Principals' Perceptions of Strategies for Offsetting the Barriers to Technology Integration in Elementary Schools in New Jersey

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PRINCIPALS' PERCEPTIONS OF STRATEGIES FOR OFFSETTING THE BARRIERS TO TECHNOLOGY INTEGRATION IN ELEMENTARY SCHOOLS IN NEW JERSEY

BY

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ABSTRACT

Technology expenditures have consistently cost school districts in the United States billions of dollars a year; however, studies have shown that these costs have not resulted in technology integration in our schools. Principals and teachers have consistently stated that, while they are in favor of technology integration as a school goal, barriers to the integration of technology have blocked successful implementation.

This study focused on principals’ perceptions of possible strategies for addressing the barriers to the integration of technology in the elementary setting. The identified barriers to technology integration included: a lack of access to technology, a lack of professional development, and a lack of teacher time for mastery. This study added to the limited research on the principals’ perceptions to these barriers, not by examining the barriers, but rather the possible solutions for addressing these barriers. Data from a principal survey provided insight into the extent to which principals perceived the ability to implement these solutions as a function of their level of knowledge, their attitudinal predisposition, or their organizational capacity.

Results of the study found that principals were significantly less successful in implementing technology than they would like to be, according to their school goals. Results also indicated that there was a statistically significant relationship between a principal’s perceived capacity to implement access to technology within their organizational structure and actual access. Three additional statistically significant effects were found concerning the principal’s knowledge of time for mastery, a principal’s attitudinal predisposition towards providing time for mastery, and a
principal’s capacity to implement time for mastery within their organizational structure on their success in providing teachers time for mastery.

The research also focused on the relationships between the total perceived success in integrating technology in schools and the overall success in addressing each of the three major barriers identified by the research. Three statistically significant effects were found: the principals’ overall success in providing access to technology, their overall success in facilitating professional development, and that their overall success in providing time for mastery was positively associated with their total perceived success in integrating technology in the schools.
ACKNOWLEDGEMENTS

There are many special people that I must thank, for without each of their efforts, my goal of completing this dissertation would never have been realized.

First, I would like to thank Dr. Martin Finkelstein for his unwavering guidance and his immense patience as I waded through the process of this dissertation. He consistently motivated me to look at the problem from a new angle, and his help in refining the topic created a study which brings new research to the field of education. Dr. Finkelstein's command of the language in this study helped to refine this work, his attention to detail ensured that I was successful, and his quick responses ensured that I was able to meet my deadline. Thank you.

I would like to thank Dr. Joseph Stetar, as our discussions over the summer of 2008 helped me to realize that education is not a field which is limited to a particular school or a certain area of the United States, but rather that education is a worldwide experience.

I would like to thank Dr. Monica Browne for being first a state-assigned administration mentor and then, more importantly, a friend. You were always there to listen to my complaints or provide me with advice on a topic. You also informed me of a program at Seton Hall that just might be the right fit! You are truly a person to model a career after.

I would like to thank all of the members of the Executive Ed.D. program at Seton Hall University. I would especially like to thank Dr. James Caulfield, who took a chance on some guy who liked the New York Giants but had a St. Peter's education, and Dr.
Maureen Blue, who always greeted me with a smile, even though she knew I was going
to ask her for a favor.

I would like to thank all of my fellow members of Cohort XI for your friendship
and partnership over the course of our two years together. I could not imagine my
experience without all of you. I would especially like to thank my brother Dr.
Christopher Huss. We have come a long way from our days at Rutgers together, and our
lunches (that were all way too big) helped me to get through the grind of the summer.

I would like to thank the West Milford School District for providing me with
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Finally, my deepest gratitude, thanks, and love go to my beautiful family for
sharing me with Seton Hall throughout this process. To my wife, Erica, you are beautiful,
you are the smartest person I know, and I would not have finished without your support.
Thank you for motivating me, thank you for supporting me, and thank you for changing
my life. I love you and now we will no longer get mail that says Mr. and Dr. Wisniewski.
To my daughter, Abby, you have provided me with an understanding about the most
important matters in life. You have captivated my heart and your Daddy loves you more
than you will ever know. Thank you for understanding that sometimes Daddy had to use
the computer for more than painting the Grinch, but understand that nothing will ever be
more important than painting the Grinch yellow with you.
DEDICATION

This dissertation is dedicated to my parents, Thomas Charles Wisniewski and Joanne Siclari Wisniewski. Some people win the lottery in life; my good fortune was set at birth.

Mom, you are the reason I became a teacher a decade ago. You were always there to pick me up when I fell down, and you have celebrated my life’s journey with me every step of the way. Our friendship now as adults is more important to me than you know. I hope one day to be half the educator that you are, and I hope one day to be half the parent you are as well. Know that my success at Seton Hall is yours. I love you.

Dad, although you cannot be here with me in the physical form, know that you are with me in spirit. Our time together has helped to mold me into the man and, more importantly, the father I am today. Your untimely departure set me on the path to education and is a constant reminder to make everyday count. I know that heaven shines a little brighter today. Please know that there is not a day that passes without a thought of sitting next to you on the couch and watching the Yankees together.

To my parents, thank you for all that you have given me in life. I hope that today I was able to give back.
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CHAPTER I

INTRODUCTION AND OVERVIEW

Introduction

Under the right conditions - where teachers are personally comfortable and at least moderately skilled in using computers themselves, where the school's daily class schedule permits allocating time for students to use computers as part of class assignments, where enough equipment is available and convenient to permit computer activities to flow seamlessly alongside other learning tasks, and where teachers' personal philosophies support a student-centered, constructivist pedagogy that incorporates collaborative projects defined partly by student interest - computers are clearly becoming a valuable and well-functioning instructional tool. (Becker, 2000)

In schools across the United States of America, there is an overwhelming financial push for innovative classroom practices incorporating computer-based technology. In the United States, school districts spent a reported $7.87 billion on technology equipment during the 2003–2004 school year (Quality Education Data, 2004). These large expenditures have enabled 99% of public elementary schools, and 86% of elementary instructional rooms, to have access to the Internet (National Center for Education Statistics, 2005). However, a nationwide survey of demographically diverse schools found that despite the massive amounts of money spent on technology in K-12 schools, 14% of K-12 teachers still do not use technology for instructional purposes, and 45% of K-12 teachers use technology for less than 15 minutes each week (Norris, Sullivan, Poirot, & Solloway, 2003). Only 18% of teachers surveyed used computers for instructional purposes more than 45 minutes each week (Norris, 2003). Internet use was even further behind, with more than a quarter of the respondents not employing the Internet at all, and an additional two-thirds of the teachers surveyed utilizing the Internet for less than 15 minutes each week (Norris, 2003).
This relatively sparse implementation of computer technology belies strong teacher attitudinal support for use. In a national study of teachers, 96% stated that they were in favor of applying computers to improve the quality of education for their students (Latham, 1999). However, only 20% of public school teachers felt prepared to incorporate technology into the classroom, according to the United States Department of Education (Norman, 2000). In fact, studies have found that elementary teachers' primary use of computers is for administrative and preparatory tasks, and not for instructional activities with students (Becker, Ravitz, and Wong, 2000). This has led critics to state that computers are not being used as often, or as effectively, as they should be for instruction (Cuban, 2001).

Student achievement is also an important factor to consider when examining the importance of the implementation of technology in the elementary setting. Students at all academic and socioeconomic levels experienced improved academic achievement when instruction was supplemented with technology (Christmann, Badgett, & Lucking, 1997). Therefore, the combined effort of computer-assisted instruction with traditional instruction produces higher student achievement than traditional, non-technical, instruction alone. This is also supported by studies that have proven that students in a technology-rich environment scored higher in the evaluation of higher-order thinking skills problems than students who were not exposed to technology instruction (Hopson, Simms, and Knezek, 2002). Computer integration, accompanied by traditional instruction, produces higher academic achievement in a number of content areas (Hopson et al, 2002). Additionally, research shows that students who use computers during
instruction have greater retention rates than those who do not use computers in the learning process (Noeth & Volkopyv, 2004).

Numerous research studies have examined the problem of the lack of integration of technology in education. For example, O’Dwyer, Russell, and Bebell, (2004) stated that a lack of professional development, restrictive policies related to technology use, low levels of access, and a lack of administrative pressure, lead to a lower use of technology. Hew and Brush (2007) found that a total of 123 barriers were evident in their review of past empirical studies. They were able to classify these barriers into a manageable six-category set. The barriers they discovered included: resources, knowledge and skills, institutional factors, attitudes and beliefs, assessment, and subject culture (p. 227). Within each category they named a number of subsets, including issues such as: access to technology, lack of time, professional development, and teacher dislikes (Hew & Brush, 2007). Finally, a number of other studies found that variables, such as teacher attitudes, time constraints, and technological limitations are all barriers to the implementation of technology in the elementary setting. (Stram-Statham, 1999; Boyd, 1997; Zher, 1997)

These studies, as do a number of other studies (Norman, 2000; Owens 1999; National Center for Educational Statistics, 1999; Leggett and Persichitte, 1998; Becker, 2000; Franklin, Sexton, Lu, & Ma, 2007; Elrod, 2008; Pavey, 2008), primarily focus on what teachers perceive as the barriers to technology. Teachers act as the end users of technology, and therefore they are a vital instrument in the success or failure of the integration of technology. However, it is the school leader who works as the medium for a technology initiative, or who can provide effective direction and oversight (Byrom,
The support and encouragement needed to continue initiatives must often come from the school principal (Bernauer, 1996), who often facilitates prospering programs (McKinzie, 2002). However, while principals tend to be the decision-makers, influencers in the implementation of technology, and directors of instructional improvement (Fullan, 1998), the studies have continually focused on the teachers’ perceptions. This is counterintuitive, as the teachers tend to maintain the least amount of decision-making power in a district. Therefore, research is needed on the principals’ perceptions of, not only the barriers, but also the possible solutions to these barriers, as they have the relative ability to address these barriers and affect change. Edyburn (2002) supported this notion: “We need more research of all kinds on this important topic. The landscape of the qualitative literature in the area is targeted much more toward the experiences of teachers and students rather than administrators and other leaders” (p. 55). Todd (1999) also suggested that administrators may be a key factor in creating environments where technology is being implemented by students and teachers.

One study that focused on principals’ perspectives to the barriers of technology use in schools was Abrams and Russell’s 2004 study, *Principals’ Beliefs About Access, Use, Support, and Obstacles to Technology Use in School*. They distributed surveys across 22 Massachusetts school districts to document the effects that different district-level technology support structures have on teaching and learning. During the 2001–2002 school year, information about district technology programs, teacher and student use of technology in and out of the classroom, and factors that influence these uses was collected through site visits and surveys. In total, survey responses were obtained from 121 principals; 86 worked in elementary schools, while 18 served as administrators in
middle schools and 17 in high schools. Abrams and Russell also conducted corresponding interviews with district leaders, principals, and technology specialists. During the 2002–2003 school year, case studies and a study focusing on the relationship among student use of technology and academic performance were conducted. Among several specific questions addressed in *The Use, Support, and Effect of Instructional Technology* (USEIT) Study were the following:

- How and to what extent are principals, teachers, and students using technology in and out of the classroom?

- How much influence does district leadership, shared vision, provision of resources, and technical support have on the ways in which, and the extent to which, teachers use technology for instructional purposes?

- How do different approaches to professional development impact instructional uses of technology? (p. 3)

Their work reported on a number of different areas of technological influencers and barriers in schools. They found that the large majority of principals believed that the use of computers had a positive impact on student learning and was one of the most important goals for their schools to achieve. According to their study, as shown in Figure 1, 93.4% of all principals reported that relative to all the goals for the school, either “Heavy Emphasis” or “Some Emphasis” was placed on the integration of classroom technology (p. 56).
Figure 1: Emphasis on the Integration of Technology

Relative to all your goals for your school, how much emphasis do you place on the integration of classroom technology?

![Bar chart showing emphasis levels for technology integration]

<table>
<thead>
<tr>
<th>Emphasis Level</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy emphasis</td>
<td>41.7%</td>
</tr>
<tr>
<td>Some emphasis</td>
<td>51.7%</td>
</tr>
<tr>
<td>Little emphasis</td>
<td>6.7%</td>
</tr>
<tr>
<td>No emphasis</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

However, this is in contrast to the number of principals who reported that technology was currently being integrated into the instructional activities as much as was needed. In fact, only 40.5% of principals reported that they would "Agree" or "Strongly Agree" with the statement that they were currently integrating technology as much as necessary, while 42.2% of principals either "Disagreed" or "Strongly Disagreed" with that statement (p. 59). Figure 2 follows:
In an examination of the actual barriers that were blocking the implementation of technology, Abrams and Russell (2004) found that the greatest barriers to technology use included not having enough computers for the students in the school and a lack of computers in the classroom (Figure 3).
Abrams and Russell also found that professional development that prepared teachers how to use technology in the classroom, but did not provide sufficient time to practice what they had learned, was a major barrier to the implementation of technology, with 37.8% of the principals responding that this was a “Major Obstacle” and 42.9% stating that this was a “Minor Obstacle” (p. 6) (Figure 4).
Rate how much each of the following conditions provide an obstacle for making more effective use of technology in your school.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Major</th>
<th>Minor</th>
<th>Not an obstacle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional development prepares teachers to use technology in the classroom but does not offer time to practice</td>
<td>37.8%</td>
<td>42.0%</td>
<td>19.3%</td>
</tr>
<tr>
<td>Teachers have a hard time connecting with our school's technology specialist</td>
<td>20.0%</td>
<td>39.2%</td>
<td>40.8%</td>
</tr>
<tr>
<td>There is too much course material to cover to make room for technology</td>
<td>14.2%</td>
<td>56.7%</td>
<td>29.2%</td>
</tr>
<tr>
<td>Teachers lack input into technology decisions</td>
<td>13.3%</td>
<td>38.3%</td>
<td>48.3%</td>
</tr>
<tr>
<td>Teachers have no idea how the district wants computers to be used in the classroom</td>
<td>10.8%</td>
<td>39.3%</td>
<td>50.8%</td>
</tr>
<tr>
<td>The kinds of computers and software at school are different from the computers teachers use at home</td>
<td>5.0%</td>
<td>33.3%</td>
<td>61.7%</td>
</tr>
<tr>
<td>Lack of flexibility for teachers in deciding how to use computers in the classroom</td>
<td>3.4%</td>
<td>37.8%</td>
<td>58.8%</td>
</tr>
</tbody>
</table>

However, other areas of technological influencers such as: Internet speed, the degree of flexibility teachers had in deciding how to use computers in their classrooms, teacher awareness of the district’s technology vision, variability of students’ academic skills, and class size, did not preclude technology use, according to a majority of the responding principals. Teacher attitudes were also addressed in the examination of teachers’ perceptions to the amount of time spent on technology training, and the amount of training was not defined as a barrier to the implementation of technology. According to the principals, teachers supported the implementation of technology. A substantial majority (80%) indicated that teachers did not object to the amount of staff time that was associated with technology (p. 69) (Figure 5).
Abrams and Russell’s (2004) report concluded that barriers such as access to computers, professional development, and time for mastery were some of the most common and identifiable barriers to technology. However, while they focused on identifying the barriers, a tool for principals to employ in their practice must examine the possible solutions to these problems. An examination of the solutions to these barriers will provide principals and other district leaders with the data necessary to make recommendations for policy, practice, and future research. Therefore, the examination of the principals’ knowledge of solutions to the problems, attitudes towards these possible solutions, and ability to make these changes within their organizational structure, is necessary to provide school leaders with ways of removing the barriers, rather than simply identifying them.

Statement of the Problem

After careful consideration of numerous published articles and examining the research conducted on technology implementation, it is evident that there are still more questions than answers. Numerous studies have researched the types of barriers that block the implementation of technology in elementary schools; however, few have focused on solutions to these barriers. Also, it is not enough to simply research solutions
to these barriers, as it is equally important to discover if elementary principals are knowledgeable about these solutions, attitudinally supportive of these solutions, and able to implement these solutions within their current organizational structure. Examining these components will help to direct practice to best implement the possible solutions to barriers of technology. These are the components that will help to drive the research in this study, and has led to the main research question for this study: What are elementary school principals’ perceptions of possible solutions to the barriers of successful use of technology in an elementary setting?

**Purpose of the Study**

The purpose of this study is to identify principals’ perceptions of possible solutions to the barriers to the use of technology in the elementary setting. Due to the fact that there are many different factors that can contribute to the lack of technology use in the classroom, this study focused on potential solutions to three major barriers identified in the research (Hew and Brush, 2007; Abrams and Russell, 2004). The barriers are: access to technology, a lack of professional development, and a lack of time for mastery. The independent variable is the possible solutions to barriers of technology and the dependent variable is the current perceived success in the implementation of technology. A survey was conducted to determine to what degree principals are knowledgeable about these strategies, attitudinally predisposed to employing these strategies, and to what degree do elementary principals have the ability to implement these strategies within their current organizational structure.
Research Questions

There are a number of questions that will help to guide this study into the implementation of technology on the elementary level. All data will be evaluated and used to determine if the following null hypothesis for this study should be accepted or not accepted: There are no statistically significant differences found in elementary principals’ perceived success in offsetting the identified barriers to technology attributable to variation in their knowledge level, attitudinal favorability, or the self-assessments of their organizational capacity.

In addition to retaining the null hypothesis, the researcher's goal is to answer the following questions:

1) What degree of emphasis do elementary principals place on the integration of technology in the elementary setting, and how do they perceive their current level of success in providing access to technology, professional development, and time for teacher mastery?

2) To what degree is the perceived success in providing access to technology affected by their knowledge, by their attitudinal predisposition, or by their organizational capacity?

3) To what degree is the perceived success in facilitating effective professional development for technology integration affected by their knowledge, by their attitudinal predisposition, or by their organizational capacity?

4) To what degree is the perceived success in providing teachers time for mastery of technology affected by their knowledge, their attitudinal predisposition, or their organizational capacity?
5) To what degree is the principals' overall perceived success in integrating technology into their schools affected by their perceived success in facilitating solutions to the barriers to technology integration?

**Significance of the Study**

With the amount of money spent on improving technology, it is important that schools properly implement the technology to justify the cost. It is easy for a district to promote technology by simply counting the number of computers in the schools, and then displaying ratios of 3.8:1 in 2004 (Education Week, 2005). However, with studies showing that over half of all teachers use the technology less than 15 minutes a week, (Norris, et. al., 2003), the expenditures and the ratios all become irrelevant. The focus of this study was not to determine if technology is effective in increasing test scores or helping a student learn to read, but rather to focus on principals' perceptions of solutions that can address why teachers are not implementing resources which constitutes a $38 billion dollar expenditure nationwide over a ten-year period (Benton Foundation, 2002). The thrust of this study was to determine the perceptions of the school leaders, rather than focusing on the teachers. Principals have the authority to influence programs, determine and establish culture, and create change. The conclusions that emanate from this study will allow school districts to examine the perceived importance of possible solutions to the barriers of technology. The conclusions will also provide superintendents with feedback that will help to provide the proper organizational structure to allow principals to apply these solutions with the least amount of resistance.
Limitations of the Study

This study examined the principals’ perceptions of possible solutions to the barriers to successful use of technology in an elementary setting. This dissertation examined the principals’ perceptions to the relationships between the independent variables of total knowledge level, total attitudinal disposition, and total organizational capacity; and the dependent variables of identified barriers to technology (access to technology, professional development, and time for teacher mastery). This study is limited to these identified barriers to technology. This limitation could lead to different findings if conducted with additional or different barriers from the research; such as, teacher characteristics, the characteristics of the teaching materials, the requirement for computer expertise, difficulties with the equipment, class size, subject area, teacher expertise, a lack of administrative support, teachers’ age, teachers’ attitudes towards the technology, and principals’ attitudes towards technology. This study could have also examined the individual principal’s ability to create change within their school.

Examinations of principals’ perceptions were based on their responses to a survey completed in December of 2009. The questionnaires are based upon the respondents’ perceptions; that is, their “personal reality” (Kaufman, Guerra, & Platt, 2005). The survey would also benefit from revision. Rea and Parker (1992) pointed to the fact that no questionnaire can be regarded as ideal for soliciting all of the information necessary. The survey had questions in which principals wrote in responses because a proper answer was not provided. Also, there were some questions that were not answered by a limited number of respondents, and further study on the survey instrument may discover why this occurred.
This study also examined the relationships between the dependent variable of the total perceived success in integrating technology in schools and the independent variables of the overall success of addressing each of the three major barriers identified by the research. The survey instrument measured principals’ perceptions to the solutions; however, it did not measure actual implementation of solutions by teachers or students. The survey instrument measured principals’ perceptions to the overall success of their school; however, it did not measure actual success. This set of questioning could help in determining if the principals’ perceptions of success were the same. The study would have benefited from a standardized definition of overall success.

The research base was limited to elementary schools in New Jersey, and not the nation as a whole. This limitation could lead to different findings in other states, as their system of funding education and lack of tenure could lead to different findings. The research base was also limited to elementary principals rather than all principals. This limitation could lead to different findings if reproduced with high school principals.

**Definition of Terms**

*Principal:* Lead administrator in an elementary school as reported by the New Jersey Department of Education (2009).

*Perception:* The process whereby information about one’s environment, as received by the senses, is organized and interpreted so that it becomes meaningful.
Access: The ability for people to get to and use technology within their educational setting.

Technology: Computer- or computer-related devices that contribute to teaching and learning in school. This can encompass hardware such as: computers, SMARTboards, Palm Pilots, laptops, overhead projectors, and LCD projectors; software; and networking capabilities.

Time for Mastery: The time provided for staff members to master the proposed initiative. This time should be provided during the work day, as it should not be simply confined to a staff member’s free time. Time for mastery should also include opportunities for professionals to collaborate with their peers.

Professional Development: The skills and knowledge attained for both personal development and career advancement. Professional development may encompass a number of facilitated learning opportunities, ranging from college degrees to formal coursework, conferences and informal learning opportunities situated in practice.

Organization of the Study

Chapter I presented an introduction of the problem behind the study, a statement of the problem, a purpose of the study, research questions, significance of the study, limitations of the study, definitions of terms, and a description of the organization of the study. Chapter II provides a review of pertinent literature, which contains an overview,
an introduction to barriers to technology integration, first-order barriers to technology integration, second-order barriers to technology integration, organizational change, and the role of the principal. In Chapter III, the researcher describes the methodology of the study by providing an introduction, a rationale for the study, the subjects, a design overview, data sampling methods, data collection methods, data analysis methods, and a summary. Chapter IV provides the presentation with an introduction, a description of the sample, and a summary of the results. Chapter V presents the summary, conclusions, and recommendations through an introduction, overview of the study, the research design, summary of results, discussion and implications, and recommendations for future research.
CHAPTER II

REVIEW OF THE LITERATURE

Overview

This chapter will present an overview of the relevant literature. Current research will be provided with an emphasis on the most repeated perceived barriers to technology in the literature. Current research outlining possible strategies to each of the selected barriers will also be provided. The change process and the role of the principal will also be addressed in this chapter, as these are influences in the implementation of technology in education as well.

Introduction to Technology Integration Barriers

In order to better understand the barriers to the implementation of technology, it is important to classify these barriers, as a number of barriers have been recognized in the literature. Many researchers have employed the first- and second-order changes (Fullan & Stiegelbauer, 1991; Cuban, 1993; Brickner, 1995; Ertmer, 1999) to explain and categorize the technology obstacles and barriers to change. The first-order barriers to technology integration are described as being external to the teacher, with problems such as lack of access to computers and software, insufficient time to plan instruction, and a lack of professional development. Second-order barriers are, in contrast, intrinsic to teachers and include teachers’ attitudes about computers, their attitudes about the change process, and the principal’s role in the implementation of technology (Ertmer, 1999). Whetstone and Carr-Chellman (2001) found that the combinations of first- and second-order barriers led to a disparity between teachers’ expectations of technology use and
their actual use. This chapter will identify a number of the first- and second-order barriers described in the literature, as well as examining the principal's role in the implementation of technology and the process of organizational change.

**First-Order Barriers to Technology Integration**

There are a number of studies that focus on the first-order barriers to the implementation of technology. The Office of Technology Assessment (1995) found that integration barriers include the lack of time, limited access, and limited professional development. Leggett and Persichitte (1998) found that time, access, resources, expertise, and technical support were the barriers to implementation most often stated by educators. Fisher, Dwyer, and Yocam (1996) stated that support, limited resources, a lack of time, and access are major first-order barriers. In an executive summary conducted by the National Center for Educational Statistics (NCES, 2000), teachers in K-12 classrooms indicated that a lack of computers, professional development, time for mastery, and a lack of administrative support were major barriers to technology integration. In this section, the researcher will focus on three reoccurring first-order barriers to technology integration: professional development, access to technology, and time for mastery.

**Professional Development**

One consistent theme in the literature regarding the use of computers in schools is the need for teacher training (Boyd, 1997; Bialo & Solomon, 1997; Zehr, 1997), as a lack of professional development has been found to be a significant barrier to success (Mann, Shakeshaft, Becker, & Kottkamp, 1999). Although research findings have discovered
the potential positive impact of technology on student achievement (Page, 2002), it is unlikely that these results will be discovered if teachers are unable to utilize the available technology. Advocates for an increase in the amount of professional development state that “school districts appear to spend more money on technology tools than on equipping teachers with the techniques and skills needed to effectively use these skills” (Watts-Taffe, et al, 2003, p. 137). Computer technology cannot be effective in school districts that refuse to create knowledgeable staff.

While a lack of time and training are major obstacles (Guha, 2000; Cox et al, 1999), research suggests that there are weaknesses in the design and delivery of many courses. By focusing on basic computer skills, training fails to prepare teachers to integrate technology into the curriculum (Van Fossen, 1999; Wild, 1996). However, Snoeyink and Ertmer (2001) found that computer novices preferred to be taught basic skills before addressing pedagogical integration of technology. This illustrates the need for differentiated training, taking into account teachers’ varying levels of computer experience and learning styles (Veen, 1993).

Quite often, the cost of educating staff members is not considered when creating technology budgets; however, spending on technology has little effect if not backed by the training (Boyd, 1997). Market Data Retrieval (2005) produced a survey of districts which showed that the average percentage of a school district’s technology budget devoted to training is just 15 percent. Policy makers find it easier to point to the number of computers bought, rather than focusing the public’s attention on the amount of money spent on professional development (Zehr, 1997). In 2002, the No Child Left Behind initiative stressed the need for aggressive professional development. The initiative stated
that at least 25 percent of the technology funds must be spent on professional
development (Bailey, 2002), thus demonstrating the perceived importance of professional
development. Wahl (2000) suggested the 30/70 rule, where 30% of the technology
budget is spent on equipment and 70% is spent on the supportive “human infrastructure”.
When teachers perceived that professional development was inadequate, they were less
likely to use technology to deliver instruction and prepare for class (O’Dwyer et al, 2004).

The quality and the type of professional development are also keys to a teacher’s
ability to incorporate technology into the classroom. Research conducted by the National
Center for Educational Statistics (2005) found that teachers’ opportunities to learn about
technology for educational purposes during traditional professional development
activities are often lacking. Professional development is often short term, with a lack of
adequate follow-up and feedback from experts. The teachers are left to work in isolation,
with too few opportunities to learn in context and with colleagues (Fullan & Stiegelbauer,
1991). The professional development opportunities utilized by school districts are often
unsuccessful, as “too often, staff development is implemented outside of the school day,
in locations and contexts removed from the classroom” (Murphy, 2002, pg. 886). This
can lead to teachers’ regarding the professional development opportunities as mandatory
requirements rather than authentic opportunities for implementing technology into their
classrooms (Murphy, 2002).

Recently, a number of researchers (Sparks & Hirsh, 1999; Wood, 1999) have
encouraged job-embedded professional development as a model for successful
technology professional development. These researchers identified activities such as
study groups, action research, mentoring and coaching as job-embedded learning over an
extended period of time. Recently, the Arkansas Department of Education developed the Internet Delivered Education for Arkansas Schools' (IDEAS, 2009) program to offer research-based, technology-delivered professional development courses to improve academic and teaching knowledge and skills of certified personnel. They have defined job-embedded professional development as "learning that takes place during the course of one's work, where daily access to necessary materials, knowledge, and assistance are readily available" (IDEAS, 2009). They provide examples of successful job-embedded professional development, including:

1) *Study Groups* – A group of people interested in collegial study and action. These groups meet to study and support one another as they design curriculum and instruction innovations, integrate a school's practices and programs, study the latest research on teaching and learning, monitor the impact of new practices on student and adult learning, and analyze and target a school-wide need.

2) *Action Research* – A process of asking important questions and looking for answers from data in a methodical way. The questions are meaningful, as the educator wants to know the answers to the questions that are closely connected to real work. The researcher is not removed from what is being studied, but rather is a part of it.

3) *Peer Coaching* – A strategy that enables educators to consult with one another, discuss and share teaching practices that increase student learning, observe in another's classroom, promote collegiality, and support and help ensure quality teaching for all students.
4) **Professional Learning Community** – A type of study group that focuses in depth on a particular issue or problem over a period of time. These groups can be formed over an entire district, and are strengthened when other support staffs, such as administrators and school board members, choose to participate to increase communication.

The Bank Street College of Education's efforts to integrate technology into classroom practices found that the most effective model for assisting teachers in the integration process is a five-year professional development plan (Cummings, 1995). No matter what type of professional development is employed, improved student achievement resulting in desired changes being made in teachers’ classrooms practices will determine the success of the trainings (Corcoran, 2007).

Myers and Halpin’s study (2002) was based on the belief that many teachers were not opposed to the implementation of technology in their classrooms, but rather it was their perceived lack of knowledge that made them apprehensive to incorporate technology. Their constructivist study involved teachers’ integrating technology into their practice while being provided continuous support from technology coordinators and other technology-proficient staff members. The training involved a two-year training cycle which incorporated teacher mentors integrating the technology into their curriculum in both classroom and lab settings. One result of this training was that teachers reported a positive attitude toward computers, as well as reporting changes in their instructional practices (Myers and Halpin, 2002). A second result was that the teachers were able to use the technology to change the way they instructed the class, but they were also more apt to provide the students with direct instruction on how to use the technology as well.
Access to Technology

Technology cannot become a meaningful support for students' work if they have access to it for only a few minutes a week. Data from national surveys suggest that, although American schools have more computers than any other country, the level of access is still insufficient, as students report using computers an average of 40 minutes a week (Becker, 1994). Another study by Beggs (2000) found that 89 percent of the teachers reported that a lack of available technology was a barrier to their integration of it into their classrooms. A lack of equipment is the highest-rated barrier internationally (Pelgrum 2001), often cited even in well-resourced countries. One study (Guha 2000) found that teachers who used technology most were more likely to complain about a lack of equipment. Furthermore, perceptions of computers as difficult to use may be as much to do with lack of confidence as with the hardware or software itself (Snoeyink & Ertmer 2001).

Schools are faced with a limited budget for equipment and they must make choices about how to best use their funds. One option is for a school district to examine whether the computers should be located in a single computer lab, or if they should be distributed throughout the individual classrooms. In 1995, most computers were located in computer labs and not in classrooms, and consequently students spent very little time academically with computers (Office of Technology Assessment, 1995). A decade later, most school computers were still located in computer labs, and not in classrooms where they could become part of the learning experience (U.S. DOE, 2004d; Cuban, Kirkpatrick, & Peck, 2001). Additionally, schools were still struggling with computer access, with
only 51% of school districts reporting access to either two computers per classroom or access to a lab of 25 computers (U.S. DOE, 2004b).

The National School Boards Association (2001) provided guidelines and recommendations for schools and school leaders to follow in providing access to technology for students, as access goes beyond simply placing computers in classrooms. There are a host of other issues that must be addressed when looking to provide adequate access for computers. The NSA (2001) supports this concept, stating, “We need to recognize that it is one thing to use technology in isolated classrooms and quite another to make technology a potent force in transforming an entire school or an entire education system” (p. 70). The NSA’s recommendations for proper access include:

1) Improving the school’s network infrastructure to help move digital information from computer to computer via the Internet or the Intranet.

2) Improving the school’s hardware, and determining the equipment needed to manipulate the digital information.

3) Improving the school’s software to help determine the programs and configurations of the programs needed for students and staff.

4) Improving the school’s system administration to determine the people and training to support the equipment.

5) Improving the school’s system of user support. This includes training of staff, on-site training and support, tutorials, and helpdesk support.

6) Developing the curriculum to include technology into specific content standards. This will help support the specific information that will be delivered via technology.
7) Understanding organizational change. Schools must provide the organization with support to create and develop changes to best utilize new technologies.

A secondary challenge of providing adequate access to technology is the concern for ensuring that all students get equal access. Data from national surveys suggest that students from low-income homes and ethnic minorities are less likely to have computers in their homes (Becker, 1994), and approximately twice as many instructional rooms are connected to the Internet in low-poverty schools as opposed to high-poverty schools (Ridgeway, Peters, & Tracy, 2002). The lack of home access to computers and the Internet for students at high-poverty schools affected how teachers in these schools employed technology, with far fewer having students use the computer or the Internet to complete assignments outside the classroom (U.S. DOE, 2004b).

A number of studies found that the availability of technology was positively related to its use, both by students during class time and by teachers for preparation. O'Dwyer, Russell, and Bebell (2004) found that when teachers were directed to use technology, they were more likely to use it across all four areas examined by their study: in the delivery of instruction, with students during class time and for the creation of products, and in lesson preparation. However, they found that teachers were less likely to use technology if they had previously experienced problems integrating technology into the curriculum.

Research has shown that even with proper training and time for mastery, without proper access to the technology, teachers will fail to incorporate technology into the curriculum. Reiser's study (2002) indicated that one of the main factors influencing the teachers' use of technology integration is support and access to computers, regardless of
the effectiveness of the technology training provided. Reiser (2002) found that, where teachers were not provided access to the technology, their likelihood of using technology was hindered. However, when teachers were not constrained by a lack of computer access, they were more likely to implement the technology into the curriculum.

**Time for Mastery**

Another barrier to the implementation of classroom computer technology in the elementary setting is that, even when provided with quality technology training, teachers lack the necessary preparation time to practice and implement the new ideas and techniques they have learned (Zher, 1997, Guha 2000). Learning to operate computer hardware, software applications, developing management systems for student computer use, and redesigning lesson plans to make use of technology, takes a great deal of time. Teachers need time to explore, reflect, collaborate with peers, and engage in learning (Sandholtz, 2001). When combined with hardware and software problems, the task can become impossible for even the strongest supporter of technology. The Integrated Studies of Educational Technology (U.S. DOE, 2004b) asked teachers about a variety of potential barriers to their use of educational technology. The three areas that teachers most often indicated as being a moderate to great barrier all had to do with time limitations. These limitations included time to develop new activities that incorporate technology, limited time in the school schedule to conduct activities, and limited time to practice technology skills.

Vannatta and Fordham’s study (2004) found that technology training is important; however, teachers must be provided time to practice and acquire new technology skills.
They found that teachers who invest the time to acquire the skills may have a greater chance of using the technology in the classroom than those who are not provided the time to work with their newfound technology. Wetzel, Zambo, and Buss’ study (2000) supported this theory, as they found that teachers who are provided time to learn, practice, and reflect on their technology training were able to apply the technology with greater ease.

The challenge for school administrators is how to provide time for staff members to develop their skill within a fixed schedule as defined by a negotiated contract. Purnell and Hill (1992) identified six general solutions to creating time for staff development. These approaches are:

1) Promoting time outside of the classroom during the school day through the use of substitutes to free teachers to attend workshops, conferences, and to observe other classes.

2) Refocus the purpose of existing time commitments. For example, refocusing the use of faculty meetings for staff development.

3) Reschedule the school day to make adjustments for collaboration and additional time.

4) Provide favorable conditions, such as babysitting services and additional space to promote teachers’ volunteering their time.

5) Increase the amount of available time through the use of supplemental contracts and stipends for teachers who attend summer trainings and other extended participation beyond the usual hours.

6) Use technology to promote more efficient use of time.
In addition, Raywid (1993) provided additional ideas for administrators to provide teachers with additional time for mastery. He supported lengthening the school day by twenty minutes, four days per week, and using an early release on the fifth day to provide an extended period of time for professional development. Another suggestion he provided is to engage students in alternative activities, such as community service, one morning per week, which are supervised by parents or non-instructional staff to provide time for mastery.

One additional support to help teachers manage their time is the creation of a technology coordinator. Boyd (1997) recommended that districts hire a technology trainer who should have no other teaching duties so that the trainer would be available to meet needs as they arise. The Integrated Studies of Educational Technology (U.S. DOE, 2004b) found that nearly all teachers (97 percent) reported that support for education technology use in the areas of hardware, software, and networking were available to them, as well as help with integration of computer activities into instruction. However, only 50 percent of teachers reported that their needs for technical support in the integration of computer activities with curriculum were being met fairly or extremely well. Teachers most often indicated (38 percent) that a full-time, paid school technology coordinator was the individual primarily responsible for technology support. However, full-time, paid school technology coordinators were significantly less likely to be found in high-poverty schools (34 percent versus 52 percent for other schools). Fuller (2000) found that the relationship between the expert change agent and the extent to which members of the organization are implementing technology was positive, as this person could be expected
to conduct training for teachers, staff, and students, reducing the technical uncertainties and the capacities of applications.

**Second-Order Barriers to Technology Integration**

When researchers investigate barriers to technology integration, it is found that the second order barrier of teacher attitudes appear to take on an important role. Fabry and Higgs (1997) found that teachers' attitudes towards technology had a significant effect on teacher resistance to the integration of technology. Evidence also suggests that self-efficacy for computer use as a learning tool may be a considerable factor in determining technology integration (Albion, 1999). A teacher's access to technology, amount of quality professional development, and time for mastery may not automatically assume they will effectively implement technology into the classroom, as a teacher's attitude is often the main impediment to integration (Ertmer, Ottenbreit-Leftwich, & York, 2007).

**Teacher Attitudes**

Research strongly suggests that teachers' attitudes toward technology play a major role in the use of technology and integration of instructions (Albion, 2001; Liu, Maddux, & Johnson, 2004; Rosen & Weil, 1995; Van Braak, 2001). Many elementary school teachers resist the use of computers in their classroom instruction. Hannafin and Savenye (1993) listed some research-based possible explanations for teacher resistance to using computers. These reasons include: poorly designed software, doubt that computers improve learning outcomes, resentment of the computer as a competitor for student's
attention, unsupportive administrators, increased time and effort required of the teacher,
fear of losing control of "center stage," and fear of "looking stupid" in front of the class.
Hannafin and Savenye (1993) went on to state that the interactive nature of the computer,
and its capacity to enable student-centered exploration, requires a "fundamental shift" (p. 28) in the role of the teacher. The teacher can no longer be a distributor of information to passive learners.

Recently, there has been an interest in the study of the individual teacher's instructional beliefs and their influence on curriculum implementation. The low degree of success in many educational reforms has been seen as a major reason why teachers' instructional beliefs need to be considered (Fullan, 1993). A number of studies show that some current teachers' attitudes are not favorable to adopting technology. Some teachers are not convinced about the benefits of computers in education and supported very limited roles of technology in the classroom. Niederhauser and Stoddart (1994) surveyed 2170 school teachers and found two groups of teachers. The first group stated that computers "are tools that students use in collecting, analyzing, and presenting information" (p. 2), while the second group stated "that teaching machines can be used to present information, give immediate reinforcement, and track student progress" (p. 2).

This difference in opinion is magnified in the elementary setting where most teachers operate in a self-contained environment, which does not require collaboration. Therefore, the implementation of technology becomes even more dependent on the individual teacher's attitudes and comfort level. Mills and Ragan (1998) examined the instructional practices of 30 elementary teachers in their implementation of educational software in their classrooms. Their findings showed that there were substantial
differences in the way that teachers implemented the innovation. There were also
differences in the levels of use of the software, which were attributed to different beliefs
on the role of the software. Another study conducted by Medcalf-Davenport (1998)
found that there has been little change in teachers’ attitudes towards technology in
education. The study found that there is resistance and fear of the integration of
anything new into the classroom, and many teachers do not recognize the usefulness or
necessity of using technology for teaching and leaning.

The teachers’ self-efficacy plays a major role in the teachers’ attitudes and
barriers to technology integration (Albion, 2001). One example of the effect of self-
efficacy is evident in Ertmer’s (1999) study, which found that teachers with equal access
to computers had different levels of integration. Oliver and Shapiro (1993) found that a
teacher’s personal beliefs about computer capabilities influenced the use of computers,
and individuals with low self-efficacy relied on strategies that were successful in the past.
Teachers with a more positive attitude toward technology not only considered technology
to be beneficial to the academic process, but these teachers were more likely to use
computers in their teaching practice (van Braak, 2001). Ertmer, Addison, Lane, Ross,
and Woods (1999) also found that teachers with higher self-efficacy and a positive
attitude towards technology were able to overcome more mundane problems; such as,
hardware failure, network shutdowns, or other problems ubiquitous to technology users.
However, teachers with low self-efficacy and poor attitudes towards technology typically
used these issues as evidence that computers are a burden rather than a tool to improve
technology.
There is also evidence that teacher attitudes do not necessarily correlate with age and experience. There have been studies that have shown that some novice teachers are resistant to implementing technology into the curriculum, as their lack of teaching experience may be the source of concern (Owens, 1999). In contrast to the novice teachers’ lack of experience, it may be the veteran teachers’ confidence in their abilities and their mastery of the subject which may provide them with the confidence to explore the new technology. Within both groups, studies by Owens (1999) and Rovai and Childress (2002) found that the teachers’ concern came in three major forms: the fear of damaging the computer, feelings of incompetence, and risk of embarrassment. Teachers’ concerns in the use of technology is not limited to a particular grade level, as close to 30% of primary and secondary teachers reported unease with technology (Bradley and Russell, 1997).

**Organizational Change**

Inherent in any new program is the issue of facilitating change within an organization. Therefore, it is important to examine change, and change models provided by researchers to help provide a background on how to facilitate the change problem as it relates to the implementation of technology. It is impossible to create and facilitate change, if change itself is not fully examined. Throughout this discussion of change, three theoretical models of dealing with organizational change will be examined and applied to the implementation of technology in schools.

Michael Fullan (2001) highlighted the understanding of change in his book, *Leading in a Culture of Change*. He pointed to the five essential aspects of changes as
being: understanding moral purpose, understanding the change process, building strong relationships, knowledge creation, and coherence. He believes that if all leaders can understand these points, and lead with energy, enthusiasm, and hope, it will help the change process run smoothly. The importance of knowledge creation points to the fact that without proper knowledge of a solution, the solution will not be implemented.

Fullan argued that change is more than the outward mechanics of the process, and to truly understand the change process one must take into account the system and all stakeholders. Without considering those involved, lasting change will be impossible. Fullan also stated that leaders must resist the urge to focus on short-term results, but rather emphasize long-term results and the systemic improvements that will generate the lasting change. One final concept to understand is the implementation dip, which states that, with any change, there will be a period of recess as people are uncomfortable. However, if the leader can continue to motivate staff during this difficult time, they will be able to create greater results in the future.

James Bess and Jay Dee (2008) expanded on the idea of knowledge creation as a key to implementing change. They provided two theories which focus on the acquisition of knowledge and its influence on organizations. They stated that “from a systems theory perspective, organizational learning entails information acquisition, processing, and storage” (p. 666). They pointed to Huber’s (1991) four constructs of organizational learning:

1) Knowledge acquisition – the process by which knowledge is obtained.
2) Information distribution – the process by which information is shared, leading to enhanced knowledge.
3) Information interpretation – when information is accorded some meaning.

4) Organizational memory – the mechanisms by which information is retained in the organization for future use. (p. 666)

Their second theory, which deals with how knowledge is acquired, is the cognitive theory, which states that knowledge leads to behavioral changes, and without these changes in behavior, it cannot be classified as organizational learning. Bess and Dee argued that organizational learning is neither one nor the other, but rather a combination of the two, because “organizational learning is not restricted merely to the acquisition, processing, and storage of information; it also involves the creation of meaning and knowledge by inter operating prior actions and putting them in to an information context” (p. 667). This interpretation will lead to a change agent’s perception of the new knowledge.

John Kotter (1988) built on the concept of perception to the change by a leader. He promoted eight stages in successful change initiative, which begins with creating a sense of urgency and putting the right people in place to create change and ends with the development of a new culture to support the change. Kotter focused on the attitudinal predispositions of leaders to motivate change. Without this motivation and sense of urgency, it is difficult to create change. Like Fullan, Kotter also discussed the difficulties involved in promoting a new process when the change becomes difficult. It is vitally important for districts and administrators to understand this change process. Without a clear understanding of the steps involved throughout the change process and the possible pitfalls that may derail the change, an organization is poised to fail.
The understanding that school leaders must view change from a number of different perspectives is paramount if leaders expect positive outcomes and exceptional teaching practices. The first theoretical foundation for the examination of organizational change models, as they relate to these different perspectives, is Lee G. Bolman and Terrence E. Deal's *Reframing Organizations* (2003), as they combined the most significant theories into a system of frames which can be applied to the direct application of the administration of schools and other organizations. Once school leaders have reframed their organizational practices in schools and school districts, it is paramount, in terms of direct application to their administration of schools, that they are able to facilitate the necessary changes to make their schools successful.

Bolman and Deal (2003) described frames as "windows on the world of leadership and management" (p. 12) which help leaders to understand aspects of leading. Throughout their work, they identified four frames in which a situation can be examined, these are: the structural frame, the human resource frame, the political frame, and the symbolic frame (p. 13). They contended that an organizational leader must "reframe" (p. 19), or view the same problem from multiple perspectives, until one or more of the frames can be identified to help one understand the particular situation. Each of the four frames is representative of a particular way of thinking as it relates to a situation. For example, the structural frame examines the architecture of an organization as it channels decisions. It includes the design of units and subunits, the roles and rules of an organization and the goals, policies and vision of the organization. This frame is built upon the work of researchers such as Taylor, Moeller, Mintzberg, Weber, and Gulick and Urwick. The human resource frame looks to have a deep understanding of the people and
relationships that make up an organization. It examines the strengths and weaknesses, reasons and emotions, and desires and fears. Bolman and Deal (2003) built their human resource frame from around the work compiled by Maslow, McGregor, Herzberg, Argyris, Follet, and Mayo. The political frame describes the power struggles within an organization as they relate to the competing interests within an organization, the allocation of scarce resources, and the struggles for power. The political frame is driven by a number of social scientists such as French and Raven, Kanter, Pfeffer, and Kotter. Finally, the symbolic frame examines the culture of an organization. This frame includes rituals, ceremonies, and stories that exist within an organization. In the symbolic frame, the meaning of events is important, and the symbols of the culture provide purpose and passion. The symbolic frame is represented in the work of Schein, and DiMaggio and Powell. All of these frames must be examined as powerful on their own and coherent with one another (Bolman and Deal, 2003).

It is necessary to examine how some of these frames could affect the change process as it relates to the principal's organizational capacity to implement technology within a specific school or a school district. Bolman and Deal (2003) provided a number of assumptions that drive the structural frame, and these are influential in terms of organizational design. The first assumption is the understanding that all school employees must be bound to a common goal or shared mission, and the idea that this goal supercedes the importance of individual goals. The second assumption is that all members must have defined roles and responsibilities that are coordinated with this goal.

It terms of organizational structure, Max Weber's division of labor, as it relates to the hierarchy of bureaucracy, is a most influential model of school structure. He believed
that there should be a hierarchy of offices, rules governing performance, qualifications for selecting personnel, and employment as a primary occupation and as a long-term career. This is how successful school districts have succeeded in creating a working structure today. The hierarchy of offices provides structure to job descriptions and responsibilities, which creates specific roles for teachers, principals, and superintendents. This hierarchy also provides parents and members of the community a path to follow when they are looking to make changes or have answers provided. This structure, however, may be detrimental to a principal’s capacity to implement change, as the hierarchy of offices will limit the amount of individual power that principals have to implement technological change (Bolman and Deal, 2003).

Hoy and Miskel (2001) further developed this concept of the individual’s capacity to create change within an organization by identifying characteristics of an enabling hierarchy versus characteristics of a hindering hierarchy. They promoted the facilitation of problem solving, collaboration, flexibility and protection of participants, which all helps to promote trust in an organization. Successful administration of schools demands an understanding of the chain of command, task responsibilities, and the characteristics of an enabling hierarchy. Schools must employ a chain of command to ensure that the members with the proper authority and training are making the informed decisions.

In order to create change, principals must have the knowledge base (Fullan, 2001; Bess and Dee, 2008), attitudinal predisposition (Kotter, 1988), and organizational capacity for change (Bolman and Deal, 2003). However, within any organization, it is imperative for the leaders to understand how members of their organization will respond to change, and therefore develop an understanding of the characteristics of those people
who adopt and ultimately facilitate change within an organization. The first step is for
administrators to identify the key members of their community who are willing to tackle
change, and then it is equally important to identify the characteristics of change agents to
help improve hiring practices and to develop these characteristics within current members
of the staff.

One of the most influential and cited theories in the social sciences concerning the
rate of change within an organization is Everett Rogers’ *Diffusion of Innovations* (2003).
Rogers stated that the rate that any new innovation or idea is adopted by staff can be
categorized into five major categories: innovators, early adopters, early majority, late
majority, and laggards. Innovators, which constitute 2.5% of the staff population, would
be the first to adopt a new technological innovation, and they would do so without
pressure from authority (Rogers, 2003). Innovators serve as role models for other staff
members, and, therefore, it is imperative that leaders identify and support the innovators
in their buildings.

The second group, the early adopters, typically makes up 13.5% of the staff, and
they are willing to accept change readily, have a positive approach to this change, and are
willing to try out new ideas. In terms of technology, innovators and early adopters are
typically exposed to a higher level of mass media, and enjoy a higher level of education
and socioeconomic status which permits them to acquire the newest technology (Rogers,
2003). According to Rogers (2003), early adopters are sought out by their peers for their
opinions, and thus serve as role models. Once again, it is imperative that administrators
identify this group of staff members and utilize their positive approach to help facilitate
change within their school.
The third group, the early majority, will typically represent 34% of the staff. This group is willing to interact with their peers, but they are often unwilling to provide opinions or help to lead the group. This large percentage of the group will deliberate before adopting a new idea (Rogers, 2003). An equally large fourth group, the late majority (34%) is more skeptical about new innovations than the early majority group. Late majority staff members are willing to approve of an idea after their peers have had a high level of success; however, they are often unwilling to adopt a new technology until pressured by their peers and administration (Rogers, 2003). It is important for administrators to identify these members, as it is the role of the administrator to provide resources for the late majority to implement an innovation.

The final group to adopt a new innovation, the laggards, typically represents 16% of the total staff. This group isolate themselves from their peers and is usually not represented as peer leaders. Often, the laggards are characterized as being suspicious of innovations and their ability to adapt to new innovations can be a lengthy process, if at all successful. It is important for administrators to understand that, with every innovation, laggards will demand a great amount of energy and effort to help them move to accept the innovation.

When Rogers’ (2003) Diffusion of Innovations theory is graphed; the rate of adoption typically creates an “s-curve”, which demonstrates a cumulative percentage of adopters over time. Thus, the level of adoption is slow at first, more rapid as adoption increases, and then levels off until there are only a small number of staff members left to adopt the innovation (Rogers, 2003). It is important for an administrator to understand that an adopter’s ability to accept an innovation depends on the staff member’s awareness.
interest, evaluation, trial, and confirmation. It is also vital for the school leader to understand that staff can fall into different categories of adoption for different innovations, as the early adaptor for one innovation may become a late majority adaptor for another innovation. Therefore, it is the role of the school leader to identify staff members’ strengths and interests, and then provide support so they can become innovators and early adopter role models for their peers.

Prevalent theories of organizational change and diffusion rates of innovations have been examined in this section on change. However, it is equally important to understand and identify the characteristics of exemplary technology-using teachers, as this will enable the school administrator to identify possible innovators and early adopters to help facilitate institutional change employing the use of the structural or human resource frame.

In 2000, Margaret Riel and Hank Becker studied 4,000 U.S. teachers, with the help of The Center for Research on Information Technology and Organizations, to examine educational background, teaching philosophy, and instructional practices, both with and without technology, to help identify the characteristics of exemplary technology teaching practices. The teachers were categorized into four groups based on their levels of professional engagement with their peers. The top group, which exemplified the best teaching practices, the “Teacher Leaders”, placed a high value on learning new technologies and sharing their knowledge with their colleagues. The second group, the “Teacher Professionals”, were also engaged in learning beyond their own classroom, but were not willing to take a leadership role. The third group, the “Interactive Teachers”, was characterized by limited learning outside of their classroom and no teacher leading.
The final group, the “Private Practice Teachers”, reported no engagement in learning or
dialogue with colleagues unless mandated by administration (Riel & Becker, 2000).
Therefore, it is critical that school leaders identify and cultivate teachers who characterize
the “Teacher Leaders”, as it is these staff members who will help to facilitate change and
new programs within the school. Riel and Becker identified five characteristics of the
“Teacher Leaders”:

1) Have made, and continue to make, higher investments in their own education.
2) Promote knowledge construction rather than engage in direct instruction.
3) Develop instructional practices, both with and without technology, that are
   theoretically tied to their constructivist philosophy.
4) Use computer technology for teaching and learning.
5) Integrate computer technology into their classrooms in ways that support
   meaningful thinking and involve collaborative project work and sharing of
   ideas with their peers. (p. 1)
Riel and Becker (2000) also found that “Teacher Leaders” spent twice the amount
of time participating in professional development than “Private Practice Teachers”. Their
self-motivation and love of learning translated into good teaching practices, as they
maintained a strong commitment to their own learning. They also found that “Teacher
Leaders” were ten times more likely to be highly active computer users, as they could not
“possibly ignore one of the most powerful tools for constructivist learning, and so they
would naturally invest their time and energy in learning how to use them” (p. 34). In
stark contrast, only 4% of “Private Practice Teachers” were found to be highly active
computer users, as they were isolated physically and intellectually (Riel and Becker,
Riel and Becker (2000) stated that “it is the isolated teachers, a majority of the teachers in classrooms today, who are less likely to use the intellectual resource that is transforming teachers’ practices in the new century – the networked personal computer” (p. 33). Therefore, it is for these reasons that it is imperative that educational leaders support teachers with exemplary practices, such as those who mirror the characteristics of the “Teacher Leaders” to help facilitate change within their schools.

The Role of the Principal

This study breaks from the research, as the focus of the survey participants moves from the end-user of the teacher, to the manager of the school the building principal. Today’s principal has the daunting task of being able to stay abreast of current trends and technologies, while also being able to discover ways to implement these new initiatives in a manner that is non-threatening to students, parents, and staff. This balance requires the principal to have a wide range of skills and practices, since not only must principals develop an understanding of the technology, but they must also discover how to utilize this technology to create a vision for educational change (Fullan, 1998). Principals have the opportunities to determine roles and responsibilities for all staff members, and they can personally move form a managerial role to that of an instructional leader working collaboratively with all staff to solve issues surrounding technology (National School Boards Association, 2001).

Thomas Sergiovanni (1992) also examined characteristics of successful leaders in his book, *Moral Leadership: Getting to the Heart of School Improvement*. He argued that leadership must evolve past a forceful, top-down direction and move towards an
understanding that emotions, values, and connections with other people are powerful sources of motivation. In his book, he argued that leaders must create a sense of collegiality between staff and management, and that this management style can transform schools into communities where teachers are self-managers and professionalism is the norm. This understanding of human relations can change the culture of the building from a reward-based culture to a culture which bases its decisions on what is the right thing to do for students.

The National School Boards Association (2001) listed a number of key elements of successful administration for school leaders to consider as they implement new technologies. They state:

1) A well-articulated vision of change with a primary focus on engaged learning and empowered teaching.
2) Attention to professional development and user support.
3) Active participation in the change process by all stakeholders including learners, teachers, parents, administrators, and others from the community.
4) Technology plans that are open and leave room for growth.
5) Funding plans that clearly establish costs/benefits and are both reasonable and sustainable
6) A plan that addresses access.

These recommendations mirror many of the themes found in the literature as they address ideas such as access, professional development, support, and the necessity for facilitating the change process. This is also supported by Stanholtz's study (2001), which found that the level of support from administration helped to determine the level of
technology integration by classroom teachers. Mouza's (2003) study of professional
development to increase teachers' self-efficacy with technology found that the school
administrator's support was vital to successful technology integration. Ronnkvist, Dexter,
and Anderson (2000) found that administrators need to lend two types of technological
support to their staff: instructional and technical. The instructional support includes
training and advisement of pedagogical ideas, instructional strategies, and effective
teaching methods. Technical support involves providing access to hardware and software,
technology resources, professional development and personal technical support.

A principal's role goes beyond supporting teachers with technology,
understanding the newest technologies, and developing change in the educational
program, because a principal must also use technology and model technology use for
staff members. The Eiffel Project found that, after an eight week, two hour a day, staff
development program, teachers felt that principals should not only encourage technology
use, but model it as well (Mouza, 2003). Principals' attitudes towards technology have
an effect on teachers' attitudes towards technology as well (Coffland & Strickland, 2004).
The Milken Exchange on Education Technology (Solmon, 1999) found that
administrators need to be modeling effective technology to support teachers' learning and
administrative tasks. They found that this becomes a three-stage process, with the final
stage, the transformation stage, occurring when technology is used to change learning
practices. It is at this stage that the principal is so familiar with technology that he or she
is able to effectively evaluate a teacher's integration of technology.

The Collaborative for Technology Standards for School Administrators (TSSA,
2001) worked to develop a national consensus on what skills P-12 administrators should
possess to be able to optimize the use of technologies in schools. The TSSA Collaborative (2001) focused on “the role of leadership in enhancing learning and school operations through the use of technology” (p. 1). The TSSA created standards as indicators of the effective leadership and skills required for comprehensive and effective use of technology in schools. The standards are communicated as six standards statements, with a set of corresponding performance indicators for each standard. These standards act as guidelines that speak directly to the heart of the role of the principal.

They are:

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 and 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. (p. 5)

These standards provide a blueprint for educational leaders to follow as they try to navigate the waters of implementing technology into their schools. Administrators are now being challenged to develop an understanding of technologies that affect the educational process for teachers and students (Bailey, 2002). According to Todd (1999), the role of the principal is vital in the implementation of new technologies. He stated that “transformational leadership is defined as focusing on creating a culture of change and fostering the synergies and energies that will empower the school as a learning community and the individuals who are part of that community” (p. 2). It is clear from the literature that the principal must understand technology, use technology, understand how to implement technology, and do all of this with a clear understanding of the process of change within their schools.

**Summary**

Technology represents a billion dollar expenditure nationwide; however, studies have shown that the cost has not equated to technology implementation in schools. Barriers to technology include the first-order barriers of: a lack of access to technology, a lack of professional development, and a lack of time for mastery. Second-order barriers are more difficult to address, as these are the attitudes inherent in the end users of technology. Additionally, change within the school structure is difficult, as it involves the acquisition of knowledge, an attitudinal predisposition to implement the change, and
the organizational capacity to make this change within the school’s hierarchy. It is the role of the principal to make these changes within their structure, as the school leader has the ability to evaluate programs and implement change.

The gap in the research, and ultimately the reason for this study, is the principal’s perspective on these barriers to technology. All too often, the research focuses on the teacher, who as the end user of the product has the least amount of ability to create change within the organization. Therefore, it is the principals’ perspectives on the barriers which are most important, as they represent the agents of change. In order to create this change, however, it is imperative to incorporate the aspects of knowledge acquisition, attitudinal predispositions, and capacity to create change within their organizational structure.
CHAPTER III

METHODOLOGY

Introduction

This chapter describes the methods and procedures used in the study. This study investigated principals’ perceptions of possible strategies for addressing the barriers to the integration of technology in the elementary setting. Included in this section is detailed information about the setting for the study, the population from whom the data were collected, the instruments used, and the processes by which data were collected and analyzed. It is designed to add to the limited body of research in this area, and to provide principals and other district leaders with the data necessary to make recommendations for policy, practice, and future research.

The chapter is organized into the following subsections: Rationale for the Study, Subjects, Design Overview, Data Sampling Methods, Data Collection Methods, Data Analysis Methods, and Summary.

Rationale for the Study

The focus of this study was to describe and evaluate how principals perceive possible solutions to the identified first-order barriers described in Chapter II of this study: lack of professional development, access to technology, and time for mastery. Data from principals’ surveys provided insight into the extent to which principals’ perceived the ability to integrate technology as it relates to the level of knowledge, their attitudinal predisposition, or their organizational capacity. The study examined principals’ perceptions of these solutions, as well as their perception of their school’s current level of
technology integration. The scores used in this dissertation were obtained through the use of a survey created by the researcher.

Elementary schools provide an interesting and unique background, and are included as the focus of this study for a number of reasons. Elementary school quite often represents a student’s first exposure to an educational concept. It is in elementary schools where students are first exposed to the nine New Jersey Core Curriculum Content Standards of: Visual and Performing Arts, Comprehensive Health and Physical Education, Language Arts Literacy, Mathematics, Science, Social Studies, World Languages, Technological Literary, and Career Education and Consumer Life Skills (NJ DOE, 2009). The New Jersey Technological Literacy Standard 8.1 states that “All students will use computer applications to gather and organize information and to solve problems” (NJ DOE, 2009). The standard points to students obtaining basic computer skills by the end of fourth grade, such as: using an operating system, inputting text and data, producing a finished document using word processing software, producing a simple graph or spreadsheet, developing a multimedia presentation, creating files and folders, identifying and using web browsers to obtain information, and using computer applications to solve simple problems (NJ DOE, 2009). Therefore, developing a strong technology program which focuses on skills and student abilities is as important as developing a comprehensive language arts or mathematics program. If a student is not provided a strong educational foundation at the elementary level, his or her performance in middle and high school levels will suffer.

Additionally, the design of most elementary schools creates situations where professionals are separated from one another, as they are quite often able to close the
Subjects

The subjects of this study are general education elementary principals in New Jersey. The public school’s classification as an elementary school was determined by the
New Jersey Department of Education with school type code 12, and the principal of the school was identified by the New Jersey Department of Education (2009). The schools represented all of District Factor Groups as characterized by the State of New Jersey to account for socioeconomic differences, and the schools covered all 21 counties, in order to help account for geographical location.

**Design Overview**

The research was a single descriptive nonexperimental (Johnson, 2001) quantitative study (survey) to investigate the principal's perceptions to the researched barriers of the implementation to technology. A paper and pencil survey instrument, entitled *Principal Survey*, was assembled to gather information in several topic areas: the knowledge, attitudinal predisposition, and organizational capacity for the identified barriers to technology; as well as the descriptive information of the respondents and their perceived current levels of technology integration. The survey instrument is based on *The Use, Support, and Effect of Instructional Technology Study* (USEIT) of 2004 created by Abrams and Russell, which was borrowed with permission. The *Principal Survey* was comprised of 25 questions which were assembled to gather descriptive information. A total of 17 questions were borrowed from the *USEIT* survey instrument, and 8 original questions were designed by the researcher. Permission was granted via email contact with Dr. Michael Russell, Chief Editor of *Journal of Technology, Learning, and Assessment*.

The *Principal Survey* was field tested on two separate occasions with two separate groups of principals over the course of two weeks in October of 2009 to determine the
validity of the survey instrument. The principals were interviewed by the researcher after their participation in the field test to help modify the questionnaire and insure that all questions were interpreted properly. Some principals commented on the vagueness of the questions, the lack of choices in the answers, and the length of the survey. As a result of these pilot studies, the length of the survey was cut from seven pages to four, and a number of questions were provided with additional answer choices.

Once the volunteer principal respondents returned the surveys to the researcher, a Cronbach’s Alpha test was conducted to determine a reliability coefficient. This will be reported in detail in Chapter IV.

The intent of this research is to provide an analysis of principals’ perceptions to researched solutions to overcome barriers presented in the implementation of technology in elementary schools in New Jersey. The results will evaluate the principals’ knowledge, attitudinal predisposition, and organizational capacity to implement the proposed solutions. The results will provide additional data for researchers to evaluate how these independent variables affect the implementation of technology and lead to suggestions and sound reasoning for conducting a controlled experiment.

**Data Sampling Methods**

The researcher identified general education elementary principals in New Jersey. The school’s classification as an elementary school was determined by the New Jersey Department of Education with school type code 12. The study took place in New Jersey, where there are approximately 1530 elementary schools (New Jersey Department of Education, 2009). In selecting the sample size, Gay (1996) suggests the following:
For small populations (N<100), there is little point in sampling. The entire population should be surveyed.

If the population is about 500, 50% of the population should be sampled.

If the population size is around 1,500, 20% should be sampled.

Beyond a certain point (N=5,000 or more), the population size is almost irrelevant, and a sample size of about 400 will be adequate. (p.125)

The researcher obtained a listing of all elementary schools from the New Jersey Department of Education, and sorted this group alphabetically, first by county and then by district. Using a systematic sampling method of every other principal, 765 elementary school principals were identified for the sample. The researcher contacted each principal in writing requesting their participation in the survey. Included in this letter was information concerning the background of the researcher, the purpose and procedure used in the research, a statement of confidentiality, a survey, and directions on how to return the survey.

Data Collection Methods

Data for this study was collected through surveys returned by elementary principals across New Jersey. Participation in the written survey was completely voluntary. The paper-and-pencil survey, entitled Principal Survey, was a modified version of the USEIT Questionnaire that was developed as a data collection instrument in 2004 by Abrams and Russell. No names or personal identification information was reported or shared in any way, as the written survey was anonymous. To maintain anonymity and confidentiality, those who participated in the written survey did not need
to return a signed informed consent form. The 765 participants received a letter mailed to their school asking them to voluntarily participate in the study. The surveys were mailed to the principals on December 8, 2009, and the participants were asked to return the survey by December 31, 2009. A second mailing was sent as a reminder to the participants two weeks after the initial mailing to ensure as many participants as possible. The researcher allowed an additional two weeks for any late mailings before beginning any statistical processes. The participants had no contact with the researcher and they were not be pressured in any way by their individual school districts. The survey did not ask for the participant's name; however, it did ask for their gender, year of birth, the grade levels included in their school, and the District Factor Group (DFG) of their school. Included with the letter was the questionnaire, with directions on how to complete it and a stamped, self-addressed envelope with the researcher's address. Consent to participate was indicated by returning the written survey, via the United States Post Office, in the self-addressed envelope.

Data Analysis Methods

The study was a nonexperimental research study with a cross-sectional explanatory design (Johnson 2001). Therefore, the principals whose data were being compared were not manipulated or affected in any way by the study. Upon receipt of the completed surveys, the data analysis was performed using a variety of statistical procedures through the Statistical Package for the Social Sciences (SPSS Advanced Statistics).
The data was obtained from the principals’ responses to the survey questions, and this information was disaggregated into groups to address each research question individually:

1) **What degree of emphasis do elementary principals place on the integration of technology in the elementary setting, and how do they perceive their current level of success in providing access to technology, professional development, and time for teacher mastery?**

2) To what degree is the perceived success in providing access to technology affected by their knowledge, by their attitudinal predisposition, or by their organizational capacity?

3) To what degree is the perceived success in facilitating effective professional development for technology integration affected by their knowledge, by their attitudinal predisposition, or by their organizational capacity?

4) To what degree is the perceived success in providing teachers with time for mastery of technology affected by their knowledge, by their attitudinal predisposition, or by their organizational capacity?

5) To what degree is the principals’ overall perceived success in integrating technology into their schools affected by their perceived success in facilitating solutions to the barriers to technology integration?

All data was evaluated and used to determine if the following null hypothesis for this study should be accepted or not accepted: There are no statistically significant differences found in elementary principals’ perceived success in offsetting the identified
barriers to technology attributable to variation in their knowledge level, attitudinal favorability, or the self-assessments of their organizational capacity.

To answer Research Question 1, description of the sample, descriptive statistics, and Chi-square analysis were used to examine the degree of emphasis elementary principals place on the integration of technology in the elementary setting, and how they perceive their current level of success in providing access to technology, professional development, and time for mastery.

To answer research questions 2-4, Chi-square statistical analyses were used to determine if any relationships exists between the independent variables of total knowledge level, total attitudinal disposition, and total organizational capacity, and the dependent variables of identified barriers to technology. In order to create a single indicator of knowledge, a single indicator of attitudinal predisposition, and a single indicator of perceived organizational capacity, the aspects of each of the three independent variable clusters were summed to create an additive scale. Chronbach's Alpha coefficient was computed to test the additivity of each of the three potential scales to measure internal consistency for all three domains. A similar exercise tested the scalability of each of the dependent variables across their various dimensions. The newly transformed independent and dependent variables were dichotomized at the median prior to undertaking the Chi-square analysis to minimize the likelihood of the number of cells with 0 or N<10.

To answer research question 5, Chi-square statistical analyses were used to determine if any relationship exists between the dependent variable of the total perceived success in integrating technology in the schools and the independent variables of the
overall success of addressing each of the three major barriers identified by the research.

In order to create a single indicator of providing access to technology, facilitating professional development, and providing time for mastery of technology, the aspects of each of the three independent variable clusters were summed to create an additive scale. Chronbach’s Alpha coefficient was computed to test the additivity to measure internal consistency for all three domains. The newly transformed independent variables, and the dependent variable of total perceived success in the integration of technology, were dichotomized at the median prior to undertaking the Chi-square analysis to minimize the likelihood of the number of cells with 0 or N<10.

Summary

In Chapter III, the researcher described the design and methods of the study by discussing the rationale for the study, the subjects, design overview, the data sampling methods, the data collection methods, and the data analysis methods. Chapter IV will present the collected data, along with an analysis of the data through the use of descriptions of the sample, descriptive statistics, frequency distributions, and Chi-square analysis. These analyses will determine which strategies for addressing the barriers to the integration of technology in the elementary setting have a statistically significant influence, as well as examining the principal’s current perceived success in the implementation of technology.
CHAPTER IV
PRESENTATION AND ANALYSIS OF DATA

Introduction

The purpose of this study is to identify principals’ perceptions of possible strategies for addressing the barriers to the integration of technology in the elementary setting. Because many different factors can contribute to the absence of technology use in the classroom, this study will focus on potential strategies to address three major barriers identified by the research (Hew and Brush, 2007; Abrams and Russell, 2004). They are: lack of access to technology, a lack of professional development, and a lack of teacher time for mastery. The dependent variables were the principals’ perceived current success in offsetting barriers to technology integration, and the independent variables were the perceptions of principals of potential strategies to offset the barriers.

The following null hypothesis was tested in this study: There are no statistically significant differences found in elementary principals’ perceived success in offsetting the identified barriers to technology attributable to variation in their knowledge level, attitudinal favorability, or the self-assessments of their organizational capacity.

In addition to testing the null hypothesis, the researcher’s goal is to answer the following research questions:

1) What degree of emphasis do elementary principals place on the integration of technology in the elementary setting, and how do they perceive their current level of success in providing access to technology, professional development, and time for teacher mastery?
2) To what degree is the perceived success in providing access to technology affected by their knowledge, by their attitudinal predisposition, or by their organizational capacity?

3) To what degree is the perceived success in facilitating effective professional development for technology integration affected by their knowledge, by their attitudinal predisposition, or by their organizational capacity?

4) To what degree is the perceived success in providing teachers time for mastery of technology affected by their knowledge, by their attitudinal predisposition, or by their organizational capacity?

5) To what degree is the principals' overall perceived success in integrating technology into their schools affected by their perceived success in facilitating solutions to the barriers to technology integration?

These research questions will be answered through the analysis of the data collected from surveys given to a sample of elementary school principals. This chapter first presents a description of the sample, and, later, a summary analysis of the data addressing each of the research questions.

Description of the Sample

Of the 765 surveys sent to principals of elementary schools throughout New Jersey, 228 (29.8%) responded; and of this total, 50.0% were males, 49.6% were females, and 1 (0.4%) principal did not respond to the question. This compares favorably to the actual gender breakdown of elementary school principals in New Jersey, as 44% are male and 56% are female, presented in Table 1. A Chi-square test was performed to determine
whether the respondents in this study differed in a statistically significant way from the
population of New Jersey Elementary Principals with respect to gender. Results of the
Chi-square test indicates that there is no significant difference between the respondents in
this study and the total population, as gender had a Chi-square value of 2.000, df = 1, and
p value of ≤ .175.

Table 1

*Gender of Responding Principals*

<table>
<thead>
<tr>
<th>Gender</th>
<th>RESPONDENTS</th>
<th>NEW JERSEY POPULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Percent</td>
</tr>
<tr>
<td>Female</td>
<td>113</td>
<td>49.6</td>
</tr>
<tr>
<td>Male</td>
<td>114</td>
<td>50.0</td>
</tr>
<tr>
<td>No Answer</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>All</td>
<td>228</td>
<td>100.0</td>
</tr>
</tbody>
</table>

As shown in Table 2, the majority of principals reported that they were born
between 1950 and 1959 (35.1%). Roughly a quarter (25.9%) indicated that they were
born between 1960 and 1969, while 19.7% indicated that they were born between 1970
and 1979. The smallest percentage (17.5%) reported that they were born between 1940
and 1949, and 4 principals (1.7%) did not respond to the question.
Table 2

*Age of Responding Principals*

<table>
<thead>
<tr>
<th>Year of Birth</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970 – 1979</td>
<td>45</td>
<td>19.7</td>
</tr>
<tr>
<td>1960 – 1969</td>
<td>59</td>
<td>25.9</td>
</tr>
<tr>
<td>1950 – 1959</td>
<td>80</td>
<td>35.1</td>
</tr>
<tr>
<td>1940 – 1949</td>
<td>40</td>
<td>17.5</td>
</tr>
<tr>
<td>No Answer</td>
<td>4</td>
<td>1.7</td>
</tr>
<tr>
<td>All</td>
<td>228</td>
<td>99.9</td>
</tr>
</tbody>
</table>

As shown in Table 3, with regard to the District Factor Group (DFG) of the responding principals, 17 (7.5%) of the principals reported working in a school with a DFG ranking of A, 15 (6.6%) of the principals reported a DFG ranking of B, 30 (13.2%) of the principals reported a DFG ranking of CD, 25 (11.0%) of the principals reported a DFG ranking of DE, 42 (18.4%) of the principals reported a DFG ranking of FG, 23 (10.1%) of the principals reported a DFG ranking of GH, 46 (20.2%) of the principals reported a DFG ranking of I, 15 (6.6%) of the principals reported a DFG ranking of J, and 14 (6.1%) principals did not report a DFG ranking in the survey results. This compares favorably to the distribution of District Factor Groups reported by the New Jersey Department of Education (2009), as the NJ DOE reports 35 (6.1%) of the school districts
in New Jersey with a DFG of A, 78 (13.7%) of the school districts in New Jersey with a DFG of B, 75 (13.2%) of the school districts in New Jersey with a DFG of CD, 100 (17.5%) of the school districts in New Jersey with a DFG of DE, 88 (15.4%) of the school districts in New Jersey with a DFG of FG, 75 (13.2%) of the school districts in New Jersey with a DFG of GH, 104 (18.2%) of the school districts in New Jersey with a DFG of I, and 15 (2.6%) of the school districts in New Jersey with a DFG of J.

A Chi-square test was performed to determine whether the respondents in this study differed in a statistically significant way from the population of New Jersey Elementary Principals with respect to District Factor Group (DFG). Results of the Chi-square test indicates that there are no significant differences between the respondents in this study and the total population, as DFG had a Chi-square value of 40.000, df = 36, and p value of ≤ .297.
Table 3

*School District Factor Group (DFG) of Responding Principals*

<table>
<thead>
<tr>
<th>DFG</th>
<th>RESPONDENTS</th>
<th>NEW JERSEY POPULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Percent</td>
</tr>
<tr>
<td>A</td>
<td>17</td>
<td>7.5</td>
</tr>
<tr>
<td>B</td>
<td>15</td>
<td>6.6</td>
</tr>
<tr>
<td>CD</td>
<td>30</td>
<td>13.2</td>
</tr>
<tr>
<td>DE</td>
<td>25</td>
<td>11.0</td>
</tr>
<tr>
<td>FG</td>
<td>42</td>
<td>18.4</td>
</tr>
<tr>
<td>GH</td>
<td>23</td>
<td>10.1</td>
</tr>
<tr>
<td>I</td>
<td>46</td>
<td>20.2</td>
</tr>
<tr>
<td>J</td>
<td>15</td>
<td>6.6</td>
</tr>
<tr>
<td>No Response</td>
<td>14</td>
<td>6.1</td>
</tr>
<tr>
<td>All</td>
<td>228</td>
<td>99.7</td>
</tr>
</tbody>
</table>

As shown in Table 4, the majority of principals reported that their school contained between 401–600 (43.9%) students. Just over a third of respondents (35.1%) indicated that their school contained 201–400 students, while 13.2% indicated that their school contained over 600 students. A small percentage (7.8%) reported that their school contained 200 or less students.
Table 4

*School Enrollment of Responding Principals*

<table>
<thead>
<tr>
<th>Number of Students</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 200 students</td>
<td>18</td>
<td>7.8</td>
</tr>
<tr>
<td>201 – 400 students</td>
<td>80</td>
<td>35.1</td>
</tr>
<tr>
<td>401 – 600 students</td>
<td>100</td>
<td>43.9</td>
</tr>
<tr>
<td>600+ students</td>
<td>30</td>
<td>13.2</td>
</tr>
<tr>
<td>All</td>
<td>228</td>
<td>100.0</td>
</tr>
</tbody>
</table>

As shown in Table 5, the majority of principals, 125 (55%), reported that they have been the principal at their current school for 0-5 years. Roughly a third, 66 (29%) indicated that they had been the principal of their school for 6-10 years, while 12% indicated that they had been the principal of their school for 11-15 years. A small percentage (4%) reported that they had been the principal of their school for more than 16 years.
Table 5

*Years as Principal of Current School of Responding Principals*

<table>
<thead>
<tr>
<th>Number of years</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 5 years</td>
<td>126</td>
<td>55.2</td>
</tr>
<tr>
<td>6 – 10 years</td>
<td>66</td>
<td>28.9</td>
</tr>
<tr>
<td>11 – 15 years</td>
<td>26</td>
<td>11.4</td>
</tr>
<tr>
<td>16+ years</td>
<td>10</td>
<td>4.3</td>
</tr>
<tr>
<td>All</td>
<td>228</td>
<td>99.8</td>
</tr>
</tbody>
</table>

In summary, 29.8% principals responded to the *Principal Survey* from December 8, 2009 through January 11, 2010. The principal respondents were, generally, by mode in schools that housed between 401 and 600 students, at their school for less than five years, and they were born between the years of 1950 and 1959. The principal respondents also resembled the larger population of elementary principals in New Jersey in terms of District Factor Group and gender, as neither of these response groups were found to be statistically significant from the total population in New Jersey. Therefore, it is reasonable to conclude that there is no obvious respondent bias and the sample is largely representative of the population.
Summary of Results

The Principal Survey, which was the instrument administered to the principals, contained 25 items that measured principals' perceptions of possible strategies for addressing the barriers to technology integration in the elementary setting. These items focused on the possible strategies to offset the barriers to technology integration described by the research, which included lack of access to technology, lack of professional development, and lack of time for mastery. The summary of results will present the statistical analysis performed for each research question presented in the study.

Findings for Research Question 1

The first research question examined the degree of emphasis elementary principals place on the integration of technology in the elementary setting, and how they perceive their current level of success in providing access to technology, professional development, and time for mastery. This research question provided the study with data on one of the dependent variables in the study, the principals' perceived success in offsetting the three basic barriers to technology integration. This research question also provided an understanding of the principals' perception of the importance of technology integration.

In order to assess the perceived importance of technology integration, Question 8 of the Principal Survey asked: Relative to all of your goals for your school, how much emphasis do you place on the integration of technology into classroom instruction?. The principals' responses to this question provides a description of the perceived importance of the implementation of technology. Over half of the group (52.2%) reported that they
place “Some Emphasis” on the integration of technology (top 5-10 goals), while another 43.9% indicated that they placed a “Heavy Emphasis” (top 3) goals on the integration of technology into classroom instruction. A small percentage (3.1%) reported that they placed “Little Emphasis” (not in top 10), and no principal reported that they placed “No Emphasis” on the integration of technology. Therefore, the results indicated that 96.1% of the principals reported that they place technology in their top ten goals for their school. Table 6 reports the degree to which principals perceive the importance of the integration of technology as it relates to all other school goals rated by principals.

Table 6 - School Goals

Relative to all of your goals for your school, how much emphasis do you place on the integration of technology into classroom instruction?

<table>
<thead>
<tr>
<th>Level of Emphasis</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy Emphasis (Top 3)</td>
<td>100</td>
<td>43.9</td>
</tr>
<tr>
<td>Some Emphasis (Top 5-10)</td>
<td>119</td>
<td>52.2</td>
</tr>
<tr>
<td>Little Emphasis (Not in Top 10)</td>
<td>7</td>
<td>3.1</td>
</tr>
<tr>
<td>No Emphasis</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>No Answer</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>All</td>
<td>228</td>
<td>100</td>
</tr>
</tbody>
</table>

In order to assess current levels of technology integration at the principals' schools, Question 7 of the Principal Survey asked: Within my school, we are currently
integrating technology into instructional activities as much as we need to. Seven percent of the respondents “Strongly Disagreed” with the statement that they were currently integrating technology as much as needed, while another 21.9% of the respondents “Disagreed” with the statement. Over thirty-eight percent (38.6%) of the respondents “Agreed” that they were currently integrating technology as much as it was needed, while another 21.9% of the respondents “Strongly Agreed”. The smallest group of the respondents (9.2%), “Neither Agreed nor Disagreed” with the statement and 1.3% did not answer the question. Therefore, the results indicated that 28.9% of the principals reported that they “Strongly Disagreed” or “Disagreed” with the statement that they were currently integrating technology as much as needed, while 60.5% reported that they either “Strongly Agreed” or “Agreed” with the statement. Table 7 reports the degree to which principals perceive their current level of technology integration into the instructional activities.
Table 7 – Perceived Current Level of Technology Integration

*Within my school, we are currently integrating technology into instructional activities as much as we need to:*

<table>
<thead>
<tr>
<th>Perception</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>16</td>
<td>7.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>50</td>
<td>21.9</td>
</tr>
<tr>
<td>Neither Agree or Disagree</td>
<td>21</td>
<td>9.2</td>
</tr>
<tr>
<td>Agree</td>
<td>88</td>
<td>38.6</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>50</td>
<td>21.9</td>
</tr>
<tr>
<td>No Answer</td>
<td>3</td>
<td>1.3</td>
</tr>
</tbody>
</table>

The results show that, while 96.1% of the principals reported that they placed technology in their top ten goals for their school, only 60.5% of the principals reported that they were effectively implementing technology at the current time. A Chi-square test was run to determine whether there was a significant difference between the identification of technology as a top ten goal and the current level of implementation. The variables were dichotomized at the median prior to undertaking the Chi-square analysis to minimize the likelihood of the number of cells with 0 or N<10. Results of the Chi-square test indicates that principals were significantly less successful than they
would like to be, as the identification of technology and the current level of implementation had a Chi-square value of 6.781, df = 1, and p value of ≤ .009.

In order to survey the principals’ perceived degree of success they have had in addressing the barriers of lack of access, professional development, and time for mastery, Question 10 of the Principal Survey asked: As of today, rate the degree of success you believe your school has achieved in implementing each of the following. The categories: Technical Professional Development (How to operate the technology) and Professional Development focused on integrating technology into the established curriculum, focused on the facilitation of professional development. The categories, Providing access to hardware, Providing access to software, Providing technical support (fixing the technology), and Providing network services, focused on providing access to the technology. The categories, Providing time for teachers to master the use of computers and Providing time for teachers to work to integrate technology into the curriculum, focused on providing time for mastery. The principals provided answers based on a four point scale: (1) “None”, (2) “Very Little”, (3) “Some”, and (4) “A lot”.

The results indicate that the frequency distribution scores for the four variables dealing with access to the technology have the four highest levels of success in the frequency distribution, with Providing access to the hardware having the greatest number of respondents with a “High Degree of Success” with 55.6% of the responses. The results also demonstrate that the two questions dealing with providing time for teacher mastery have the two lowest levels of success in the frequency distribution, with Providing time for teachers to work to integrate technology into the curriculum having the least number of respondents with a “High Degree of Success” with 19.3% of the
responses. The results demonstrate that the two questions dealing with professional development fall between access to technology and providing time for mastery. The results from Question 10 also acted as the dependent variables for the Chi-square tests for Research Questions 2-4, as the results for Question 10 represent the perceived level of success for each dependent variable. The results for Question 10 also acted as the independent variable for the Chi-square tests for Research Question 5, as the results were compared against the level of perceived success in technology integration overall. Table 8 ranks the results from Question 10.
Table 8 – Perceived Current Level of Strategies for Offsetting the Barriers to Technology Integration

*As of today, rate the degree of success you believe your school has achieved in implementing each of the following:*

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Percent of Low Degree</th>
<th>Percent of High Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing access to hardware</td>
<td>225</td>
<td>44.4</td>
<td>55.6</td>
</tr>
<tr>
<td>Providing network services</td>
<td>225</td>
<td>47.1</td>
<td>52.9</td>
</tr>
<tr>
<td>Providing access to software</td>
<td>225</td>
<td>55.1</td>
<td>44.9</td>
</tr>
<tr>
<td>Providing technical support (fixing the computers)</td>
<td>225</td>
<td>55.1</td>
<td>44.9</td>
</tr>
<tr>
<td>Technical Professional Development (How to operate the technology)</td>
<td>225</td>
<td>60.0</td>
<td>40.0</td>
</tr>
<tr>
<td>Professional Development integrating technology into the curriculum</td>
<td>224</td>
<td>75.4</td>
<td>24.6</td>
</tr>
<tr>
<td>Providing time for teachers to master the use of computers</td>
<td>225</td>
<td>77.8</td>
<td>22.2</td>
</tr>
<tr>
<td>Providing time for teachers to work to integrate technology into the curriculum</td>
<td>223</td>
<td>80.7</td>
<td>19.3</td>
</tr>
</tbody>
</table>
Findings for Research Question 2

The second research question examined to what degree the perceived success in providing access to technology was affected by the level of knowledge about technology access, by the principal's attitudinal predisposition towards technological access, or by the principal's organizational capacity to provide technology access. This question provided the study with an examination of the level of knowledge, attitudinal predisposition, or organizational capacity that principals have about possible facilitators of technological use associated with the effective implementation of access to technology. The results of this question will help to determine if the possible facilitators are not being implemented due to a lack of knowledge, a lack of attitudinal predisposition, or a lack of organizational skill.

In order to survey the principals' level of knowledge, attitudinal predisposition, and organizational capacity about the possible facilitators to access of technology, Question 20 surveyed principals' perceptions to the solutions on three levels: How knowledgeable are you about this strategy?, How much importance do you ascribe to this strategy?, and How capable do you feel to implement this strategy within your organizational structure?. The possible aspects of technology access included: Network infrastructure improvements, Additional hardware, Hardware improvements, Additional software, Software improvements, Additional helpdesk support, Additional staff to train and support staff/equipment, Rewriting the curriculum to support instruction in technology, and Hiring a technology coordinator. The principals provided answers based on a four point scale: (1) “Not at all”, (2) “Very Little”, (3) “Somewhat”, and (4) “A great deal”.

In order to create a single indicator of knowledge about technology access (on all 9 dimensions), and a single indicator of attitudinal predisposition and a single indicator of perceived organizational capacity, the aspects of each of the three independent variable clusters were summed to create an additive scale of total knowledge level, total attitudinal disposition, and total organizational capacity of various dimensions of access. Chronbach’s Alpha coefficient was computed to test the additivity of each of the three potential scales to measure internal consistency for all three domains. All three coefficient alphas were sufficient to assume additivity within each category, as the knowledge-based alpha was .888, the attitudinal predisposition was .855, and the organizational capacity was .897. A similar exercise was undertaken to test the scalability of the dependent variables across their various dimensions. The scalability analysis included the following individual items: Providing access to hardware, Providing access to software, Providing technical support (fixing the computers), and Providing network services to create a new overall category of total access to technology. Once again, the coefficient alpha was sufficient to assume scalability with an alpha of .772.

The newly transformed independent and dependent variables were dichotomized at the median prior to undertaking the Chi-square analysis to minimize the likelihood of the number of cells with 0 or N<10. Chi-square tests were run to determine whether there were significant differences between the knowledge level, the attitudinal predisposition, or the organizational capacity of possible facilitators to technology and the current perceived degree of success the principals have achieved in providing access to technology. Results of the Chi-square tests indicate that there are no statistically significant effects of the level of knowledge or attitudinal predisposition on the current
perceived degree of success that principals have achieved in providing access to technology. However, results of the Chi-square tests indicate that there are statistically significant effects of the level of organizational capacity and the current perceived degree of success that principals have achieved in providing access to technology with a Chi-square value of 16.439, a df value of 1, and p value of ≤ .000. These results indicate that there is a significant effect, based on a principal’s perceived capacity to implement access to technology within their organizational structure. The results of the Chi-square tests are presented in Table 9.

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Table 9 – Chi-square results for providing access to technology

*The Chi-square results for level of knowledge, attitudinal predisposition, or organizational capacity of the implementation of possible facilitators in technology and the current perceived degree of success that principals have achieved in providing access to technology.*

<table>
<thead>
<tr>
<th>Independent Variable of Access to Technology</th>
<th>Chi-square</th>
<th>df</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>3.590</td>
<td>1</td>
<td>.058</td>
</tr>
<tr>
<td>Attitudinal Predisposition</td>
<td>2.335</td>
<td>1</td>
<td>.126</td>
</tr>
<tr>
<td>Organizational Capacity</td>
<td>16.439</td>
<td>1</td>
<td>.000*</td>
</tr>
</tbody>
</table>

* p ≤ .05
The results of Question 17, *Does your school have a budget for technology expenditures in the following areas over which you have sole discretionary authority? (check all that apply)*, supports the statistically significant findings that principals felt unable to provide technology within their organizational structure, as less than half of all principals surveyed responded that they had the ability to make these technology purchases (49.6%). This may point to the fact that the current purchasing restraints of the building principals are not conducive to the implementation of technology.

The results of Question 16, *How Much flexibility do you have in determining the type and amount of technology purchased for your school?*, also supports the statistically significant findings that principals felt unable to provide technology within their organizational structure. Chi-square tests were run to determine whether there were significant differences between the amount of flexibility in determining the type and amount of technology purchased at the principal’s school and the current perceived degree of success the principals have achieved in providing access to technology. Results of the Chi-square tests indicate that there are statistically significant effects of the level of flexibility in purchasing and the degree of success the principals have achieved in providing access to technology with a Chi-square value of 8.929, a df value of 1, and p value of ≤ .003. These results indicate that there is a statistically significant effect based on the principals’ ability to purchase technology and the total perceived success in providing access to technology.
Findings for Research Question 3

The third research question examined to what degree the perceived success in facilitating effective professional development of technology is affected by the level of knowledge about professional development, by the principal's attitudinal predisposition towards professional development, or by the principal's organizational capacity to implement professional development. This question provided the study with an examination of the level of knowledge, attitudinal predisposition, or organizational capacity that principals have about possible strategies for offsetting the barriers associated with the implementation of professional development. The results of this question helped to determine if the solutions are not being implemented due to a lack of knowledge, lack of attitudinal predisposition, or lack of organizational skill.

In order to survey the principals' level of knowledge, attitudinal predisposition, and organizational capacity about the possible solutions to a lack of effective professional development in technology, Question 15 surveyed principals' perceptions to the solutions on three levels: *How knowledgeable are you about this strategy?*, *How much importance do you ascribe to this strategy?*, and *How capable do you feel to implement this strategy within your organizational structure?*. The possible professional development formats included: Study groups, Action Research, Peer Coaching, and Professional Learning Communities. The principals provided answers based on a four-point scale: (1) "Not at all", (2) "Very Little", (3) "Somewhat", and (4) "A great deal".

In order to create a single indicator of knowledge about professional development (on all 4 formats), and a single indicator of attitudinal predisposition and a single indicator of perceived organizational capacity, the aspects of each of the three
independent variable clusters were summed to create an additive scale of total knowledge level, total attitudinal disposition, and total organizational capacity to implement various formats of professional development. Chronbach’s Alpha coefficient was computed to test the additivity of each of the three potential scales to measure internal consistency for all three domains. All three coefficient alphas were sufficient to assume additivity within each category, as the knowledge-based alpha was .696, the attitudinal predisposition was .631, and the organizational capacity was .696. A similar exercise was undertaken to test the scalability of each of the dependent variables across their various dimensions. The scalability analysis included the following individual items: Technical Professional Development (How to operate the technology) and Professional Development (Integrating technology into the curriculum). Once again, the coefficient alpha was sufficient to assume scalability with an alpha of .767.

The newly transformed independent and dependent variables were dichotomized at the median, prior to undertaking the Chi-square analysis to minimize the likelihood of the number of cells with 0 or N<10. Chi-square tests were run to determine whether there were significant differences between the knowledge level, the attitudinal predisposition, or the organizational capacity of professional development and the current perceived degree of success the principals have achieved in implementing professional development. Results of the Chi-square tests indicate that there are no statistically significant effects of the level of knowledge, attitudinal predisposition, or organizational capacity of professional development on the current perceived degree of success that principals have achieved in implementing professional development. The results of the Chi-square tests are presented in Table 10.
Table 10 – Chi-square results for implementing professional development

The Chi-square results for level of knowledge, or attitudinal predisposition, or organizational capacity of professional development formats and the current perceived degree of success that principals have achieved in implementing professional development.

<table>
<thead>
<tr>
<th>Independent Variable of Professional Development</th>
<th>Chi-square</th>
<th>df</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>.070</td>
<td>1</td>
<td>.792</td>
</tr>
<tr>
<td>Attitudinal Predisposition</td>
<td>.016</td>
<td>1</td>
<td>.898</td>
</tr>
<tr>
<td>Organizational Capacity</td>
<td>.541</td>
<td>1</td>
<td>.462</td>
</tr>
</tbody>
</table>

* \( p \leq .05 \)

Findings for Research Question 4

The fourth research question examined to what degree the perceived success in providing teachers with time for mastery of technology is affected by the level of knowledge about time for mastery of technology, by the principal’s attitudinal predisposition to the creation of additional time for mastery, or by the principal’s organizational capacity to develop time for mastery of technology. This question provided the study with an examination of the level of knowledge, attitudinal predisposition, or organizational capacity that principals have about possible strategies for providing staff with additional time for mastery. The results of this question helped to
determine if the possible strategies are not being implemented as the result of a lack of knowledge, lack of attitudinal predisposition, or lack of organizational skill.

In order to survey the principals’ level of knowledge, attitudinal predisposition, and organizational capacity about the possible strategies for providing staff additional time for mastery, Question 25 surveyed principals’ perceptions to the solutions on three levels: How knowledgeable are you about this strategy?, How much importance do you ascribe to this strategy?, and How capable do you feel to implement this strategy within your organizational structure?. The possible strategies for providing time for mastery included: Providing release time through the use of substitutes, Refocusing the purpose of existing time commitments, Rescheduling the school day to provide time for collaboration, Providing babysitting and other services to promote community volunteers, Increase stipends and supplemental contract for participation, Lengthening the school day, Engaging students in alternative activities supervised by non-instructional staff to provide release time for teachers, and Engaging students in alternative activities supervised by parents to provide release time for teachers. The principals provided answers based on a four-point scale: (1) “Not at all”, (2) “Very Little”, (3) “Somewhat”, and (4) “A great deal”.

In order to create a single indicator of knowledge about time for mastery of technology (on all 8 dimensions), a single indicator of attitudinal predisposition, and a single indicator of perceived organizational capacity, the aspects of each of the three independent variable clusters were summed to create an additive scale of: total knowledge level, total attitudinal disposition, and total organizational capacity of various dimensions of creating time for mastery. Chronbach’s Alpha coefficient was computed
to test the additivity of each of the three potential scales to measure internal consistency for all three domains. All three coefficient alphas were sufficient to assume additivity within each category, as the knowledge-based alpha was .852, the attitudinal predisposition was .703, and the organizational capacity was .828. A similar exercise was undertaken to test the scalability of each of the dependent variables across their various dimensions. The scalability analysis included the following individual items: Providing time for teachers to master the use of computers and Providing time for teachers to work to integrate technology into the curriculum, and to create a new overall category of total time for mastery. Once again, the coefficient alpha was sufficient to assume reliability with an alpha of .862.

The newly transformed independent and dependent variables were dichotomized at the median prior to undertaking the Chi-square analysis to minimize the likelihood of the number of cells with 0 or N<10. Chi-square tests were run to determine whether there were significant differences between the knowledge level, the attitudinal predisposition, or the organizational capacity of possible strategies for providing staff additional time for mastery on the current perceived degree of success the principals have achieved in providing additional time for mastery. Results of the Chi-square tests indicate that there are statistically significant effects of the level of knowledge of possible strategies and the current perceived degree of success that principals have achieved in providing additional time for mastery with a Chi-square value of 4.781, a df value of 1, and p value of ≤ .029. Results of the Chi-square tests also indicate that there are statistically significant effects of the level of attitudinal predisposition of possible strategies and the current perceived degree of success that principals have achieved in
providing additional time for mastery with a Chi-square value of 16.452, a df value of 1, and p value of \( \leq .000 \). Results of the Chi-square tests also indicate that there are statistically significant effects of the level of the organizational capacity to implement the possible strategies and the current perceived degree of success that principals have achieved in providing additional time for mastery with a Chi-square value of 6.661, a df value of 1, and p value of \( \leq .010 \). These results indicate that there is a statistically significant effect, based on the principal's knowledge of time for mastery, a principal's attitudinal predisposition towards providing time for mastery, and a principal's capacity to implement time for mastery within their organizational structure. The results of the Chi-square tests are presented in Table 11.

### Table 11 – Chi-square results for providing additional time for mastery

The Chi-square results for level of knowledge, or attitudinal predisposition, or organizational capacity of the implementation of possible strategies for providing additional time for mastery and the current perceived degree of success that principals have achieved in providing additional time for mastery.

<table>
<thead>
<tr>
<th>Independent Variable of Time for Mastery</th>
<th>Chi-square</th>
<th>df</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>4.781</td>
<td>1</td>
<td>.029*</td>
</tr>
<tr>
<td>Attitudinal Predisposition</td>
<td>16.452</td>
<td>1</td>
<td>.000*</td>
</tr>
<tr>
<td>Organizational Capacity</td>
<td>6.661</td>
<td>1</td>
<td>.010*</td>
</tr>
</tbody>
</table>

* \( p \leq .05 \)
In order to understand how much influence principals have in providing additional time for mastery, Question 21 of the Principal Survey asked principals: *How much flexibility do you have in creating a schedule that will provide staff with additional release time for the purpose of mastering and implementing technology?*. The majority of principals (38.9%) responded that they had "Some", and another 26.3% responded that they had "A lot", while 27.1% of the principals responded that they had "Very little" and only 7.7% responded that they had "None". Therefore, 65.2% of the principals responded that they had the majority of the influence in developing the schedule.

However, Question 24 of the Principal Survey asked principals: *Has your school created alternative schedules in the past three years to support experimental programs?*, and 48.2% of the principals reported that they had not created an alternative schedule, while 31.7% of the principals reported that they had but not specifically to do with technology and only 20.1% reported that they did create alternative schedules that deal specifically with technology.

Additionally, in order to gauge principals’ perceptions to teachers’ attitudes towards the amount of time spent on technology training, Question 23 of the Principal Survey asked principals: *Do teachers in your school object to the amount of staff time spent on technology training?*. According to principal respondents, the vast majority (76.4%) responded that "No" teachers object to the amount of time spent on staff training, while 22.2% responded that "Yes, a few teachers" object to the amount of time spent on staff training, and only 1.3% responded that "Yes, many teachers" object to the amount of time spent on staff training. This demonstrates that the majority of principals feel that
teachers are willing to devote additional time to master technology; however, the results of the Chi-square test show that principals are not currently providing this time.

Findings for Research Question 5

The fifth research question examined to what degree the principals’ overall perceived success in integrating technology into their schools is affected by their perceived success in addressing the barriers to technology integration. This question provides an examination of how the total perceived success in integrating technology in the schools relates to the overall success of addressing each of the three major barriers identified by the research (Hew and Brush, 2007; Abrams and Russell, 2004), which are: lack of access to technology, a lack of professional development, and a lack of teacher time for mastery. The results of this question will help to determine if the successful implementation of the strategies addressing each barrier creates overall success in technology implementation.

As discussed in Findings for Research Question 1, 28.9% of the principals reported they “Strongly Disagreed” or “Disagreed” with the statement, Within my school we are currently integrating technology into instructional activities as much as we need to (Question 7), while 60.5% reported that they either “Strongly Agreed” or “Agreed” with the statement. In order to conduct a Chi-square analysis, the dependent variable (Question 7) was dichotomized at the median to minimize the likelihood of the number of cells with 0 or N<10.

Chi-square tests were run to determine whether there were significant differences between the overall success of addressing each of the three major barriers identified by
the research and the total perceived success in integrating technology in the schools.

Results of the Chi-square tests indicate that there are statistically significant effects of the overall success in providing access to technology and the total perceived success in integrating technology in the schools with a Chi-square value of 15.257, a df value of 1, and p value of ≤ .000. Results of the Chi-square tests also indicate that there are statistically significant effects in overall success in facilitating professional development and the total perceived success in integrating technology in the schools with a chi-square value of 14.734, a df value of 1, and p value of ≤ .000. Results of the Chi-square tests also indicate that there are statistically significant effects of providing additional time for mastery of technology and the total perceived success in integrating technology in the schools with a chi-square value of 7.278, a df value of 1, and p value of ≤ .007. These results indicate that there is a statistically significant effect, based on the principal’s ability to facilitate solutions to the identified barriers of technology (access to technology, professional development, and organizational capacity) and the overall perceived success in integrating technology in schools. The results of the Chi-square tests are presented in Table 12.
Table 12 – Chi-square results for total perceived success of integrating technology

The Chi-square results for the overall success of addressing each of the three major barriers identified by the research and the total perceived success in integrating technology in the schools.

<table>
<thead>
<tr>
<th>Independent Variable of success in addressing each barrier to technology</th>
<th>Chi-square</th>
<th>df</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to Technology</td>
<td>15.257</td>
<td>1</td>
<td>.000*</td>
</tr>
<tr>
<td>Professional Development</td>
<td>14.734</td>
<td>1</td>
<td>.000*</td>
</tr>
<tr>
<td>Time for Mastery</td>
<td>7.278</td>
<td>1</td>
<td>.007*</td>
</tr>
</tbody>
</table>

* p ≤ .05

Summary

In Chapter IV, the researcher used several methods, such as a description of the sample, descriptive statistics, and Chi-square analysis to answer Research Question 1. The results show that while 96.1% of the principals reported that they placed technology in their top ten goals for their school, only 60.5% of the principals reported that they were effectively implementing technology at the current time. It was found that principals were significantly less successful in implementing technology than they would like to be according to their school goals. The results of Research Question 1 also indicate that four variables dealing with access to the technology have the four highest levels of success,
while the variable dealing with providing time for teacher mastery have the two lowest levels of success in the frequency distribution.

The researcher reported that Chi-square statistical analyses were done to determine any relationships between the indicated dependent and independent variables in Research Questions 2-4. These analyses focused on the relationships between the independent variables of total knowledge level, total attitudinal disposition, and total organizational capacity; and the dependent variables of identified barriers to technology (access to technology, professional development, and time for teacher mastery). These analyses indicated four statistically significant relationships. The first indicated that there was a statistically significant relationship, based on a principal’s perceived capacity to implement access to technology within their organizational structure. The other three results indicate that there is a statistically significant effect, based on the principal’s knowledge of time for mastery, a principal’s attitudinal predisposition towards providing time for mastery, and a principal’s capacity to implement time for mastery within their organizational structure.

The research also reported that Chi-square statistical analyses were done to determine any relationships between the indicated dependent and independent variables in Research Question 5. These analyses focused on the relationships between the dependent variable of the total perceived success in integrating technology in schools and the independent variables of the overall success of addressing each of the three major barriers identified by the research. These analyses indicated three statistically significant relationships. Results of the Chi-square tests indicate that there are statistically significant effects of the overall success in providing access to technology, overall
success in facilitating professional development, and overall success in providing time for mastery on the total perceived success of integrating technology in the schools.

Chapter V will include an introduction, an overview of the study, the research design, summary of results, discussion and implications, and recommendations for future research.
CHAPTER V
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

This study has examined the effect of principals’ perceptions of possible strategies for addressing the barriers to the integration of technology in the elementary setting. Chapter V will present an overview of the study, a design review, a summary of the principal findings, and a discussion of the findings and their implications for practice, as well as recommendations for future research.

Overview of the Study

The purpose of this study was to identify principals’ perceptions of possible strategies for addressing the barriers to the integration of technology in the elementary setting. Because many different factors can contribute to the absence of technology use in the classroom, this study focused on potential strategies to address three major barriers identified by the research (Hew and Brush, 2007; Abrams and Russell, 2004). They are: lack of access to technology, a lack of professional development, and a lack of teacher time for mastery. The dependent variables were the principals’ perceived current success in offsetting barriers to technology integration, and the independent variables were the perceptions of principals of potential strategies to offset the barriers.

Research Design

The research was a single descriptive non-experimental (Johnson, 2001) quantitative study (survey) to investigate the principals’ perceptions to the researched
barriers to the implementation to technology. A paper- and-pencil survey instrument, entitled *Principal Survey*, was assembled to gather information in several topic areas: the principal’s knowledge, attitudinal predisposition, and organizational capacity for addressing the identified barriers to technology, as well as the descriptive information on the respondents and their perceived current levels of technology integration. The researcher identified the population of general education elementary principals in New Jersey. Their public school’s classification as an elementary school was determined by the New Jersey Department of Education with school type code 12. The study took place in New Jersey where there are approximately 1530 elementary schools (New Jersey Department of Education, 2009).

The researcher obtained a listing of all elementary schools from the New Jersey Department of Education, and sorted this group alphabetically, first by county and then by district. Using a systematic sampling method of every other principal, 765 elementary school principals were identified for the sample. The researcher contacted each principal in writing requesting their participation in the survey. Included in this letter was information concerning the background of the researcher, the purpose and procedure used in the research, statement of confidentiality, a survey, and directions on how to return the survey. Participation in the written survey was completely voluntary. No names or other personal identification information were reported or shared in any way, as the written survey was anonymous. To maintain anonymity and confidentiality, those who participated in the written survey did not need to return a signed informed consent form. The surveys were mailed to the principals on December 8, 2009, and the participants were asked to return the survey by December 31, 2009. A follow-up mailing was sent
out two weeks after the initial mailing to encourage as many participants as possible. The researcher allowed an additional two weeks for any late mailings before beginning any statistical analyses. The participants had no personal contact with the researcher, and they were not pressured in any way by their individual school districts. The survey did not ask for the participant's name; however, it did ask for their gender, year of birth, the grade levels included in their school, number of students enrolled in their school, number of years as a principal in their current school, and the District Factor Group (DFG) of their school.

**Summary of Results**

The null hypothesis tested in this study was: There are no statistically significant differences in elementary principals' perceived success in offsetting the identified barriers to technology attributable to variation in their knowledge level, attitudinal favorability, or the self-assessments of their organizational capacity. This null hypothesis led to the formation of five research questions:

1) What degree of emphasis do elementary principals place on the integration of technology in the elementary setting, and how do they perceive their current level of success in providing access to technology, professional development, and time for teacher mastery?

2) To what degree is the perceived success in providing access to technology affected by their knowledge, by their attitudinal predisposition, or by their organizational capacity?
3) To what degree is the perceived success in facilitating effective professional development for technology integration affected by their knowledge, their attitudinal predisposition, or their organizational capacity?

4) To what degree is the perceived success in providing teachers time for mastery of technology affected by their knowledge, their attitudinal predisposition, or their organizational capacity?

5) To what degree is the principals' overall perceived success in integrating technology into their schools affected by their perceived success in facilitating solutions to the barriers to technology integration?

The researcher reported that 29.8% principals responded to the Principal Survey from December 8, 2009 through January 11, 2010. The principal respondents were generally, by mode, in schools that housed between 401 and 600 students, at their school for less than five years, and they were born between the years of 1950 and 1959. The principal respondents also resembled the larger population of elementary principals in New Jersey in terms of District Factor Group and gender, as neither of these response groups were found to be statistically significant from the total population in New Jersey. Therefore, it was reasonable to conclude that there was no obvious respondent bias, and that the sample was largely representative of the population.

Research Question 1 of the study determined that, while 96.1% of the principals reported that they placed “Heavy Emphasis” or “Some Emphasis” on the integration of technology as a goal for their school, only 60.5% of the principals reported that they would “Agree” or “Strongly Agree” with the statement that they were currently integrating technology effectively. These results compare favorably to Abrams and
Russell’s 2004 study, *Principals' Beliefs About Access, Use, Support, and Obstacles to Technology Use in School*, as they found that 93.4% of the all principals reported that, relative to all the goals for the school, either “Heavy Emphasis” or “Some Emphasis” was placed on the integration of classroom technology (p. 56). Their results also showed that 40.5% of principals reported that they would “Agree or “Strongly Agree” with the statement that they were currently integrating technology as much as necessary (p. 59).

The relationship in this study was determined to be statistically significant, as the identification of technology and the current level of implementation had a Chi-square value of 6.781, df = 1, and p value of ≤ .009. The results indicated that principals were significantly less successful in the implementation of technology, when compared to their stated importance as a school goal.

The results of the study also indicated that the four dependent variables dealing with access to the technology had the four highest levels of successful implementation. Principals’ responses stated the most success in providing access to hardware, with 55.6% of the principals stating “High Degree of Success”. The two questions dealing with providing time for teacher mastery have the two lowest levels of successful implementation. Principals responded that they had the least amount of success in providing time for teachers to implement technology into the curriculum, with only 19.3% of the principals stating a “High Degree of Success”. Once again, this result is supported by Abrams and Russell’s (2004) study, as they found that professional development that prepared teachers to use technology in the classroom, but did not provide sufficient time to practice what they had learned, was a major barrier to the implementation of technology, with 37.8% of the principals responding that this was a
“Major Obstacle” and 42.9% stating that this was a “Minor Obstacle” (p. 6). In fact, Adams and Russell found that only 19.3% of the principals reported that providing time to practice was “Not an Obstacle” (p. 6), which compares favorably to the results of this study that only 19.3% of the principals stated a “High Degree of Success” in providing sufficient time to implement technology into the curriculum.

Research Question 2 provided an examination of the level of knowledge, attitudinal predisposition, or organizational capacity that principals had about possible facilitators of technological use associated with the effective implementation of access to technology. Chi-square tests were run to determine whether there were significant effects of the knowledge level, the attitudinal predisposition, or the organizational capacity of possible facilitators to technology on the current perceived degree of success the principals have achieved in providing access to technology. Results of the Chi-square tests indicate that there are no statistically significant effects of the level of knowledge or attitudinal predisposition on the current perceived degree of success that principals have achieved in providing access to technology. However, results of the Chi-square tests indicate that there are statistically significant effects of the level of organizational capacity and the current perceived degree of success that principals have achieved in providing access to technology with a Chi-square value of 16.439, a df value of 1, and p value of ≤ .000. These results indicate that there is a statistically significant effect, based on a principal’s perceived capacity to implement access to technology within their organizational structure.

Research Question 3 provided the study with an examination of the level of knowledge, attitudinal predisposition, or organizational capacity that principals have
about possible strategies for offsetting the barriers associated with the facilitation of professional development. Chi-square tests were run to determine whether there were significant effects of the knowledge level, the attitudinal predisposition, or the organizational capacity of professional development on the current perceived degree of success the principals have achieved in implementing professional development. Results of the Chi-square tests indicated that there were no statistically significant effects of the level of knowledge, attitudinal predisposition, or organizational capacity of professional development on the current perceived degree of success that principals have achieved in implementing professional development.

Research Question 4 provided an examination of the level of knowledge, attitudinal predisposition, or organizational capacity that principals have about possible strategies for providing staff additional time for mastery. Chi-square tests were run to determine whether there were significant effects of the knowledge level, the attitudinal predisposition, or the organizational capacity of possible strategies for providing staff additional time for mastery on the current perceived degree of success the principals have achieved in providing additional time for mastery. Results of the Chi-square tests indicated that there were statistically significant effects of the level of knowledge of possible strategies and the current perceived degree of success that principals have achieved in providing additional time for mastery with a Chi-square value of 4.781, a df value of 1, and p value of ≤ .029. Results of the Chi-square tests also indicated that there were statistically significant effects of the level of attitudinal predisposition of possible strategies and the current perceived degree of success that principals have achieved in providing additional time for mastery with a Chi-square value of 16.452, a df value of 1,
and p value of ≤ .000. Results of the Chi-square tests also indicated that there were statistically significant effects of the level of the organizational capacity to implement the possible strategies and the current perceived degree of success that principals have achieved in providing additional time for mastery with a Chi-square value of 6.661, a df value of 1, and p value of ≤ .010. These results indicate that there is a statistically significant effect, based on the principal’s knowledge of time for mastery, a principal’s attitudinal predisposition towards providing time for mastery, and a principal’s capacity to implement time for mastery within their organizational structure.

Additionally, according to principal respondents, the vast majority (76.4%) responded that “No” teachers object to the amount of time spent on staff training, while 22.2% responded that “Yes, a few teachers” object to the amount of time spent on staff training, and only 1.3% responded that “Yes, many teachers” object to the amount of time spent on staff training. Once again, these results compared favorably to Abrams and Russell’s (2004) study, which found that a vast majority (80.0%) responded that “No” teachers object to the amount of time spent on staff training, while 19.2% responded that “Yes, a few teachers” object to the amount of time spent on staff training, and only 0.8% responded that “Yes, many teachers” object to the amount of time spent on staff training. Results from this study demonstrated that the majority of principals feel that teachers are willing to devote additional time to master technology; however, the results of the Chi-square test show that principals are not currently providing it at this time.

Research Question 5 provided an examination of how the total perceived success in integrating technology in the schools relates to the overall success of addressing each of the three major barriers identified by the research. Chi-square tests were run to
determine whether there were significant effects of the overall success of addressing each of the three major barriers identified by the research and the total perceived success in integrating technology in the schools. Results of the Chi-square tests indicated that there were statistically significant effects of the overall success in providing access to technology on the total perceived success in integrating technology in the schools with a Chi-square value of 15.257, a df value of 1, and p value of \( \leq .000 \). Results of the Chi-square tests also indicated that there was a statistically significant effect, based on the principal's overall success in providing professional development on the total perceived success in integrating technology in the schools with a Chi-square value of 14.734, a df value of 1, and p value of \( \leq .000 \). Results of the Chi-square tests also indicated that there were statistically significant effects of providing additional time for mastery of technology on the total perceived success in integrating technology in the schools with a Chi-square value of 7.278, a df value of 1, and p value of \( \leq .007 \). These results indicate that there is a statistically significant effect of the principal's ability to facilitate solutions to the identified barriers of technology (access to technology, professional development, and organizational capacity) and the overall perceived success in integrating technology in schools. Table 13 provides a summary of the significant findings from Research Questions 1-5.
Table 13 – Summary Chart

The statistically significant variables for Research Questions 1 – 5

<table>
<thead>
<tr>
<th>Research Question 1 – Chi-square results for Emphasis on Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variable</td>
</tr>
<tr>
<td>Current Level of Success</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research Question 2 – Chi-square results for providing access to technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variable of Access to Technology</td>
</tr>
<tr>
<td>Organizational Capacity</td>
</tr>
<tr>
<td>Ability to Purchase</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research Question 4 – Chi-square results for providing additional time for mastery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variable of Time for Mastery</td>
</tr>
<tr>
<td>Knowledge</td>
</tr>
<tr>
<td>Attitudinal Predisposition</td>
</tr>
<tr>
<td>Organizational Capacity</td>
</tr>
</tbody>
</table>
(Table 13 continued)

**Research Question 5 – Chi-square results for total perceived success of integrating technology**

<table>
<thead>
<tr>
<th>Independent Variable of success in addressing each barrier to technology</th>
<th>Chi-square</th>
<th>df</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to Technology</td>
<td>15.257</td>
<td>1</td>
<td>.000*</td>
</tr>
<tr>
<td>Professional Development</td>
<td>14.734</td>
<td>1</td>
<td>.000*</td>
</tr>
<tr>
<td>Time for Mastery</td>
<td>7.278</td>
<td>1</td>
<td>.007*</td>
</tr>
</tbody>
</table>

* $p \leq .05$

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**Discussion and Implications**

Schools in America have demonstrated a deep commitment to the implementation of technology. Districts spent a combined $7.87$ billion dollars in 2003–2004 (Quality Education Data, 2004), to ensure that 99% of public elementary schools and 86% of elementary instructional rooms have access to the Internet (National Center for Education Statistics, 2005). Studies have shown that 96% of teachers were in favor of applying computers to improve the quality of education for their students (Latham, 1999) and 93.4% of principals reported that, relative to all the goals for the school, either “Heavy Emphasis” or “Some Emphasis” was placed on the integration of classroom technology (Adams and Russell, 2004).

However, the dollars spent and the opinions stated are in stark contrast with the reality that technology still lacks a strong presence in public education. A nationwide
A number of studies have attempted to isolate the reasons why schools have found it so difficult to implement technology into the curriculum. These studies have not identified a single cause, but rather they have identified a number of variables which, in combination, act as barriers to technology implementation. Three barriers consistently found in research studies are: lack of access to technology, lack of proper professional development, and lack of teacher time for teacher mastery (O’Dwyer, Russell, & Bebell, 2004; Hew & Brush, 2007; Stram-Statham, 1999; Boyd, 1997; Zher, 1997; Adams & Russell, 2004; The Office of Technology Assessment, 1995; NCES, 2000). Data from this study confirm that the identified barriers to technology have a statistically significant effect on the overall perception of success in technology integration. Results show that there are statistically significant effects of the overall success in providing access to technology with a Chi-square value of 15.257, a df value of 1, and p value of ≤ .000; overall success in facilitating professional development with a Chi-square value of 14.734, a df value of 1, and p value of ≤ .000; and overall success in providing time for
mastery with a Chi-square value of 7.278, a df value of 1, and p value of ≤ .007, on the total perceived success of integrating technology in the schools. Therefore, it can be confirmed that the identified barriers of this study have a direct effect on the implementation of technology.

Studies also primarily focus on what teachers perceive as the barriers to technology (Norman, 2000; Owens 1999; National Center for Educational Statistics, 1999; Leggett & Persichitte, 1998; Becker, 2000; Franklin, Sexton, Lu, & Ma, 2007; Elrod, 2008; Pavey, 2008). Teachers act as the end users of technology; however, it is the school leader who works as the medium for a technology initiative or can provide effective direction and oversight (Byrom, 2002). Therefore, research is needed on the principals’ perceptions of, not only the barriers, but also the possible solutions to these barriers, as they have the relative ability to address these barriers and effect change. Edyburn (2002) supports this notion, “We need more research of all kinds on this important topic. The landscape of the qualitative literature in the area is targeted much more toward the experiences of teachers and students rather than administrators and other leaders” (p. 55). This study added to the limited research on the principals’ perceptions to these barriers, not by examining the barriers, but by providing possible solutions for addressing these barriers. Data from principal surveys provided insight into the extent to which principals perceived the ability to implement these solutions as it relates to their level of knowledge, their attitudinal predisposition, or their organizational capacity.

Results of this study confirmed the concept that the relatively sparse implementation of computer technology belies strong attitudinal support for its use. The study determined that, while 96.1% of the principals reported that they placed “Heavy
Emphasis" or “Some Emphasis” on the integration of technology as a goal for their school, only 60.5% of the principals reported that they would “Agree” or “Strongly Agree” with the statement that they were currently integrating technology effectively. It was found that principals were significantly less successful in the implementation of technology when compared to their stated importance as a school goal, with a Chi-square value of 6.781, df = 1, and p value of ≤ .009. Therefore, this researcher suggests that the implementation of technology is an important concept for school districts to address, as the amount of money spent on technology and the stated importance of technology do not equate to the successful implementation of technology.

Results of this study demonstrated that principals enjoyed the most overall success in the area of access to technology. Market Data Retrieval (2005) supports this finding, as they reported that school districts typically spend 85% of their technology budget focusing on providing access to the technology. In this study, the four dependent variables dealing with access to technology had the four highest levels of successful implementation. Principals’ responses reported the most success in providing access to hardware, with 55.6% of the principals stating “High Degree of Success”.

Results of the Chi-square tests also indicate that there are no statistically significant effects of the level of knowledge or attitudinal predisposition on the current perceived degree of success that principals have achieved in providing access to technology. However, results of the Chi-square tests indicate that there are statistically significant effects of the level of organizational capacity on the current perceived degree of success that principals have achieved in providing access to technology with a Chi-square value of 16.439, a df value of 1, and p value of .000. This demonstrates that
provision of access to technology is not affected by the principals’ level of knowledge or their perceived importance, but rather successful access to technology is affected by their organizational capacity to implement the possible facilitators of access to technology.

This assertion by the researcher is supported by the fact that less than half of all principals surveyed responded that they had the ability to make these technology purchases (49.6%). This is also supported by the statistically significant finding that the principals’ ability to purchase technology affects the total perceived success in providing access to technology with a Chi-square value of 8.929, a df value of 1, and p value of \( \leq .003 \). Therefore, this researcher suggests that superintendents and school districts provide principals with the purchasing power and the capacity to implement facilitators of technology within their organizational structure. Principals have the unique managerial role to evaluate the needs of their building and the strengths of their staff, and to provide access to the technology. However, results show that principals are not being provided with the capacity to implement the changes and make purchases which directly affect the overall technology success of their schools.

In terms of facilitating teachers’ professional development, results of the Chi-square tests indicated that there were no statistically significant effects of the level of knowledge, attitudinal predisposition, or organizational capacity on the current perceived degree of success that principals have achieved in implementing professional development. However, in terms of implementing technical professional development (how to operate the technology), results of this study indicate that 40.4% of the principals have had “A lot” of success, 48.9% have had “Some”, 10.7% have had “Very Little”, and 0% have had “None”. In terms of implementing professional development focused on
integrating technology into the established curriculum, results of this study indicate that 24.1% have had "A lot" of success, 56.1% have had "Some", 17.0% have had "Very Little", and 1.3% have had "None". This researcher recommends further study on the individual aspects of professional development to address these differences in the levels of successful implementation, as principal respondents have had more success in implementing technical professional development compared to professional development integrating technology into the established curriculum.

The Integrated Studies of Educational Technology (U.S. DOE, 2004b) asked teachers about a variety of potential barriers to their use of educational technology. The three areas that teachers most often indicated as being a moderate to great barrier all had to do with time limitations. These limitations included time to develop new activities that incorporate technology, limited time in the school schedule to conduct activities, and limited time to practice technology skills. This study supported the Department of Education's findings, as the principals' responses to the possible strategies for providing staff additional time for mastery provided the greatest number of statistically significant results. Results of Chi-square tests indicate that there are statistically significant effects on the current perceived degree of success that principals have achieved in providing additional time for mastery and the level of knowledge with a Chi-square value of 4.781, a df value of 1, and p value of ≤ .029; the level of attitudinal predisposition with a Chi-square value of 16.452, a df value of 1, and p value of ≤ .000; and the level of the organizational capacity to implement the possible strategies with a Chi-square value of 6.661, a df value of 1, and p value of ≤ .010.
These results indicate that there is a statistically significant effect based on the principal's knowledge of time for mastery, a principal's attitudinal predisposition towards providing time for mastery, and a principal's capacity to implement time for mastery within their organizational structure. Therefore, this researcher recommends that further research focus on finding innovative strategies that have been proven to provide teachers with additional time for mastery. Once successful strategies have been identified, principals must be presented with these concepts to increase their level of knowledge of strategies. It is also imperative that principals are afforded the organizational structure to implement these strategies as well. As stated earlier in Chapter V, principals have reported that teachers do not object to the amount of staff time spent on technology training; therefore, principals must be made aware of these strategies. One again, results of this study have determined that there is difficulty in implementing a strategy based on the current organizational structure of the school. This researcher suggests that principals, superintendents, and boards of education come together to adjust the current organizational structure to provide principals with an increased ability to implement changes. Further research is necessary in this area.

**Recommendations for Future Research**

Although there were many statistically significant findings in this study, there are recommendations for future research. The results of the study do allow for replication, and these recommendations will add to the reliability of study findings in the future.

1) This study should be replicated in middle schools and high schools. The researcher focused on elementary schools, as this was the researcher's area of
expertise. Principals at different levels of schools may have different perceptions, as their experiences with teachers may be less direct with additional levels of administration.

2) This study should be replicated outside of the State of New Jersey. If this study were extended to other states, factors such as school funding, teacher tenure, socioeconomic standing, and geographic location could produce additional results.

3) This study should be replicated with a larger sample size. If sample sizes were increased, the reliability of the findings would certainly increase as well.

4) This study should be replicated by examining additional first-order barriers to technology. Access to technology, professional development, and time for mastery were the independent variables examined in this study. A number of other first-order barriers; such as, teacher characteristics, the characteristics of the teaching materials, the requirement for computer expertise, difficulties with the equipment, class size, and subject area; can be examined in terms of the knowledge level, the attitudinal predisposition, and the organizational capacity.

5) This study focused on the first-order barriers to technology, as the first-order barriers are easier to quantify and solutions to the first-order barriers are easier to implement. The first-order barriers to technology integration are described as being external to the teacher, with problems such as lack of access to computers and software, insufficient time to plan instruction, and a lack of professional development. Second-order barriers are, in contrast, intrinsic to teachers, and include teachers' attitudes about computers, their attitudes about the change process, and the principal's role in the implementation of technology. Therefore,
it is much harder to change attitudes. However, second-order barriers are important to address; therefore, this study should be replicated by examining second-order barriers to technology. One suggestion, which was not examined in this study, is principals’ perceptions of teacher attitudes towards technology, principals’ attitudes towards technology, principals’ attitudes towards the change process, and principals’ role in the implementation of technology.

6) The researcher recommends further study on the individual aspects of professional development to address the differences in the levels of successful implementation, as principal respondents have had more success in implementing technical professional development, when compared to professional development integrating technology into the established curriculum. Since no significant findings were established in this study, a closer examination as to why there is a difference between the successes in implementing technical professional development, when compared to professional development integrating technology into the established curriculum is necessary.

7) The researcher recommends further study on the possible strategies of providing teachers with time for mastery. It is evident from the findings that there is a lack of providing time for mastery, and principals have a significant deficiency in terms of knowledge, attitudinal predisposition, and organizational capacity. The strategies provided in this study were compiled from the literature on time for mastery. Strategies should be selected for case studies to be conducted to analyze the successfulness of individual strategies. These studies should then be reported to principals to further their knowledge in this area.
8) This study examined the relationships between the dependent variable of the total perceived success in integrating technology in schools and the independent variables of the overall success of addressing each of the three major barriers identified by the research. The survey instrument measured principals' perceptions to the solutions; however, it did not measure actual implementation of solutions by teachers or students by way of number of minutes per week or number of computers. The survey can be altered to include this data.

9) The survey instrument measured principals' perceptions to the overall success of their school; however, it did not measure actual success. The study would have benefited from a standardized definition of overall success; however, to date there is no standardized measure of success provided by the State of New Jersey's Department of Education. If this is created in the future, the study could more accurately delineate the successful schools from the schools that are lacking success.

10) This study obtained data from an anonymous survey mailed to principals to gather a large amount of quantitative data to provide a basis for study. This study should be replicated using qualitative data from a number of identified schools that are successful in the implementation of technology and schools lacking implementation to help provide further insight into the data.

11) This study discussed the role of the principal as one who works as the medium for a technology initiative or can provide effective direction and oversight. The survey instrument measured principals' perceptions of success; however, it did not measure actual leadership strategies to assist teachers in the implementation of
technology which lead to actual success. One example of these leadership strategies is linking the use of technology with the teacher evaluation process. By holding teachers accountable through teacher observations and evaluations, principals will be able to document actual success in technology integration. The survey can be altered to include this data.
References


*Proceedings of Fifth Annual Mid-South Instructional Technology, Middle Tennessee State University, USA.* Retrieved May 24, 2009 from http://www.mtsu.edu/~itconf/proceed00/beggs/beggs.htm


Appendix A: Letter of Solicitation
Dear Principal:

I am currently enrolled at Seton Hall University, South Orange, New Jersey, in the Executive Ed.D. program as a doctoral student in the College of Education and Human Services, Department of Education Leadership, Management and Policy. I am writing to invite your participation in a survey that is needed for my dissertation study of New Jersey Elementary School Principals and the possible solutions of perceived barriers to the implementation of technology.

The purpose of my quantitative study of elementary principals in New Jersey is to identify principals' perceptions of possible solutions to the barriers of successful use of technology in the elementary setting. Due to the fact that there are many different factors that can hinder technology use in the classroom, this study will focus on potential solutions of first order potential barriers of technology integration as identified by the research. These areas of implementation will include: time for mastery, professional development, and access to technology. The survey will help to determine to what degree principals are knowledgeable about strategies, attitudinally predisposed to employ these strategies, and to what degree to elementary principals have the organizational and leadership capabilities to implement these strategies. This survey should take 20 minutes to complete.

The written survey, which is a modified version of the USEIT Questionnaire that was developed as a data collection instrument in 2004 by Abrams and Russell, will sample elementary principals in New Jersey. This questionnaire was originally developed to document the effects that different district level technology support structures have on teaching and learning across 22 Massachusetts school districts. The instrument for this study has been modified to evaluate to what degree principals are knowledgeable and attitudinally predisposed to employ these strategies described in the accompanying research. The study will also examine to what degree elementary principals have the organizational and leadership skills to implement these strategies. The instrument presents items with a Likert-type response set at a five point scale from low to high. The principals will be identified using the New Jersey Department of Education website, and every other name on the list will be mailed a survey via the United States Post Office. A return envelope will be provided for all participants to return the written survey via the United States Post Office. Participants will have until December 31, 2009 to return the written survey.

Participation in this study is completely voluntary. You are not required to submit a written survey. Refusal to participate or discontinuing participation at any time will involve no penalty or loss of benefits to which you are otherwise entitled.

The written survey is completely anonymous. Procedures have been put in place for the distribution, completion, and return of the written survey to ensure anonymity. There will be no identifying information that will ever be able to link the data to any individual. The data from the written surveys will remain in the possession of the researcher. In addition, all other electronic data will be stored on USB memory keys. All data, including electronic and written, will be locked in the researcher's cabinet and will

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A HOME FOR THE MIND, THE HEART AND THE SPIRIT
be secured in this location until it is destroyed three years after the study. No other individuals other than the researcher's Seton Hall University faculty mentor, Dr. Martin Finkelstein, will have access to the data. Responses will be kept completely confidential.

No individuals will have access to the list of participants for the research, the names of the administrators, or the names of the schools. The data analysis will be included in the dissertation; however, no names of participants will be included in the dissertation.

The results from this research study will be used to improve the implementation of technology in elementary schools. The conclusions that emanate from this study will allow school districts to examine the perceived importance of possible solutions to the barriers of technology. The conclusions will also provide superintendents with feedback that will help to provide the proper organizational structure to allow principals to apply these solutions with the least amount of resistance.

There are no alternatives to participate in the written survey, and there are no risks associated with this study. Consent to participate is indicated by returning the written survey to the researcher.

There is one researcher for this study, Stephen Wisniewski. My Seton Hall University faculty mentor is Martin Finkelstein, Ph.D. Dr. Finkelstein may be contacted with questions or concerns regarding the study or for information about participants' rights by writing to him at Seton Hall University, College of Education and Human Services, Department of Education Leadership, Management, and Policy, Jubilee Hall Office #406, 400 South Orange Avenue, South Orange, NJ 07079, or by telephoning him at Seton Hall University at (973) 275-2056. Additionally, Mary F. Ruzicka, Ph.D., the Seton Hall University Institutional Review Board (IRB) Director, may be contacted with questions or concerns regarding the study or for information about participants' rights by writing to her at Seton Hall University, Office of the Institutional Review Board, Presidents Hall Third Floor, 400 South Orange Avenue, South Orange, NJ 07079, or by telephoning her at Seton Hall University at (973) 313-6314.

If you are participating in the written survey, please complete the enclosed survey and return it in the enclosed self-addressed envelope no later than December 31st. I would like to emphasize that you are not obligated to be a part of the written survey. Participation is completely voluntary. However, if you do participate, your input will be valuable in improving the implementation of technology in schools statewide. If you have any questions or concerns regarding the study, please do not hesitate to contact me at work at 973-697-7142, or home at 201-638-1178. Thank you for your time and consideration.

Sincerely,

Stephen T. Wisniewski
Seton Hall University

Seton Hall University
Institutional Review Board

College of Education and Human Services
Executive Ed. D. Program
Tel. 973-275-2728
400 South Orange Avenue • South Orange, New Jersey 07079-2685
Appendix B: Principal Survey
Please take a moment to provide us with the information needed to complete our research study. When you are done, please return the survey in the self-addressed, stamped envelope. Thank you for your time.

1) How many years have you been the principal at your current school?

2) In what year were you born?

3) What is your gender?
   - Female
   - Male

4) How many students are in your school?

5) What is the District Factor Group (DFG) ranking of your school district?
   - A
   - B
   - C
   - D
   - E
   - F
   - G
   - H
   - I
   - J

6) What grade levels are in your school?

7) Within my school, we are currently integrating technology into instructional activities as much as we need to:
   - Strongly Disagree
   - Disagree
   - Neither Agree nor Disagree
   - Agree
   - Strongly Agree

8) Relative to all of your goals for your school, how much emphasis do you place on the integration of technology into classroom instruction?
   - Heavy emphasis (top 3 goals)
   - Some emphasis (top 5-10 goals)
   - Little emphasis (not in top 10)
   - No Emphasis

9) Rate the extent to which each of the following influence decisions about technology in your school:

<table>
<thead>
<tr>
<th>Influence Source</th>
<th>Extent of Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>None</td>
</tr>
<tr>
<td>Principals</td>
<td>1</td>
</tr>
<tr>
<td>Technology Directors</td>
<td>1</td>
</tr>
<tr>
<td>Supervisors</td>
<td>1</td>
</tr>
<tr>
<td>Superintendent</td>
<td>1</td>
</tr>
<tr>
<td>Board of Education</td>
<td>1</td>
</tr>
<tr>
<td>Parents</td>
<td>1</td>
</tr>
</tbody>
</table>
10) As of today, rate the degree of success you believe your school has achieved in implementing each of the following:

<table>
<thead>
<tr>
<th>Professional Development</th>
<th>Degree of Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Professional Development (How to operate the technology)</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Professional Development integrating technology into the curriculum</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Providing access to hardware</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Providing access to software</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Providing technical support (fixing the computers)</td>
<td>1 2 3</td>
</tr>
<tr>
<td>Providing network services</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Providing time for teachers to master the use of computers</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Providing time for teachers to work to integrate technology into the curriculum</td>
<td>1 2 3 4</td>
</tr>
</tbody>
</table>

11) How much flexibility do you have in determining which types and how much professional development is provided for your school?
- None
- Very little
- Some
- A lot

12) What best describes the majority of professional development opportunities in your school?
- Single session(s), whole school attendance
- Out of district workshops
- In district workshops
- Ongoing collaboration between staff and presenter

13) What best describes the way teachers most often plan lessons in your school?
- Individually – each do their own thing in the classroom
- Teachers work together within their own grade
- Teachers work together across grade levels
- All teachers, including special area teachers, work together to plan curriculum

14) Which of the following best describes the learning environment in your district?
- School-wide goals and/or initiatives change often
- School-wide goals and/or initiatives rarely change
- School-wide goals and/or initiatives are actively reflected upon for improvement
- School-wide goals are written but never implemented

15) Possible professional development formats:

<table>
<thead>
<tr>
<th>Professional Development Formats</th>
<th>How knowledgeable are you about this strategy?</th>
<th>How much importance do you ascribe to this strategy?</th>
<th>How capable do you feel to implement this strategy within your organizational structure?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Groups</td>
<td>Not at all 2 3 4</td>
<td>Not at all 2 3 4</td>
<td>Not at all 2 3 4</td>
</tr>
<tr>
<td>Action Research</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Peer Coaching</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Professional Learning Communities</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
</tbody>
</table>
23) Do teachers in your school object to the amount of staff time spent on technology training?
   - [ ] No
   - [ ] Yes, a few teachers
   - [ ] Yes, many teachers

24) Has your school created alternative schedules in the past three years to support experimental programs?
   - [ ] Yes, but not specifically to do with technology issues
   - [ ] Yes, with some programs that deal specifically with technology
   - [ ] No

For each of the strategies for providing staff additional time for mastery in the left hand column, make three ratings as follows:

<table>
<thead>
<tr>
<th>25) Possible strategies for providing staff additional time for mastery:</th>
<th>How knowledgeable are you about this strategy?</th>
<th>How much importance do you ascribe to this strategy?</th>
<th>How capable do you feel to implement this strategy within your organizational structure?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not at all</td>
<td>Very little</td>
<td>Some-what</td>
</tr>
<tr>
<td>Provide release time through the use of substitutes</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Refocus the purpose of existing time commitments</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Rescheduling the school day to provide time for collaboration</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Providing babysitting and other services to promote community volunteers</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Increase stipends and supplemental contracts for participation</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Lengthening the school day</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Engage students in alternative activities supervised by non-instructional staff to provide release time for teachers</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Engage students in alternative activities supervised by parents to provide release time for teachers</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Thank you for completing this survey!
16) How much flexibility do you have in determining which types and how much technology is purchased for your school?
- None
- Very little
- Some
- A lot

17) Does your school have a budget for technology expenditures in the following areas over which you have sole discretionary authority? (Check all that apply)
- Hardware
- Software
- Computer Supplies
- Professional Development
- Network Access

18) When a school computer has a major problem (one that requires assistance from the technology department), how long does it typically take for the problem to get fixed?
- Hours
- A day
- Within a week
- More than a week

19) When your teachers want to use computers with all of their students at the same time, how easy is it for them to find enough computers to use in a lab or in their classroom?
- Always easy
- Usually easy
- Usually difficult
- Always difficult

For each of the strategies for facilitating technology use in the left hand column, make three ratings as follows:

<table>
<thead>
<tr>
<th>20) Possible facilitators of technology use:</th>
<th>How knowledgeable are you about this strategy?</th>
<th>How much importance do you ascribe to this strategy?</th>
<th>How capable do you feel to implement this strategy within your organizational structure?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network infrastructure improvements</td>
<td>Not at all Very little Somewhat A great deal</td>
<td>Not at all Very little Somewhat A great deal</td>
<td>Not at all Very little Somewhat A great deal</td>
</tr>
<tr>
<td>Additional Hardware</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Hardware improvements</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Additional Software</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Software improvements</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Additional helpdesk support</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Additional staff to train and support staff/equipment</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Rewriting the curriculum to support instruction in technology</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>Hiring a technology coordinator</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
<td>1 2 3 4</td>
</tr>
</tbody>
</table>

21) How much flexibility do you have in creating a schedule that will provide staff with additional release time for the purpose of mastering and implementing technology?
- None
- Very little
- Some
- A lot

22) What best describes the daily schedule in your school?
- Flexible schedule
- 40 minute blocks of time within a school day
- Core/Block schedule (double periods for certain classes)
- Other.