewhat true of me now</td>
</tr>
<tr>
<td>2</td>
<td>Very true of me now</td>
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</table>

1 Score  
I assign daily or weekly computer-related tasks that involve students analyzing information, making predictions, and/or drawing inferences via the internet, computer databases, spreadsheet programs, and/or concept mapping applications (e.g., Inspiration).

2 Score  
I find computers to be a very effective and powerful tool to present information to students using presentation software such as PowerPoint or HyperStudio. This approach helps my students better understand the content that I teach.

3 Score  
Designing instructional units that integrate higher-order thinking skills with relevant student-based performance tasks using the available classroom computers is a challenge for me, yet, I still manage to make it happen.

4 Score  
Students in my classroom design either web-based or multimedia presentations to showcase their research (e.g., information gathering) on topics that I assign in class.

5 Score  
I have experienced past success with designing and implementing web-based projects with my students that emphasize complex thinking skill strategies such as problem-solving, scientific inquiry, or decision-making.

6 Score  
My students are involved in establishing individual goals within my classroom curriculum.

7 Score  
Using cutting-edge technology and computers, I have stretched the limit of instructional computing in my classroom and at my school.

8 Score  
I have experienced past success with project-based learning in my classroom that emphasizes higher-order thinking skills using the available computers.

9 Score  
I use computers primarily to support my classroom management tasks such as taking attendance, posting assignments to a web page, using a grade book program, and/or communicating with parents via email.

10 Score  
In my classroom, students use peripherals (e.g., digital video cameras, scanners, probes), web-based tools (e.g., online surveys, CGI scripts), and resources beyond the school building (e.g., partnerships with businesses, interest groups, other schools) to solve authentic problems of interest and importance to them.

11 Score  
In my classroom, I find the computers (either Windows or Macintosh) to be very effective with improving my students’ basic math and literacy skills.

12 Score  
Technical problems with our network and/or the computer hardware has really prevented me from using our classroom computers.

13 Score  
I am proficient with basic software applications such as word processing tools, internet browsers, spreadsheet programs, and multimedia applications.

14 Score  
My students discover innovative ways to use the endless array of classroom computer(s) to make a difference in their lives and in their community.

15 Score  
I can troubleshoot hardware problems with computers (e.g., printers, peripherals) and/or various software problems (e.g., translations, compression/decompression, cross-platform issues, system management).

16 Score  
Locating good software programs, web sites, and/or CD’s to supplement my curriculum and reinforce basic skills is a major challenge of mine.

17 Score  
Getting more comfortable with using computers in my classroom is my goal for this school year.

18 Score  
I am qualified to train others in the use of a variety of software applications (e.g., Excel, Inspiration, PowerPoint), the internet (e.g., web browsers, web page construction and design), and peripherals (e.g., scanners, digital video cameras, probes).

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Appendix A (continued)

**LoTı Questionnaire**

*Read each response and assign a score based on the following scale:*

<table>
<thead>
<tr>
<th>Score</th>
<th>Not true of me now</th>
<th>Somewhat true of me now</th>
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19 Score ________

The older computers in my classroom really do not fit into my curriculum plans. Until I get a newer computer or software that works with the older computers, I see little use for these older machines.

20 Score ________

In addition to traditional assessments, I consistently provide alternative assessment opportunities that encourage students to "showcase" their content understanding in nontraditional ways.

21 Score ________

My students use the internet for (1) collaboration with others, (2) publishing, (3) communication, and (4) research to solve issues and problems of importance to them and to their community regardless of their grade level.

22 Score ________

Students in my classroom participate in online collaborative projects (not including email exchanges) with other schools to solve relevant problems of importance to them.

23 Score ________

Given my current work load, it is much easier and more practical for me to send my students to our school computer lab for instruction without me.

24 Score ________

I would prefer to use a curriculum management system that generates specific lesson plans appropriate to my grade level and aligns with district and state standards.

25 Score ________

Using the classroom computers is not a priority for me this school year.

26 Score ________

I seldom have to call someone (e.g., computer technician, system's manager) to figure out a problem with my computer; I have the confidence and expertise to "fix" it myself.

27 Score ________

I prefer using previously-developed, integrated curriculum units that emphasize complex thinking skills, computer use, and student relevancy to the real world.

28 Score ________

My students' authentic problem-solving is supported by continuous access to a vast array of state-of-the-art computer-based tools and technology.

29 Score ________

I seek professional development, software applications, and peripherals that take full advantage of the endless array of computers and technology available to my students.

30 Score ________

I prefer to use existing curriculum units with the classroom computers that emphasize students solving "real" problems or issues of importance to them rather than building my own units from scratch.

31 Score ________

I have an immediate need and interest in contacting other teachers, "qualified" consultants, and/or related professionals who could assist me in my ongoing effort to design student-based performance tasks using computers that involve students making a difference in their school/community.

32 Score ________

Having students apply what they have learned in my classroom to improve their quality of life (e.g., at home, at school, in the community) is a cornerstone to my approach to instruction and assessment.

33 Score ________

I alter my instructional use of the classroom computer(s) based upon (1) the newest software and web-based innovations and (2) the most current research on teaching and learning.

34 Score ________

It is quite easy for me to design student-centered, integrated curriculum units that use the classroom computer(s) in a seamless fashion on my own.

35 Score ________

I use my students' interests, experiences, and desire to solve authentic and relevant problems when planning a variety of computer-related activities in my classroom.

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Appendix A (continued)

**LoTi Questionnaire**

*Read each response and assign a score based on the following scale:*

<table>
<thead>
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<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
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</tbody>
</table>

36 Score ________
Students taking meaningful action at school or in the community relating to the content learned in class is a vital part of my approach to using the classroom computer(s).

37 Score ________
I have an immediate need for more professional development that places greater emphasis on using the classroom computer(s) with relevant and challenging learning experiences rather than how to use specific software applications to support my current lesson plans.

38 Score ________
An important goal of mine is for students to learn how to create their own web page or multimedia presentation that shows what they have been learning in class.

39 Score ________
The types of professional development offered through our school, district, and/or professional organizations does not satisfy my need for more engaging and relevant experiences for my students that take full advantage of both my "technology" expertise and personal interest in developing learner-based curriculum units.

40 Score ________
My students often use the internet for research purposes that require them to take a position, role play an issue, make decisions, and/or seek out a solution.

41 Score ________
My instructional delivery approach enables students to always see and appreciate the relevancy of what I am teaching to their daily lives.

42 Score ________
The curriculum demands at our school such as implementing standards and increasing student test scores has really diverted my attention away from using computers in my classroom.

43 Score ________
I have the background and confidence to show others how to use technology with relevant and challenging learning experiences that emphasize higher-order thinking skills and student relevancy to the real world.

44 Score ________
Though I currently use integrated, thematic units, it is still difficult for me to design these units to take advantage of the limited (one or two) computers in the classroom.

45 Score ________
My immediate professional development priority is to learn more ways to use limited (one or two) computers to address student outcomes.

46 Score ________
It is easy for me to evaluate software applications, peripherals, and network configurations to determine whether their use in the classroom will support and expand student's critical thinking and authentic problem solving skills.

47 Score ________
My students have immediate access to all forms of cutting-edge technology and computers at any time during the instructional day to pursue their authentic problem-solving surrounding an issue or problem of importance to them.

48 Score ________
Our school really does not provide adequate training for me to take full advantage of the computers in my classroom.

49 Score ________
I have taken and passed multiple online or classroom examinations to become certified with a variety of tool-based applications and network systems.

50 Score ________
Students' questions dictate both the context and content of my instruction.

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Appendix A (continued)

The Levels of Technology Implementation (LoTi) Framework

**Level 0 - Nonuse**
Technology-based tools (e.g., computers) are either (1) completely unavailable in the classroom, (2) not easily accessible by the classroom teacher, or (3) there is a lack of time to pursue electronic technology implementation. Existing technology is predominately text-based (e.g., ditto sheets, chalkboard, overhead projector).

**Level 1 - Awareness**
The use of technology-based tools is either (1) used almost exclusively by the classroom teacher for classroom and/or curriculum management tasks (e.g., taking attendance, using grade book programs, accessing email), (2) used to embellish or enhance teacher-directed lessons or lectures (e.g., multimedia presentations) and/or (3) is one step removed from the classroom teacher (e.g., integrated learning system labs, special computer lab pull-out programs, central word processing labs).

**Level 2 - Exploration**
Technology-based tools supplement the existing instructional program (e.g., tutorials, educational games, basic skill applications) or complement selected multimedia and/or web-based projects (e.g., internet-based research papers, informational multimedia presentations) at the knowledge/comprehension level. The electronic technology is employed either as extension activities, enrichment exercises, or technology-based tools and generally reinforces the content under investigation.

**Level 3 - Infusion**
Technology-based tools including spreadsheet and graphing packages; multimedia and desktop publishing applications; and the internet complement selected instructional events or multimedia/web-based projects at the analysis, synthesis, and evaluation levels. Though the learning activity may or may not be perceived as authentic by students, emphasis is placed on using a variety of thinking skills (e.g., problem-solving, decision-making, experimentation, scientific inquiry) to address the content under investigation.

**Level 4a - Integration (Mechanical)**
Technology-based tools are integrated in a mechanical manner that places heavy reliance on prepackaged materials, outside resources, and/or interventions that aid the teacher in the daily management of their operational curriculum. Technology is perceived as a tool to identify and solve authentic problems as perceived by the students relating to an overall theme/concept. Emphasis is placed on student action and/or on issues resolution that requires higher levels of cognitive processing and in-depth examination of the content.

**Level 4b - Integration (Routine)**
Technology-based tools are integrated in a routine manner whereby teachers can readily design and implement learning experiences (e.g., units of instruction) that empower students to identify and solve authentic problems relating to an overall theme/concept using the school's available technology with little or no outside assistance. Emphasis is placed on student action and/or on issues resolution that requires higher levels of student cognitive processing and in-depth examination of the content.

**Level 5 - Expansion**
Technology access is extended beyond the classroom. Teachers actively elicit technology applications and networking from outside sources to expand student experiences directed at problem-solving, issues resolution, and student activism. The complexity and sophistication of the technology-based tools used are now commensurate with (1) the diversity, inventiveness, and spontaneity of the teacher's experiential-based approach and (2) the students' level of complex thinking and in-depth understanding of the content at hand.

**Level 6 - Refinement**
Technology is perceived as a process, product, and/or tool for students to find solutions related to an identified "real-world" problem or issue of significance to them. Technology provides a seamless medium for information queries, problem-solving, and/or product development. The classroom content emerges based on the needs of the learner according to his/her interests, needs, and/or aspirations and is supported by unlimited access to the most current computer applications and infrastructure available.

4 - 2001 National LoTi Technology Use Profile: 09/20/2002
APPENDIX B

Leader Behavior Description Questionnaire

Name (or Position Title) of Leader Being Described

Name of Organization

On the following pages is a list of items that may be used to describe the behavior of your supervisor. Each item describes a specific kind of behavior, but does not ask you to judge whether the behavior is desirable or undesirable. This is not a test of ability. It simply asks you to describe as accurately as you can the behavior of your supervisor.

Note: the term "group" as employed in the following items refers to a department, division or other unit of organization which is supervised by the person being described

Note: the term "members" refers to all the people in the unit of the organization which is supervised by the person being described.

Directions: Read each item carefully.

- Think about how frequently the leader engages in the behavior described by the item.

- Decide whether s/he always, often, occasionally, seldom or never acts as described by the item.

- Draw a circle around one of the five letters following the item to show the answer you have selected

   A = Always

   B = Often

   C = Occasionally

   D = Seldom

   E = Never

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Appendix B (continued)

1. S/he does personal favors for group members
2. S/he makes her/his attitudes clear to the group.
3. S/he does little things to make it pleasant to be a member of the group.
4. S/he tries out his new ideas with the group.
5. S/he acts as the real leader of the group.
6. S/he is easy to understand.
7. S/he rules with an iron hand.
8. S/he finds time to listen to group members.
9. S/he criticizes poor work.
10. S/he gives advance notice of changes.
11. S/he speaks in a manner not to be questioned.
12. S/he keeps to her/himself.
13. S/he looks out for the personal welfare of individual group members.
14. S/he assigns group members to particular tasks.
15. S/he is the spokesman of the group.
16. S/he schedules the work to be done.
18. S/he refuses to explain her/his actions.
19. S/he keeps the group informed.
20. S/he acts without consulting the group.
21. S/he backs up the members in their actions.
22. S/he emphasizes the meeting of deadlines.
23. S/he treats all group members as her/his equals.
24. S/he encourages the use of uniform procedures.
25. S/he gets what s/he asks for from her/his supervisors.
26. S/he is willing to make changes.
27. S/she makes sure that her/his part in the organization is understood by group members.
Appendix B (continued)

28. S/he is friendly and approachable.

29. S/he asks that group members follow standard rules and regulations.

30. S/he fails to take necessary action.

31. S/he makes group members feel at ease when talking with them.

32. S/he lets group members know what is expected of them.

33. S/he speaks as the representative of the group.

34. S/he puts suggestions made by the group into action.

35. S/he sees to it that group members are working up to capacity.

36. S/he lets other people take away her/his leadership in the group.

37. S/he gets her/his superiors to act for the welfare of the group.

38. S/he gets group approval in important matters before going ahead.

39. S/he sees to it that the work of the group members is coordinated.

40. S/he keeps the group working together as a team.
APPENDIX C

Letter Granting Permission to Use the Leader Behavior Description Questionnaire

FISHER
COLLEGE OF BUSINESS
THE OHIO STATE UNIVERSITY
FISCAL OFFICE

May 2, 2003

Dear Aquanette Smith:

We grant you permission to use the Leader Behavior Description Questionnaire for your research. As indicated in the Statement of Policy, the forms should not be used for promotional activities or for producing income.

Please call if you have any questions or if there is any way I can be of assistance.

Sincerely,

Jessica Hart-Rector
Fiscal Associate
Max M. Fisher College of Business
100H Fisher Hall
2100 Neil Avenue
Columbus, OH 43210

Phone: (614) 292-5031
Fax: (614) 292-1651
REFERENCES


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