ABSTRACT

TOWNSEND, LATRICIA WALKER. An Exploration of Principal Instructional Technology Leadership. (Under the direction of Dr. Lance Fusarelli and Dr. Kevin Brady.)

Nationwide the demand for schools to incorporate technology into their educational programs is great. In response, North Carolina developed the IMPACT model in 2003 to provide a comprehensive model for technology integration in the state. The model is aligned to national educational technology standards for teachers, students, and principals. Charged with increasing the level of technology integration, principals must possess a specific skillset to be effective in the role of instructional technology leader. The goal of this study was to examine how IMPACT principals of North Carolina K-12 schools take on the mantle of instructional technology leader. Utilizing a mixed methods approach, principal instructional technology leadership preparation and practices were examined by school level (i.e., elementary, middle, and high) to ascertain their level of alignment with National Educational Technology Standards for Administrators (NETS-A) and actual teacher needs.

Quantitative methods were utilized to analyze the School Technology Needs Assessment (STNA) results from teachers (n=1185) in an effort to determine the overall instructional technology health of the IMPACT schools (n=31) in the first phase of the study. During Phase II of the study, both qualitative and quantitative methods were used. Using a semi-structured protocol, principals (n=7) were interviewed about their instructional technology preparation mechanism and their leadership behaviors. Teachers (n=116) were surveyed to determine the level to which they believed their principal's instructional technology behaviors aligned to NETS- A standards. Teachers were also asked to provide

information about how their principals could best support them in their quest to integrate technology into their instruction.

Although the principals in the study exhibited instructional technology leadership practices that were aligned to NETS-A standards, the analysis of their instructional technology leadership preparation mechanisms revealed evidence of the need to ensure principals are adequately prepared to meet instructional technology needs at the pre-service level. Principals in the study attributed high level of preparedness to serve as instructional technology leaders to the extensive professional development provided through IMPACT and the use of informal networks with their counterparts, not through coursework completed during principal credential courses. Moreover, the limited coverage of instructional technology in principal preparation programs as described by participants underscores the need for improvement to pre-service programs as well as comprehensive, thoughtful professional development for existing principals.

Principals described instructional technology leadership behaviors that aligned well to NETS-A standards. Teacher survey results validated the results provided by principals. When compared across school levels, significant differences were noted between the elementary and secondary (middle and high) teachers. Elementary teachers rated their principals lower across each of the five NETS-A standards.

Teachers shared the specific actions needed from their principals to make them successful when integrating technology in their classrooms. Teachers desired principals to: 1) provide relevant, job-embedded professional development, 2) be supportive as teachers acquire new skills, 3) pursue additional funding opportunities to ensure the acquisition of new technology devices and maintenance of a robust technology infrastructure, 4) adjust

policies and procedures surrounding digital citizenry to ensure technology is used in a safe, legal, and ethical manner, and 5) consider the context of the school including its locale and student population.

Future directions for research are suggested, including the completion of a comprehensive review of U.S. principal preparation programs and their ability to prepare principals for the rigor of the role of instructional technology leader and how that role varies by school level. Because technology will continue to be a focal point for schools, institutions of higher education must innovate their principal preparation programs so that principals have the opportunity to learn the how to be best attend to their schools' instructional technology needs.

An Exploration of Principal Instructional Technology Leadership

by
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DEDICATION

This dissertation is dedicated to:

My late mother-Janice Delores Hill. Thank you for all that you poured into me to make me the woman I am today. This effort was a labor of love. Knowing you were with me every step of the way made all the difference. I have completed what you started. (II Timothy 4:7-I have fought a good fight, I have finished my course, I have kept the faith.)

My family-my beloved husband- John, my amazing daughter-Sydney, my talented daughter-Taylor, and my intellectually curious son-William. Thank you for the sacrifices you made for me to complete this endeavor. Without your love and unwavering support it would not have been possible. Your continually belief that I could indeed make it to the finish line helped light a flame to my progress. We all learned during the process that you have to keep going to finish what you start no matter how long it takes. I implore you never give up, finish! You can do anything you put your minds to. (Philipians 4:13-I can do all things through Christ which strengtheneth me.)

BIOGRAPHY

LaTricia Walker Townsend was born in Fort Benning, Georgia in1972, but grew up in Raleigh and Garner. She is a product of the Wake County Public School System where she graduated from Garner Senior High in 1990. Ms. Townsend received a Bachelor of Science in Textile Chemistry with a concentration in Polymer Chemistry in 1994 and a Master of School Administration in 2005 from North Carolina State University.

Ms. Townsend began her professional career as a chemist for the Dow Corning Corporation. After two years in that role and acquiring teacher certification from Saginaw Valley State University, she entered the ranks of education as a high school teacher in 1996 with the Saginaw Public School System. She began teaching with the Wake County Public School System in 1998 and taught all levels of Chemistry-academic, honors and AP, Algebra I and II, as well as Integrated Mathematics. For a brief period, she left teaching and worked for the American Association of Textile Chemists and Colorists (AATCC) in RTP as a technical specialist who assisted those who had questions about textile wet processing standard test procedures.

In 2006, Ms. Townsend returned to her alma mater where she served as a Science Content Specialist for the state's testing program. In that role, she aided in the development of statewide standardized science assessments. She joined the Friday Institute Evaluation Team in September, 2008. Since that time, she has worked on numerous evaluation projects including: IMPACT, North Carolina Virtual Public School (NCVPS), Maximizing the Impact of STEM Outreach (MISO), Race to the Top, and Golden Leaf Essential Skills.

LaTricia is married to John Townsend, and they reside in Raleigh, N.C. They have three children-Sydney, Taylor, and William. She enjoys reading, traveling, cooking new recipes, and spending time with family. She is an advocate of scouting and spends much of her free time serving as a Girl Scout leader. She is a disciple of Wake Chapel Church.

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To my work colleagues at the Friday Institute for Educational Innovation at North Carolina State University, I am honored to co-labor with you to craft educational evaluation projects that make an impact on policy and practice in the state of North Carolina. I

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CHAPTER 1

INTRODUCTION TO THE STUDY

The Elementary and Secondary Education Act of 2001 (ESEA), later renamed "No Child Left Behind" (NCLB), passed with large majorities in both the Senate (87-10) and the House (381-41) and was signed into law by President Bush on January 8, 2002 (Hursh, 2007, p. 494). NCLB ushered in a revolution in schools with the noble goal of ensuring all—not some—children become proficient in reading and math by 2014. NCLB provides a necessary impetus for schools to change their practices. The law advocates the use of instructional technology as one such mechanism to improve student achievement.

The portion of NCLB that explicitly relates to instructional technology, Title II, Part D, Enhancing Education Through Technology (EETT), offers three goals. The first and broadest of the goals aims to improve student academic achievement by implementing the use of instructional technology. The second goal requires schools to assist students with acquiring technology literacy before exiting eighth grade. Specifically, it states that schools have the responsibility to "assist every student in crossing the digital divide by ensuring that every student is technologically literate by the time the student finishes the eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability" (Enhancing Education Through Technology Act of 2001, Section 2402, b, (2)). The third goal encourages state and local school officials to seek the use of "effective integration of technology resources and systems with teacher training and curriculum

development to establish research-based instructional methods" (Enhancing Education Through Technology Act of 2001, Section 2402, b, (2)).

As such, there is a tremendous push to implement various technology initiatives aimed at improving achievement in today's schools. The thrust to use instructional technology in schools has necessitated the need for schools to seek ways to acquire devices, plan for their use, train teachers and students, and assess their effectiveness. Charged with managing the implementation of instructional technology within their schools, principals must assure the necessary conditions are in place to facilitate the transition to such practices. For maximal results, the International Society for Technology in Education (ISTE) offers a common set of parameters, *Essential Conditions: Necessary Conditions to Effectively Leverage Technology for Learning* which suggests leaders strive for: shared vision, empowered leaders, implementation planning, consistent and adequate funding, equitable access, skilled personnel, ongoing professional learning, technical support, curriculum framework, student-centered learning, assessment and evaluation, engaged communities, support policies, and supportive external context (ISTE, 2008).

In striving for technology integration, principals are tasked with increasing the level of access to technology products and encouraging their use. Research conducted by the U.S. Department of Education Institute of Education Sciences (IES) (2000, 2010) suggests that both instructional technology availability and usage in schools have increased dramatically over the last decade. Using the Fast Response Survey System (FRSS), IES collects a variety of data each year about schools throughout the United States including information about

each school's degree of instructional technology deployment. The following table summarizes computer availability and usage from 1999 to 2009.

Table 1.1

Percent of Teachers Reporting Student Computer Availability and Student Use of Computers

		1999	**2009**
Availability	Computer Access in Classroom	84	97
	Computer Access Elsewhere in School	95	99
Usage	Student Computer Classroom Use	69	88
	Student Computer Use Elsewhere in School	78	91

Table 1.1: Source (IES, 2000 & 2010)

According to Table 1.1, teachers reported an increase in both availability and student use over a ten-year period. Each of the IES studies asked teachers to describe the frequency that students use computers according to the categories of *often, sometimes, rarely, never, and not available*. In 2000, teachers responded that their students used a computer in classrooms in the following fashion: 13%-rarely, 37%-sometimes, and 28%-often for a total usage rate of 69%; however, teachers in 2009 responded: 19%-rarely, 43%-sometimes, and 29%-often for a total student classroom usage of 91%. Clearly, the usage rates have increased substantially over the last decade. Although there has been an increase in both availability and usage, it is important to note that the uptick in availability and use do not necessarily translate into effective use of the available instructional technology products. Miltello and

Eroszlu (2013) assert, “Technophiles continue to pump technology into school at record rates, using the sheer abundance as measures of success” (p. 233).

The increase in technology in several schools has been the result of many schools participating in grant-driven projects or programs that provide technology products to schools. Since 2003, North Carolina has utilized EETT program funds to enact a comprehensive technology integration project known as IMPACT in 45 schools throughout the state (Overbay, Mollette, & Vasu, 2011). The IMPACT project provides a set of program components designed to maximize the effectiveness of technology integration, one of which is the provision of supportive leadership by the school principal and technology leadership team. It allowed participating schools to acquire technology devices which best fit their needs as determined by school leadership, but emphasized the necessity for schools to build capacity to employ the devices in a meaningful manner.

Similarly, locally funded technology initiatives have taken place in various school districts. Two such examples are the implementation of one-to-one laptop computing initiatives; the first of which was instituted in 2003 in a rural district in the northeastern part of North Carolina (Greene County Schools, 2009). Each student in middle and high school received a laptop computer, while students and teachers at the elementary level were given access to laptops via mobile laptop carts for classroom use. The second school district implemented its one-to-one program in phases with the first wave of laptop computers being provided to teachers during the 2007-08 school year along with extensive professional

development (Mooresville Graded School District, 2011). The second wave of computers was given to students in grades 4-12 across the 2008-09 and 2009-10 school years.

Ultimately, the success or failure of such technology projects hinges primarily upon the leadership in place within a school. For instance, “Scratch the surface on an excellent school and you are likely to find an excellent principal. Peer into a failing school and you will find weak leadership” (Leithwood & Riel, 2003, p. 2). The authors suggest that the quality of the person at the helm of a school can be the difference between success and failure within a school. The need for quality leadership is amplified when undertaking a technology initiative such as the facilitation of instructional technology usage within a school which is a complex process that requires a specific set of skills.

ISTE puts forth a set of standards widely accepted by school leaders across the United States. The National Educational Technology Standards for Administrators (NETS-A) embodies the traits necessary for successful instructional technology leadership (ISTE, 2009). NETS-A has the following constructs: Visionary Leadership, Digital-Age Learning Culture, Excellence in Professional Practice, Systemic Improvement, and Digital Citizenship. This model serves as the conceptual framework for this dissertation study. Each construct is followed by a set of three to five sub-constructs which explicitly describe educational technology leadership behaviors. Visionary Leadership embodies a leader’s actions towards the conceptualization, development, and implementation of a vision for technology integration in a school. Digital-Age Learning Culture is typified by an environment in which innovative teaching and student centered learning in all subjects are grounded in research-

based best practices and the involvement of school-level staff in larger learning communities. Excellence in Professional Practice relates to administrators participating in and promoting professional learning among their staff as well as providing the requisite technology resources for their schools. Systemic Improvement is best described as the enactment of continuous enhancements through a series of data-driven decisions. Lastly, Digital Citizenship is distinguished by ensuring ethical, legal, and social issues are addressed while facilitating a technology rich environment. According to ISTE, ascribing to the aforementioned standards as outlined in NETS-A provides principals with the best opportunity to provide the high level of instructional technology leadership necessary to support teachers as they work to deploy instructional technology in their classrooms.

Statement of the Problem

Leonard and Leonard (2006) polled 214 administrators in a southern state about their beliefs about technology and its use in schools. An overwhelming majority (97%) stated technology integration was vital to impacting the quality of teaching and learning in their schools; however, only 56% felt they were qualified and armed with knowledge and skills to lead their schools on their quest for achieving effective technology integration. The results of the study beg the question: How do principals become equipped to serve in the role of instructional technology leaders?

Unfortunately, preparation for service as a school principal may lack direct exposure to serving as an instructional technology leader. According to North Carolina State Board of Education policy QP-A-001(2006), all professional educators, including principals, must earn

and maintain a license for the area in which they are employed. The traditional route to obtaining North Carolina principal licensure requires the completion of an approved program in school administration aligned to the Interstate School Leaders Licensure Consortium's (ISLLC) "Standards for School Leaders" (Council of Chief State School Officers (CCSSO), 2008). These standards address general leadership practices with two functions explicitly focused on instructional technology leadership—Standard 2, Function H, and Standard 3, Function B, featured in Table 1.2 below.

Table 1.2

Interstate School Leaders Licensure Consortium (ISLLC) Technology Related Standards

ISLLC Standard	**Function**
Standard 2: An education leader promotes the success of every student by advocating, nurturing, and sustaining a school culture and instructional program conducive to student learning and staff professional growth.	Function H: Promote the use of the most effective and appropriate technologies to support teaching and learning.
Standard 3: An education leader promotes the success of every student by ensuring management of the organization, operation, and resources for a safe, efficient, and effective learning environment.	Function B: Function: Obtain, allocate, align, and efficiently utilize human, fiscal, and technological resources.

Table 1.2 Source: (CCSSO, 2008, p. 14)

While the presence of general standards is a positive mechanism for ensuring technology leadership is addressed in some way in the school administration curricula, the existence of just two standards addressing instructional technology functions may not ensure that future principals will be well equipped in this domain.

According to Barnett (2004), a gap exists between what is demanded in practice and what is provided in terms of preparation. He conducted a study in which he identified activities aligned to ISSLC standards. He asked respondents to rate how often they engage in the activities (*1-never, 3-sometimes, 5-always*) as well as how they gauged the effectiveness of their preparation to complete the activities based on their preparation in a graduate program curriculum based on ISSLC standards (*1-needs improvement, 3-adequate, 5-excellent*). Across all respondents, there was a small difference in the means of practice and preparation in the area of supporting technology use. The practice mean was 4.17 and the preparation mean was 3.43. Barnett (2004) suggests future principals engage in coursework designed to better equip them in the area of technology leadership: "Courses related to instructional technology must require students to explore the various uses of technology in today's best schools and then compel students to put those in place" (p. 126).

Although scholars have expressed the need for changes to principal preparation programs, McLeod and Richardson (2011) still found areas for improvement as of late. They cited three broad areas pertaining to technology as it relates to educational leadership programs. One area of focus for educational leadership programs has been to update their pedagogical techniques to reflect today's reliance on technology. The second area of interest has been the move to train aspiring principals to integrate technology in their leadership practices such as using technology to enhance the effectiveness and efficiency of the communication with school leaders and school stakeholders. The final area is the inclusion of instructional technology leadership content into coursework.

Additionally, gaining principal licensure in North Carolina allows principals to serve in the K-12 setting with no additional requirements for specific grade levels. While the rudimentary leadership skills of a principal may be applicable to all grade levels, a one-size-fits-all approach is dangerous and presents problems for school principals practicing instructional technology leadership at different school levels. Teachers engaged in the application of instructional technology through a structured program at each level may necessitate different leadership characteristics and behaviors from their principals to experience success. Anderson and Dexter (2005) conducted a study which showed differences exist in teacher perceptions of principal instructional technology leadership. The researchers hypothesized that differences were likely due to size differences in elementary schools versus middle and high schools. Further study to investigate the issue of differences in instructional technology leadership based on school level could help refine the preparation process and professional development processes for principals.

Pressure to improve student achievement leaves school principals seeking new ways to institute change within their schools. Many embark upon instructional technology initiatives with the belief that these efforts will lead to substantive changes. To its detriment, the institution of education often functions in a top-down orientation. The top-down orientation as described in Bolman and Deal (2008) exists in schools and leads to problems with the buy-in of teachers as they are placed in a position of following the whims of those at the top. Unfortunately, participation in any change initiatives is often decided upon by a

select few individuals in administration; however, the implementation falls to the teachers (Bolman & Deal, 2008; Fullan, 2007).

Deal and Nutt (1979) describe a scenario in which a school district applied and received a large sum of money to fund a technology initiative. Due to a tight deadline, school administrators completed the application process without the input of teachers. When awarded the funding, the administrators were confused by the teachers' lack of enthusiasm for the new initiative and chalked up their ill feelings to an aversion to change. The issue was the teachers were extremely angry that they had to implement a program in which they had no input. The program appeared to be doomed to less than expected results because of how the process was handled. Because of how the project was conceived, failure appeared to be likely.

To prevent a situation similar to the aforementioned scenario, Oliver, Mollette, and Corn (2012) suggest eliciting staff buy-in to enable maximal results for a 1:1 computing program. The offer five actions that could lead to buy-in: implementing a framework (e.g., IMPACT model) prior to technology device acquisition, providing professional development, increasing teacher collaboration, allowing teachers the time and opportunity to adapt to new instructional practices, and ensuring adequate infrastructure for connectivity.

While teachers shoulder the responsibility to effectively implement the different strands of a technology program within their classrooms, principals hold the key to ensuring the climate and culture of the school lends itself to innovation. Unfortunately, many teachers cite poor principal leadership as a possible impediment to technology usage (IES, 2000). As

an effective instructional technology leader, principals must facilitate meaningful instructional technology deployment which stems from a clearly articulated and actionable vision, equitable access to an array of technology products as part of a robust infrastructure, and facilitation of and participation in high quality professional development and communities of practice.

Purpose of the Study

The purpose of this study was to examine the instructional technology leadership behaviors of principals who serve K-12 schools in North Carolina at schools engaged in a structured technology initiative. The study explored leaders' instructional technology preparation mechanisms. It also assessed the alignment of principal instructional technology leadership behaviors to industry-standard best practices and determined if differences existed in teacher perceptions' of principal leadership behaviors at different school levels (i.e., elementary, middle, and high). Finally, the study investigated the specific instructional technology leadership behaviors desired by teachers at various school levels to better inform principals tasked with implementing effective instructional technology programs.

Research Questions

This study addressed the following questions:

1. How do IMPACT teachers' perceive the level of instructional technology implementation in their schools, and does variance exist by school level?
2. In which ways do principals become prepared to serve as instructional technology leaders?

3. In what ways do principals approach instructional technology leadership, and does variance exist by school level?
4. In which ways can principals best meet the needs of their teachers through their instructional technology leadership, and does variance exist by school level?

Definition of Terms

Instructional Technology- the deployment of various technological devices by teachers and students to individualize and improve learning.

Instructional technology devices- computers, cameras, audio devices such as iPods and MP3 players, PDA's, GPS devices, computer-based probes, calculators, etc.

Instructional Technology Leadership- the behaviors and practices of a school principal applied to the facilitation of students, teachers, and other staff members engaging in the use of instructional technology.

International Society of Technology Educators (ISTE) - an educational technology organization which provides technology standards across various stakeholders-students, teachers, and administrators.

National Education Technology Standards for Administrators (NETS-A)-a set of standards for educational administration created by the ISTE.

One-to-one computing environment- each student in a classroom is provided a laptop computer for educational purposes.

School Technology Needs Assessment (SNTA) - an instrument which measures a school's level of technology integration

Technology- any tool used to assist or enhance a pre-existing process.

Technology Literacy- the ability to use computers or other technological devices in a meaningful way to improve learning, productivity, and performance.

Overview of Research Design

A mixed methods research approach was utilized to determine the level of technology integration, to ascertain principals' instructional technology leadership behaviors and their alignment to NETS-A, and to uncover teachers' desired principal instructional technology leadership behaviors. In Phase I of the study, descriptive statistical analysis procedures were conducted on data from the School Technology Needs Assessment (STNA) survey followed by Kruskal Wallis analysis of the data to determine if differences existed by school level. In Phase II of the study, seven principals interviewed about their instructional technology preparation and behaviors. Additionally, teachers of all school levels were surveyed about their principals' level of alignment to NETS-A and the instructional technology leadership behaviors desired by teachers to effectively spur quality technology integration within their schools.

Significance of the Study

To date, several studies explore instructional technology usage in the K-12 setting; however, the main areas of research focus on improving equity of access to technology and

using instructional technology as a vehicle to spur student achievement (Gosmire & Grady, 2007). The researchers further posit, “The body of research in educational technology is narrow compared with other knowledge bases in education. This is a field of emerging research—and the verdict is still out on all fronts” (p.18). Further, with specific respect to research surrounding educational technology leadership, McLeod and Richardson (2011) contend, “We have little to no scholarly knowledge about what it means to be an effective school technology leader” (p.3). Because the literature base in the area of instructional technology leadership is thin, this study is timely and will bolster the knowledge in this area.

While the behaviors of effective technology leaders exist writ large via NETS-A, this study will provide insight into the specific subset of skills desired by teachers at each level of K-12 education-elementary, middle, and high school. Using the framework designed by ISTE, this study seeks to examine teachers’ perceptions of the qualities of principals germane to each level that may enhance their effectiveness as instructional technology leaders.

The study will be significant for use in policy and practice to federal, state, and local level stakeholders who may be tasked with altering policies regarding principal standards and licensure, developing principal hiring protocols, tailoring educational leadership programs for aspiring principals, and creating meaningful professional development for existing principals. National and state level agencies can determine how to integrate technology strands into existing standards and licensure requirements to accurately reflect the need to equip principals with essential technology leadership skills. District-level staff and school boards can use a specific set of instructional technology leadership indicators to facilitate the

hiring process of principals. Educational leadership programs can design their curricula to ensure that 21st century leadership is developed such that principals can employ sound instructional technology practices. Finally, the findings of this study may help providers of professional development design more effective training programs in instructional technology leadership for school administrators.

Organization of the Study

This chapter overviewed the purpose of the study in relation to the problem, research questions, definition of pertinent terms, and the significance of the study. The next chapter will review research regarding instructional technology leadership. The following will be presented: a brief history of instructional technology, a survey of federally funded technology initiatives including a specific example from North Carolina, an exploration of the role of instructional technology leader, instructional technology leadership preparation, and a view of instructional technology leadership by school level. The third chapter will describe the methodology to be implemented in this study, with an emphasis on data collection and analysis procedures. The fourth chapter will detail the data collected from principals and teachers participating in the study. Finally, chapter five will include a summary of the study, discussion of findings, alignment to existing research, recommendations and implications for educational practice, and recommendations for further research.

CHAPTER 2

LITERATURE REVIEW

Introduction

In the era of accountability in which schools are tasked with improving each student's level of achievement, principals actively seek more novel ways in which to change the teaching and learning practices prevalent in their schools. The implementation of various forms of instructional technology is one possible mode of change; however, the pervasiveness of the change largely depends on the direction set forth by the principal. Technology integration must be implemented in a meaningful and practical manner in order to fully reap its benefits. This necessitates the use of the appropriate fiscal, technological, and human resources in concert with administrative oversight provided by school principals.

Bennett (1996) suggests that schools are greatly influenced by the ever-changing technology available, and it is of great importance that school principals' "attitudes and actions" accommodate the changes (p. 57). Change of any kind, especially the implementation of instructional technology strategies, cannot be effectively facilitated without the presence of a strong leader who possesses specific characteristics. While Marzano's (2003) assertion that leadership is the most crucial feature of effective school reform is geared to general principal leadership skills, it readily applies to the subset of leadership skills known as instructional technology leadership.

A review of the research literature relevant to this mixed-methods study which seeks to explore the instructional technology leadership practices and behaviors of principals is

provided. A historical overview of instructional technology is presented, followed by a look at instructional technology initiatives funded under the auspices of EETT. Next, the key competencies, as evidenced by NETS-A, necessary to serve in the role of an instructional technology leader are explored as well as a candid look taken at principals' preparation process to serve in the capacity of instructional technology leaders. Finally, a portion of the review is dedicated to reviewing how technology leadership has been studied across levels.

History and Background of Instructional Technology

Defining Instructional Technology. Bebell, Russell and O'Dwyer (2004) assert that no clear definition for instructional technology exists. In fact, many definitions of instructional technology abound (Cuban, 2001; Hew & Brush, 2007; Reiser, 1987; Robyler, 2003). A definition offered by Robert Reiser (1987) has stood the test of time and remains relevant. He describes a statement provided in 1970 by the United States Commission on Instructional Technology which sought to more clearly define the meaning of instructional technology. According to the Commission, instructional technology can be thought of in terms of the actual devices or the process of using such devices in a systematic fashion to enhance overall instruction. Reiser further describes a third component to instructional technology to be individualized instruction which can be attributed the 1972 Definition and Terminology Committee of the Association for the Educational Communications and Technology. The committee posited that there should be a concerted effort to ensure that the "range of resources used for learning, emphasizing the individual learner and his unique needs, and using a systematic approach to the development of learning resources" (p. 12).

Using this three-pronged definition, instructional technology can be simply thought of as the process of delivering personalized instruction to students enhanced with the use of various technological devices.

Evolution of Instructional Technology. In terms of the devices, the lineage of instructional technology devices, also known as audiovisual devices, may be traced to the works of Johann Comenius in the 1600s and to Pestalozzi in the 1800s. Both conjectured that learners may be best taught by accessing their senses during instruction through the use of pictures or actual objects in concert with spoken and written instruction (Reiser, 1987). Comenius gave rise to the first set of illustrated textbooks and Pestalozzi developed a teaching method in which objects were used during instruction and it remained popular in the United States until the 1860s.

During the 1900s, the growth of instructional technology was explosive. In the early 1900s, school museums which are akin to modern-day district media centers were developed to house and distribute a collection of educational materials including slides, films, prints, and charts (Saettler as cited in Reiser, 1987). The 1920s gave rise to photographic media and educational films were first used. The 1930s saw the use of television at the State University of Iowa and the 16mm sound motion picture came onto the scene. The 1950s marked the use of mainframe style computers to train pilots and the use of recorded films to train troops during World War II. An influx of federal funds in the 1970s led to the use of mainframe computer-aided instruction at both the K-12 and collegiate levels. The introduction of the first microcomputer or personal computer in the late 1970s paved the way for schools to use

computers in the 1980s for instructional usage. The internet or the World Wide Web connected schools to additional resources in the 1990s. Since that time, a proliferation of devices for instructional use has been developed and deployed in schools. Current and popular devices include, but are not limited to laptop computers, tablets, LCD projectors, interactive white boards, and student response systems.

Political Pressure to Increase the Use of Instructional Technology. As a direct result of the increasing availability of various instructional technology devices, political pressure has been placed on schools to implement higher levels of instructional technology use. In 1983, the National Commission on Excellence in Education produced *A Nation at Risk* which detailed a set of findings and recommendations tied to the areas of Content, Standards and Expectations, Time, Teaching, and Leadership and Fiscal Support (Gardner, 1983). It painted a gloomy picture of schools that suggested immediate and continual intervention was necessary to assist schools and suggested reforms in K-12 that would assist students and teachers with becoming more technologically literate.

Similarly, the Goals 2000: Educate America Act, signed into law in 1994, had a specific portion geared to the advancement of instructional technology usage with school (United States Congress, 1994). Part C entitled Leadership in Educational Technology stated that a national strategy and vision would be developed in an effort to provide leadership at the federal level through the Department of Education. A list of four objectives and several sub-objectives are provided which involve the integration of technology into educational programing and training, the coordination of educational technology activities across federal,

state, and local level constituent groups, the establishment of guidelines to ensure equity of access to all schools systems, and the development of federal policies and programs which facilitate the use of instructional technology. Following momentum generated by Goals 2000, the first educational national technology plan was released in 1996-Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge. A report to the nation on technology and education (Riley, Kunin, Smith, & Roberts, 1996), presents four goals for the U.S. to work towards- ensuring all teachers have the appropriate training to teach students using technology resources, addressing issues of access to up-to-date computers, enabling access to the world wide web, and integrating software and online resources into local school curricula.

Ten years later, the National Educational Technology Plan 2004, *Toward a New Golden Age in American Education: How the Internet, the Law and Today's Students are Revolutionizing Expectations,* offered seven action steps to be implemented by state, district, and school leaders. They suggest the following: strengthen leadership, consider innovative budgeting, improve teacher training, support e-learning and virtual schools, encourage broadband access, move toward digital content, and integrate data systems. When adhered to, the recommendations provide a clear and comprehensive approach to technology integration.

In the same vein, 2010 marked the release of an updated version of National Technology Plan-*Transforming American Education: Learning Powered by Technology*. It sets forth the following goals: create learning experiences which are "engaging an empowering" for all students, assess the most critical areas will be leveraged to generate data

for continuous improvement cycle, bolster the effectiveness of professional educators by providing them with the appropriate tools, create access to a robust and reliable infrastructure for learning, and restructure our educational system to best make use of available technology to create efficiency.

Another impetus to encourage school reform has been the Race to the Top (RTTT) competitive grant program which was a part of the American Recovery and Reinvestment Act of 2009 (ARRA) (U.S. Department of Education, 2009). The program required states to strive to enact innovative strategies to improve student-level outcomes. The ARRA allocated $4.35 billion for RTTT. One of 12 states, North Carolina received nearly 400 million dollars in 2010 to spend on four core areas: (1) Adoption of internationally-benchmarked standards and assessments that prepare all students for success in college and the workplace;(2) Construction of data systems that measure student success and inform teachers and principals in how they can improve their practices; (3) Attention to increasing teacher and principal effectiveness, and achieving equitable distribution of effective teachers and principals; and (4) Development of plans to turn around the lowest-achieving schools (North Carolina Office of the Governor, 2010). Each of these areas is addressed through a comprehensive NC RTTT plan, many of which address instructional technology in some fashion (e.g., infrastructure, district device acquisition, professional development on Common Core). Among these is the NC Education Cloud program which addresses infrastructure within school districts. It provides a comprehensive approach for districts to store data using the cloud concept instead of local servers (North Education Cloud Team, 2011). The NC Education Cloud program

provides districts, especially ones with less financial resources, to enhance their technology infrastructure and remain up-to-date with the latest technological advances.

This section presented information on federal reports and plans that have impacted the state of technology integration in K-12 education. Over time, these reports and plans have filtered down through state-level leadership in an effort to reach individual school districts and schools. The next section examines technology integration projects spawned from these plans.

Technology Integration Projects

EETT Technology Integration Projects. Several school technology integration projects stem from the federal government granting funds to states to be disseminated to individual schools and school districts under the auspices of the Enhancing Education Through Technology Act of 2001, a provision of the No Child Left Behind legislation. One of the main goals of EETT is to improve student achievement in K-12 education through the use of technology. Additionally, in accordance with the national goal of all students becoming technologically literate by the end of the eighth grade, one strategy of the program is to provide resources to accomplish this task. EETT enables teachers, administrators, and other school staff to receive the appropriate professional development and technology resources to facilitate the successful integration of technology into teacher instruction and student learning.

According to State Strategies and Practices for Educational Technology: Volume I—Examining the Enhancing Education Through Technology Program, in the first five years of

the United States Department of Education administering the EETT program, it disseminated nearly $2.7 billion to states and localities to support increasing instructional technology in elementary and secondary instruction (United States Department of Education, 2007). Once distributed to states, state education agencies (SEA) may keep a small portion, no greater than 5 percent, for state level activities, while the remaining funds are distributed equally between formula funds which are poverty-weighted and by competition. Both are designed to reach districts with the highest number of students living below the poverty line. Due the unique nature of each state, individual states develop individual programs in a manner which best meets the needs of its schools. EETT guidelines allow states wide latitude in the use of EETT resources for technology device acquisition, technology infrastructure improvements, professional development (25 percent minimum), and developing technology integration practices aimed at increasing student achievement and equity of access to technology resources.

NC EETT Funded Technology Initiative-IMPACT. In 2003, eleven schools were awarded EETT grants by the North Carolina Department of Public Instruction to implement the IMPACT model within their schools (Osborne, Overbay, Seaton, Vasu, & Grable, 2006). Comprised of several integral components, the IMPACT model consists of hiring full-time media and technology personnel, allowing dynamic leaders to create an atmosphere conducive to technology integration, providing flexible access to media centers and technology labs, acquiring and integrating technology resources to promote effective teaching and learning practices, encouraging collaboration among teachers, engaging in

formative assessment, and offering professional development to support all elements of the model (Bradburn, 2005). Each school chooses how best to implement the model given each school's specific needs. Support with model implementation is provided by the Instructional Technology Division of the North Carolina Department of Public Instruction.

Since 2003, additional versions of IMPACT have been implemented across the state in both rural and urban areas-IMPACT I, IMPACT II, IMPACTing Leadership, IMPACT III, IMPACT IV, IMPACT Continuation, and IMPACT V. The various iterations of IMPACT have leveraged lessons learned from each version to enhance the quality of the program (Osborne et al., 2006). For instance, the first two versions of IMPACT featured single schools in each school district, or local education agency (LEA) selected for participation in the grant. As a result of evaluation findings, it was determined that a greater support system was needed. As a result, future versions employed a district approach with district leaders being trained simultaneously with school-level staff members for a greater sense degree of continuity and support across each school in the district. Table 2.1 provides greater detail about each of the various IMPACT model cohorts.

Table 2.1

IMPACT Model Detail

IMPACT Model	Schools	Years	Model Notes
IMPACT I	8 Elementary Schools and 2 Middle Schools each in a single LEA	2003-2006	Grant funds could be used to hire personnel. Most schools used funding to hire one or more of the following: technology facilitator, a media assistant, a technology assistant or technician. Professional development occurred over the course of the grant period.
IMPACT II	5 Middle Schools each in a single LEA	2007-2009	This iteration of the grant sought to more fully test the model at the middle school level. Elements of professional development from the previous iteration were monitored and adjusted as necessary to meet the unique needs of middle school.
IMPACTing Leadership	4 School Districts	2006-2008	Summer and quarterly professional development workshops were provided for both school and district level leaders.
IMPACT III	3 School Districts-17 schools total All school levels	2008-2010	Selected IMPACTing Leadership districts/schools that funded a media specialist and a technology facilitator in the previous year and met other requirements. Professional development was completed prior to the onset of the implementation. This version of IMPACT marked the first time that funds could not be used to pay for salaries for personnel.
IMPACT IV	4 School Districts-13 schools total All school levels	2008-2010	Year-long training was interspersed throughout the first year of implementation.
IMPACT Continuation	Selected IMPACT II, III, and IV Schools-33 schools total All school levels	2010-2011	This iteration of the grant provided funding for schools to continue their efforts to increase each school's level of technology integration. The seven participating high schools used funding to implement 1:1 computing environments.
IMPACT V	9 School Districts- 12 schools-total Middle and High School	2011-2013	This iteration moves from the sole technology facilitator to a team of facilitators, one from each of the four content areas. Professional development in this model is provided during the implementation phase of the grant. Professional development about instructional technology is provided about integrating technology and general leadership practices. A principal or assistant principal from each participating school will earn educational specialist (Ed.S.) licensure through the University of North Carolina at Greensboro and each of the four core participating teachers will earn a Master's degree in instructional technology from UNC-Charlotte.

Table 2.1 Source: Mollette, Overbay, Corn, Townsend, Townsend, 2011; Division of Instructional Technology North Carolina Department of Public Instruction, 2011.

Schools across the state are encouraged to use the model in their schools, even in the absence of participation in the actual grant (Overbay, Mollette, & Vasu, 2011). Materials about the implementation are widely available and free to use. Many of the strategies can be enacted without a high fiscal cost. One of the major components of the IMPACT model is providing strong instructional technology leadership to provide the necessary leadership, infrastructure, resources, and a deep commitment to moving their teachers and students to the use of technology in a meaningful manner. The next section of this chapter features a glimpse of this role.

Role of Instructional Technology Leader

> Although the role of the principal is frequently cited as the key element in school reform, it is not the solitary role of past times. It is a role that demands skills in enhanced team building, shared decision making, and enhanced technological competency. (MacNeill & Delafield, 1998, p. 296)

The role of a principal is varied and continues to evolve especially in today's time of increased access to technology. Principals are organizational leaders, strategic leaders, instructional leaders, political leaders, community leaders, and change leaders as well as technology leaders (Brockmeier, Sermon, & Hope, 2005). Kafka (2009) chronicles the role of the school principal from the days of a lead teacher with administrative responsibilities in a school to that of today's principal with a multitude of roles serving at a time in which political pressure is immense. With the impetus to increase the level of instructional technology use, principals find themselves in a position to serve in a relatively new capacity-

instructional technology leader, while still focusing on traditional roles such as the management of fiscal and human resources, the acquisition and distribution of curricular materials and basic supplies, the instructional leader, the creation and maintenance of a positive tone for student learning and behavior, the implementation of school, district, state, and federal guidelines, the facilitation of school improvements and overall maintenance, the development of business and community partnerships, and a myriad of other roles necessitated by the daily rigors of the position (Valdez, 2004).

Richardson and McLeod (2011) studied the phenomena of technology integration and the associated technology leadership of principals in Native American schools. In their qualitative study, researchers explored each school's level and degree of access to technology, technology funding sources, technology leadership, and the relationship between technology and Native American culture. It was found that many of the issues plaguing Native American schools unearthed in the study reflect those of other schools that serve more heterogeneous populations of students. Three major impediments to meaningful technology were uncovered. They were: staff members who were unable or unwilling to use technology in their teaching practices due to limited access to high quality professional development, limited numbers of school-level technology coordinators based on funding, availability, isolation, and poverty of their schools, and an inadequate number and type of technology devices. These conditions are further confounded by dated facilities with inconsistent and unreliable technology connectivity.

Overcoming the barriers that inhibit meaningful technology use falls to principals. Mehlinger and Powers (2002) posit, “It is no longer possible for administrators to be both naïve about technology and be good school leaders” (p. 218). While the activities of a principal may be varied, the ultimate goal of principals serving in the role of instructional technology leader is to assist teachers with attaining meaningful instructional technology integration in their classrooms which in turn will yield academic benefits for students. Utilizing the National Educational Technology Standards for Administrators (NETS-A) standards (Visionary Leadership; Digital-Age Learning Culture; Excellence in Professional Practice; Systemic Improvement; Digital Citizenship) as a basis for their practice is one such mechanism for addressing the need to function as a competent instructional technology leader (ISTE, 2009).

Further, several researchers offer frameworks—many of them in part based on NETS-A Standards (2000; 2009), which delineate instructional technology leadership behaviors and strategies to increase the level of technology usage in their schools (Anderson & Dexter, 2005; Chang, Chin, & Hsu, 2008; Flanagan & Jacobsen, 2003; McLeod & Richardson, 2013).

According to the NETS-A Standard, Visionary Leadership, principals are to lead the process of crafting and executing a comprehensive technology integration vision in concert with various stakeholder groups. Flanagan and Jacobsen (2003) recommend the visioning process focus on a holistic plan and not become mired solely in the acquisition of technology tools. Establishing a technology vision for the school and clarifying the context for which it

is to be situated ultimately falls to the principal (Brockmeier et al., 2005; Fullan, 2001); however, a leader may choose to use the common option of creating a shared vision through the use of a school technology committee (Anderson & Dexter, 2005; Fishman & Pinkard, 2001). Ultimately, a school technology committee can serve as an "organizational mechanism for developing consensus on technology visions and for distributing the leadership function across different administrative and instructional staff" (Anderson & Dexter, 2005, p. 58). In a later study—a cross-case analysis of team-based technology leadership within a 1:1 student laptop initiative—Dexter (2011) further asserts that this approach allows for multiple perspectives and types of expertise which in sum permits for stronger instructional technology leadership.

The second standard of NETS-A, *Digital Learning Culture*, suggests that principals foster an environment within their schools that is ripe with the appropriate use of technology. Hew and Brush (2007) conducted a comparative analysis of educational technology studies in which they reviewed the types of barriers that could impede technology integration in schools. They categorized the barriers across six broad areas that leaders must consider: resources, knowledge and skills, institution, attitudes and beliefs, assessment, and subject culture that leaders must consider. Further, Baylor and Ritchie (2002) investigated the impact of factors critical to successful integration of technology in schools. They determined principal technology leadership to be an important factor in successful technology integration efforts. The researchers suggest,

> Administrators who promote the use of technology, not only in words but also in action, lend credence to a technology culture…The bottom line appears to be that administrators who wish to nurture a technology culture need to figuratively 'roll up their sleeves and join in' rather than sitting by the side. (p. 412)

To create this type of environment, principals must understand what constitutes meaningful teaching and learning practices and seek to support teachers as they enact them (Militello, Friend, Hurley, & Mead, 2011). In addition to principals understanding their own standards for technology integration, administrative knowledge of the standards for both teachers and students enables administrators to best support innovative environments within their schools.

School administrators providing adequate opportunities to engage in professional learning experiences to enable the use of various technology resources is the crux of the third NETS-A standard, *Excellence in Professional Practice*. Research supports offering the appropriate professional development to school staff as a crucial component to the successful implementation of technology integration (Anderson & Dexter, 2005; Chang et al., 2008; Flanagan & Jacobsen, 2003). Further, Flanagan and Jacobsen (2003) report that many professional development opportunities initially focus on the mechanics of learning a particular tool or technique and do not emphasize "technology integration strategies or project design skill" (p. 127). Research from an evaluation study echoed the work of Flanagan and Jacobsen (2003) in noting the transition from learning a specific technology skill to actual technology integration behaviors generally takes place after the first year of a technology integration project (Overbay et al., 2011).

The fourth NETS-A standard, *Systemic Improvement*, suggests that administrators utilize leadership strategies to employ technology in a manner that facilitates positive change in their schools. Eliciting change in a school is a complicated and often a time-consuming process which according to Fullan (2001) could take a period of three to five years to implement with more complex change requiring longer periods of time to fully implement. To assess and promulgate the change process surrounding the successful implementation of technology integration, principals should use available data to drive decisions within their schools (Gosmire & Grady, 2007; Wargo, 2006). The researchers suggest using technology as the conduit to collect, manage, and interpret data such as student scores on various formative and summative assessments, stakeholder technology satisfaction surveys and skills inventories, and staff and student usage logs.

The final NETS-A Standard, *Digital Citizenship*, suggests that principals model and require responsible technology usage by assuring the social, ethical, and legal factors are attended to within their schools. Once schools have secured the appropriate devices, principals must then ensure that technology use happens in a safe, ethical, and legal manner under the auspices of various federal and state laws, as well as local city ordinances and school policies (Brooks-Young, 2009; Garland, 2009). Garland states, “School leaders have additional responsibilities to promote safe Internet use policies, protect student privacy, adhere to copyright laws, and establish student health and environmentally sound policies” (p. 40). Increased access to the internet and various forms of social media adds another dimension to be addressed. Schools must monitor inappropriate contact with adults as well as

the phenomenon known as cyberbullying, a form of taunting or teasing where students are attacked by posting hurtful words or images using the internet or mobile devices (Smith, Mahdavi, Carvalho, Fisher, Russell, & Tippett, 2008). Summarily, Warschauer (2005-2006) suggests thoughtful consideration be given to how students will be monitored while using technology devices to ensure high on-task behavior rates and calls for the enactment of acceptable use policies and various forms of filtering and monitoring to ensure students' safe, legal, and ethical use of technology.

Used as a frame for bolstering technology leadership skills and behaviors, NETS-A standards provide principals with a mechanism to understand their role as an instructional technology leader in their schools (Anderson & Dexter, 2005; Chang et al., 2008; Creighton, 2003). Creighton (2003) suggests,

> These standards enable us to move from just acknowledging the importance of administrators in defining the specifics of what administrators need to know and be able to do in order to discharge their responsibility as leaders in the effective use of technology in our schools. (p. 1)

Ultimately, the degree to which a principal understands and enacts the sound instructional technology leadership behaviors impact the level of technology integration attained by teachers and students (Dawson & Rakes, 2003). Spillane, Halverson, and Diamond (2004) opine that, "leadership is thought to be critical to innovation in schools" (p. 3). Without basic instructional leadership technology competency, it stands to reason that most school leaders will lack the ability to understand the various policy and planning issues related to the

successful implementation of technology within their schools. The next section focuses on the mechanisms in place for principal preparation for instructional technology leadership.

Preparation of the Instructional Technology Leader

Mehlinger and Powers (2002) contend “graduate school programs generally are doing a poor job in preparing school principals and superintendents to be technology leaders” (p. 218). Several researchers (Barnett, 2004; Flanagan & Jacobsen, 2003; McLeod & Richardson, 2011; Redish & Chan, 2007; Richardson, Bathon, & Flora, 2013;Yu & Durrington, 2006) mirror the assertion of Mehlinger and Powers (2002) through their studies which found that thrusting principals into the role of an instructional technology leader left many of them feeling ill-prepared for the task. Unfortunately, the process of becoming equipped to serve in the role of instructional technology leader largely comes from trial and error or on the job training as the current modes of preparation fall short.

In general, educational leadership programs have failed to make changes to their programs to keep up with the needs of practitioners. Barnett (2004) found leadership programs deficient in their ability to align their programs with the rigors and demands of actual practice, especially in the area of instructional technology. Most programs address technology through existing courses and not through dedicated instructional technology leadership courses. This approach does not to appear to assist principals to the extent that would adequately prepare principals to serve in the role of instructional technology leader (McCoy-Thomas, 2012). An early example in the literature which deviates from the general lack of progress in this area chronicles the development of course specifically designed for

the purpose of developing instructional technology leadership behaviors (Davidson & Maurer, 1995). Understanding the need to improve the ability of its graduates to serve as instructional technology leaders, an educational leadership professor with a keen interest in instructional technology created a course entitled, “Leadership in Instructional Technology”, to address the deficiencies that many practitioners cited as hindering their development in the area of instructional technology leadership (Davidson & Maurer, 1995). The course sought to address the role of technology in improving the teaching and learning strategies in the K-12 setting. The course focused on three main areas: exploring instructional models and strategies, acquiring the appropriate hardware and software applications, and investigating leadership theory.

Redish and Chan (2007) conducted a study about 58 future principals’ perceived readiness to serve as an instructional technology leader as a result of completion of an educational leadership program located in the southeast portion of the United States. They assessed program participants’ perceived ability to adhere to NETS-A standards via a researcher developed instrument. Across all of the subscales measured (Leadership and Vision; Learning and Teaching; Productivity and Professional Practice; Support, Maintenance, Operations, and Finance; Assessment and Evaluation; and Social, Legal, and Ethical Issues), participants rated the program to have a mean value of 3.602 with a standard deviation of 1.285 which suggests that the answers among participants varied widely. The areas of Support, Maintenance, Operations and Finance, and Assessment and Evaluation were rated the least favorably with means of 3.137 and 3.372, respectively. Participants

identified the need for assistance with the developing and refining the skills necessary to develop solutions for simple technical issues, allotting funds for the appropriate technology resources, evaluating the efficacy of technology resources, and assessing the change in student technology skills.

Similarly, participants in Yu and Durrington's 2006 study consisted of in-service teachers (n=57) enrolled in an educational leadership graduate program and their mentors who served as active school administrators (n=16). They evaluated each participant's perceived ability to meet national technology standards for administrators and desire for additional professional development. The researchers found no difference in aspiring principals and practicing principals in terms of their perceived ability to meet administrator technology standards overall. However, there was a significant difference in ratings of practicing and aspiring principals in the ratings of their desire to attain additional professional development about the standard addressing social, legal, and ethical issues. Aspiring principals indicated that they would benefit from receiving additional professional development in this area.

Barnett (2004) surveyed practicing principals as to their perceived adherence to Interstate School Leaders Licensure Consortium (ISLLC) Standards-general leadership standards adopted by several states. Principals rated themselves in terms of how frequently they utilize behaviors outlined in the standards and how well they rate their programs of educational leadership as preparing them for the role of being a practicing administrator. With specific regard to their role as using various forms of evidence to measure how well

technology is implemented in their school, respondents felt there was a disconnect between their practice and their preparation in this area of utilizing various data sources to measure the effectiveness of technology integration within their schools.

The studies cited before address initial principal leadership programs at the masters-level. A study by Richardson et al. (2013) addresses the incorporation instructional technology leadership topics at the doctoral-level. Practicing principals Educational Leadership program were studied to determine how their vision of instructional technology would evolve while engaged in a graduate course about the topic. Students were asked to create technology plans at the onset of the course and to make changes as a result of what they learned at the end of the course. Using NETS-A as frame, researchers analyzed how each of the standards was addressed in the plans. Researchers desired to learn "how students matured in their visions of school technology leadership and what actionable steps they will make when they lead their own schools" (p. 157). Changes to participant plans drawing them closer to alignment to NETS-A standards were observed. The researchers expressed their belief that the participants would be better prepared to lead their schools' technology integration efforts.

Furthermore, Richardson, Bathon, and Flora (2013) assert that the topic of instructional technology leadership must be woven into the required coursework that will enable these future school leaders to create visions that directly align with the internationally recognized NETS-A" (p. 158). They call on those in the field to consider adding a course to

those required for school leaders, or reworking courses to integrate instructional technology leadership topics across other courses.

Research overwhelming indicates that principals are thrust into their role of instructional technology leader with a system of preparation that may leave them feeling underprepared (Barnett, 2004; Flanagan & Jacobsen, 2003; Mehlinger & Powers, 2002; Redish & Chan, 2007; Richardson, Bathon, & Flora, 2013; Yu & Durrington, 2006). Additional preparation deficiencies may be uncovered when the level at which a principal serves is taken into account. The next section takes a candid look at the differences reported in instructional leadership across levels.

Instructional Technology Leadership by School Level

Most studies surrounding instructional technology leadership utilized samples from the elementary level (Bowen-Grey, 2010; Chang et al., 2008; Flanagan & Jacobsen, 2008; Macaulay, 2009). Studies geared specifically at the middle and high school level were not located during the review. A limited number of research studies investigated various aspects of instructional technology leadership across all school levels-elementary, middle, and high (Anderson & Dexter, 2005; Dawson & Rakes, 2003; Ertmer et al., 2002).

Two recent studies about instructional technology leadership used the elementary level in their samples (Grey-Bowen, 2010; Macaulay, 2009). In her dissertation study, Grey-Bowen (2010) explored 103 principals' proficiency and perceived importance of technology leadership based on NETS-A. Across the six standards of NETS-A, the researcher found

elementary principals most proficient in the area of Assessment and Evaluation and least proficient in the area of Support, Management, and Operations.

Macaulay (2009) sought to determine the extent to which elementary principal behaviors support their role as an instructional technology leader. She polled both teachers and principals in Maryland and Pennsylvania about the behaviors that principals exhibit with regard to practices aligned to NETS-A, and found teachers and principals and view principals' performance differently. Principals rated themselves more highly than the teachers rated them. While the results from teachers were less favorable across all of the domains of the NETS-A, none were found to be significantly different when subjected to analysis. In addition to the correlational analyses conducted, the researcher offered a conceptual framework of what encompasses effective technology leadership in elementary schools.

Ertmer, Bai, Dong, Khalil, Park, and Wang (2002) surveyed administrators (n=8) in an online graduate class about technology as to how they defined technology leadership. Though the sample was limited, it still included principals from each of the levels. They surveyed the participants over the course of the class as well as used various qualitative data sources such as discussion board posts and a principal generated technology lesson to be used at their schools. The authors presented anecdotal evidence attributed to principals at each school level. An elementary principal indicated that she feels that an instructional technology leader should serve as both technology role model and advocate for staff as they implemented technology. Middle school principals offered two salient points which hinted at

their growth as a result of the class. The first one questioned how one could lead technology integration without truly understanding the “potential of technology” (p. 13); while, another middle school principal shared the process of moving from the expectation of teachers using basic technologies such as the internet and various drill and skill oriented software to more in-depth forms of technology integration. Lastly, a high school assistant principal shared that the course changed the manner in which he interacts with teachers about their integration techniques.

Dawson and Rakes (2003) investigated the relationship between the level and type of technology training attained by principals and the degree to which it impacts teacher technology integration in concert with several factors including teacher age, gender, school size, and school level. They found that technology integration within classrooms is greatly influenced by both the principal’s and teachers’ technology training; however, they found no significant differences on the basis of personal characteristics of the principal (gender, age, numbers of years of administrative experience) or school characteristics (size and level).

Anderson and Dexter (2005) explored differences in technology leadership by school level. They found that technology leadership as evidenced in their study by the presence eight indicators: budget, district support, grants, intellectual property policy, principal days, principal e-mail, staff development policy, and a technology committee was rated lower by elementary schools in comparison to both middle and high schools. They discovered middle and high schools were more likely to exhibit higher instructional technology leadership scores. Schools at this level were more apt to attain grants, to employ technology

committees, possess a high level of district technology support, and have principals deemed as heavy e-mail users. The researchers posited that elementary schools appeared to have less formalized structures in place due to their small size which tended to allow them to function in a more informal manner.

Chapter Summary

Incorporating technology into schools will continue to be an expectation of schools. As such, providing effective instructional technology leadership is crucial to the success of technology integration in schools (Anderson & Dexter, 2005; Flanagan & Jacobsen, 2003). Given the evidence that suggests that principals may not be adequately prepared as a result of completion of principal preparation programs, this study provides an important glance into how principals can perform their instructional technology leadership duties when exposed to professional development as a part of a structure media and technology program. Additionally, further study is warranted to ascertain the degree to which differences across school levels exist or are merited in principals' behaviors surrounding instructional technology leadership. Table 2.2 summarizes the relevant literature presented in Chapter 2.

Table 2.2

Summary of Literature Reviewed in Chapter 2

	Source	Sample/Study Description	Main Findings
History and Background of Instructional Technology			
Defining Instructional Technology	Bebell, D., Russell, M., & O'Dwyer, L. (2004). Measuring teachers' technology uses: Why multiple-measures are more revealing.	3000 K-12 teachers from Massachusetts were surveyed about their technology usage.	The study was conducted to provide a mechanism to define teacher technology use. Teacher use falls within a set of 21 indicators.
	Cuban, L. (2001). *Oversold and underused: Computers in the classroom*	Through a series of case studies Cuban explores technology usage. He asserts that most schools have access to technology tools that are not used in a meaningful manner or not used at all.	
	Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research.	The researchers define instructional technology integration as the use of computing devices for instructional purposes. They cite numerous barriers to technology integration and provide strategies to overcome these- 1) having a shared vision and technology integration plan, 2) overcoming the scarcity of resources, 3) changing attitudes and beliefs, 4) conducting professional development, and 5) reconsidering assessments.	
	Reiser, R.A (1987). Instructional technology: A history. In R.M. Gagne (Ed.), *Instructional technology: Foundations* (pp. 11-48).	The researcher offers a definition of instructional technology which is the process of delivering personalized instruction to students enhanced with the use of various technological devices.	
Evolution of Instructional Technology	Reiser, R.A (1987). Instructional technology: A history. In R.M. Gagne (Ed.), *Instructional technology: Foundations* (pp. 11-48).	A historical treatise about the evolution of instructional technology in which he tracks the use of devices from the 1600s with the use of objects and pictures to the use of educational films, televisions, computers, and the world wide web in the 1900s. Current devices include laptop computers, tablets, LCD projectors, interactive white boards, and student response systems.	
Political Pressure to Increase Instructional Technology Use	Gardner, D. P. (1983). *A nation at risk: The imperative for educational reform.*	*A Nation at Risk* provides information about the failing state of U.S. schools. Recommendations for improvement to Content, Standards and Expectations, Time, Teaching, and Leadership and Fiscal Support.	

Table 2.2 Continued

	Source	Sample/Study Description	Main Findings
	U.S. Congress (1994). Goals 2000: Educate America Act. Public Law, 103–227.	The Goals 2000: Educate America Act provides an overarching strategies and vision for instructional technology. Strategies included: 1) integration of technology into educational programing and training, 2) the coordination of educational technology activities across federal, state, and local level constituent groups, 3) the establishment of guidelines to ensure equity of access to all schools systems, and 4) the development of federal policies and programs which facilitate the use of instructional technology.	
	Riley, R., Kunin, M., Smith, M., & Roberts, L. (1996*). Getting America's students ready for the 21st century: Meeting the technology literacy challenge. A report to the nation on technology and education.*	The U.S. released its first educational national technology plan in 1996. Four directives included: 1) ensuring all teachers have the appropriate training to teach students using technology resources, 2) addressing issues of access to up-to-date computers, 3) enabling access to the world wide web, and 4) integrating software and online resources into local school curricula.	
	United States Department of Education, Office of Educational Technology (2004). Toward a new golden age in American education: How the internet, the law and today's students are revolutionizing expectations. Washington, D.C.	An updated National Educational Technology Plan was released in 2004 and included seven action steps to be implemented by state, district, and school leaders. Steps included: 1) strengthen leadership, 2) consider innovative budgeting, 3) improve teacher training, 4) support e-learning and virtual schools, 5) encourage broadband access, 6) move toward digital content, and 7) integrate data systems.	
	United States Department of Education. (2010). National educational technology plan 2010.	An updated version of National Technology Plan was released in 2010 with the following goals: 1) create learning experiences that are "engaging an empowering" for all students, 2) assess the most critical areas to generate data for improvement, 3) increase the effectiveness of educators by providing them with the appropriate tools, 4) create access to a robust and reliable infrastructure, and 5) restructure our educational system to best make use of available technology.	
	United States Department of Education. (2009). Race to the Top Executive Summary.	As part of the American Recovery and Reinvestment Act of 2009 (ARRA), the Race to the Top (RTTT) competitive grant program required states to participate in various strategies to improve student-level outcomes. The ARRA allocated $4.35 billion for RTTT of which North Carolina received nearly $400 million.	

Table 2.2 Continued

	Source	Sample/Study Description	Main Findings
Technology Integration Projects			
	United States Department of Education; Office of Planning, Evaluation and Policy Development; Policy and Program Studies Service. (2007). *State strategies and practices for educational technology: Volume I—Examining the enhancing education through technology program,*	Enhancing Education Through Technology Act of 2001, a provision of the No Child Left Behind legislation provided funding for instructional technology projects to improve student achievement in K-12 education. Funds were intended to help achieve the national goal of all students becoming technologically literate by the end of the eighth grade. As of 2007, nearly $2.7 billion to states and localities to support increasing instructional technology in elementary and secondary instruction.	
NC Instructional Technology Projects	Overbay, A., & Vasu, E. (2010). *IMPACT II: Year 2 - 2008-09 Evaluation Report.*	EETT grants have been distributed to schools by the North Carolina Department of Public Instruction to implement the IMPACT model. Grant cycles included: IMPACT I, IMPACT II, IMPACTing Leadership, IMPACT III, IMPACT IV, IMPACT Continuation, and IMPACT V.	
Role of Instructional Technology Leader			
	Macneil, A. & Delafield, D. (1998). Principal Leadership for Successful School Technology Implementation.	64 principals and assistant principals from Texas were surveyed about their instructional technology beliefs.	Administrators viewed technology use as very important in their schools and must strive to provide the necessary comprehensive support to create the necessary conditions for optimal technology use. The study revealed the main impediments to implementing technology in the classroom are lack of financial resources for hardware, software, and infrastructure, and lack of time for professional development and planning.
	Brockmeier, L. L., Sermon, J. M., & Hope, W. C. (2005). Principal's relationship with computer technology.	268 K-12 principals in Florida were given the 40-item Computer Technology Survey	Principals are central to successful teacher integration of technology. To be effective and comfortable in the role of instructional technology leader, ample technology professional development for principals is crucial. There is a clear need to improve their proficiency.
	Kafka, J. (2009). The principalship in historical perspective.	Kafka provides a historical overview of the role of the school principal. The role of principal has evolved from the principal/teacher who serves as an instructor and completed various administrative tasks such as role taking to the one today who handles a myriad of administrative tasks in the wake of political pressure.	

Table 2.2 Continued

	Source	Sample/Study Description	Main Findings
	Valdez, G. (2004). *Critical issue: Technology leadership: Enhancing positive educational change*.	Valdez offers an overview of the leadership qualities and best practices of superintendents and principals necessary to support instructional technology integration.	
	Richardson, J.W., & McLeod, S. (2011). Technology leadership in Native American schools.	Nine principals in Native American schools participated in a semi-structured telephone interview about instructional technology in their schools	Principals reported facing challenges that were compounded when cultural issues and outdated facilities were considered. Issues included: limited access to professional development, limited numbers of school-level technology coordinators, and an inadequate number and type of technology devices.
	Flanagan, L., & Jacobsen, M. (2003).Technology leadership for the twenty-first century principal.	The authors provide a contextual framework for principals to successfully lead technology integration as well as specific actions to overcome barriers.	
	McLeod, S. and Richardson, J. (2013). Supporting effect technology integration and implementation. In M. Militello & J. Friend (Eds.), Principal 2.0 technology and educational leadership (pp. 249-268).	Using ISTE's 14 Essential Conditions as a framework, the authors provided literature about the importance of each of the conditions and how principals can ensure each condition is met. Conditions included: Shared Vision, Empowered Leaders, Implementation Planning, Consistent and Adequate Funding, Equitable Access, Skilled Personnel, Ongoing Professional Learning, Technical Support, Curriculum Framework, Student-Centered Learning, Assessment and Evaluation, Engaged Communities, Support Policies, and Supportive External Context.	
	Baylor, A. L., & Ritchie, D. (2002). What factors facilitate teacher skill, teacher morale, and perceived student learning in technology-using classrooms?	94 teachers from four states were surveyed about their instructional technology beliefs related to school technology, individual technology skill level, and perceived student learning.	The level of technology leadership and support for professional development impacted the level of instructional technology use among teachers. Researchers found that administrators were most effective if they were actively involved in the technology culture through modeling and actively rewarding teachers who integrated technology well.
	Fishman, B. J., & Pinkard, N. (2001). Bringing urban schools into the information age: planning for technology vs. technology planning.	A case study follows a large urban K-8 school in a Midwestern city as it planned how it would improve instructional technology use through the use of the Planning for Technology (PfT) model.	The use of a systematic instructional technology planning, such as the PfT model, enables schools to make decisions that consider contextual issues. The researchers emphasize the need to use technology as a support mechanism to undergird the teaching and learning. Instructional technology decisions should be secondary to curricula and pedagogical concerns.

Table 2.2 Continued

	Source	Sample/Study Description	Main Findings
	Dexter, S. L. (2011). School technology leadership: Artifacts in systems of practice.	|A set of five case studies of team-based technology leadership in middle schools with laptop programs identifies systems of practice that organize teams' distributed leadership.	A team-based leadership approach is the most efficient process for implementing an instructional technology implementation plan. A team approach makes it more likely that there is a sufficient level of expertise to support technology supported teaching and learning.
	Militello, M., Friend, J., Hurley, R., & Mead, M. (2011). Preparing educational leaders to harness the power of advanced technologies: An introduction.	To best support technology integration efforts, instructional technology leaders should be well-versed in both teacher (TPACK) and administrator standards (NETS-A).	
	Chang, I., Chin, J. M., & Hsu, C. (2008). Teachers' perceptions of the dimensions and implementation of technology leadership of principals in Taiwanese elementary schools.	1024 teachers selected from188 elementary schools in seven cities in Taiwan were surveyed using a revised version of the *Principals' Technology Leadership Questionnaire* in an effort to gauge teachers' perceptions of principals' instructional technology leadership skills through the use of structural equation modeling.	There is a strong correlation between principals' technology leadership and teachers' integration of educational technology. Technology leadership was viewed through four constructs- vision, staff development, infrastructure support, evaluation and research. Major issues facing principals include: budget shortages, inadequate technology facilities, staff development, and leadership problems.
	Overbay, A., Mollette, M. & Vasu, E. (2011). A technology plan that works.	Researchers provide lessons learned over the course of a multi-year evaluation of the IMPACT model. They emphasize the need for instructional technology plans to 1) limit the focus on technology items, 2) tailor the plan to fit the needs of the school, 3) incorporate an extensive professional development plan; 4) allow time for collaboration, and 5) insulate against teacher turnover.	
	Gosmire, D., & Grady, M. L. (2007). A Bumpy Road: Principal as Technology Leader.	The authors claim that principals do not have to be experts at technology integration. Instead they should be adept at asking the correct questions to bring clarity and focus to their technology initiatives. Ten topical question areas are provided. Content focuses on technology trends and policies.	
	Wargo, E. (2006). No data left behind	Numerous forms of data are available to support educational technology decisions. Educational technology plans should be guided using information such as network capacity used, issue tracking, log records or individual user rates, performance and availability rates, and network maps.	

Table 2.2 Continued

	Source	Sample/Study Description	Main Findings
	Brooks-Young, S. (2009). *Making technology standards work for you: A guide to NETS-A for school administrators with self-assessment activities*	The author offers NETS-A implementation strategies for various aspects of technology leadership such as planning, curriculum and instruction, assessment, staff development, legal and social issues.	
	Smith, P. K., Mahdavi, J., Carvalho, M., Fisher, S., Russell, S., & Tippett, N. (2008). Cyberbullying: Its nature and impact in secondary school pupils.	92 children from 14 different London schools were surveyed about the level of cyberbullying in school, and outside of school. They were asked to classify the events into seven different categories of cyberbullying.	Results from two studies showed that most cyberbullying was done by one or a few students, usually from the same grade. Being a cybervictim, but not a cyberbully, correlated with internet use. Many cybervictims were traditional 'bully-victims'. Students recommended blocking/avoiding messages, and telling someone, as the best coping mechanisms.
	Warschauer, M. (2005/2006). Going one-to-one	The author presents lessons learned from 1:1 laptop initiatives in 10 schools in California and Maine. Results from the case studies showed little or no impact on test scores, reforming failing schools, and eliminating achievement gaps. Positive impacts were noted on the acquisition of 21st century learning skills, enhancing student engagement, improving writing, more natural technology integration, and deeper learning,	
	Spillane, J.P., Halverson, R., & Diamond, J.B. (2004). Towards a theory of leadership practice: A distributive perspective	The authors provide an overview of the existing literature surrounding educational leadership. They offer a conceptual frame for distributed leadership. The authors assert school leadership is understood through considering leadership tasks and leadership practice is distributed over leaders, followers, and the school's situation and context.	
Preparation of the Instructional Technology Leader			
	Mehlinger, H. D., & Powers, S. M. (2002). *Technology and teacher education: A guide for educators and policymakers.*	Mehlinger and Powers provide a guide of improving the level of instructional technology preparation for educators as a way to combat what they deem as ineffective programs. The researchers content that "graduate school programs generally are doing a poor job in preparing school principals and superintendents to be technology leaders" (p. 218).	
	Barnett, D. (2004). School leadership programs: Are they preparing tomorrow's leaders?	160 practicing administrators were interviewed about their leadership practices as aligned to Interstate School Leaders Licensure Consortium (ISLLC) Standards and their perceived level preparedness as a result of principal preparation graduate programs.	The researcher found administrators leadership practices to be aligned to ISLLC standards; however, the administrators felt there was mismatch between those leadership tasks and how they were prepared to undertake them.

Table 2.2 Continued

	Source	**Sample/Study Description**	**Main Findings**
	Redish, T., & Chan, T. (2007). Technology leadership: Aspiring administrators' perceptions of their leadership preparation program.	58 future principals from a southeastern state were surveyed using an instrument based on NETS-A about their perceived readiness to serve as an instructional technology leader.	Participants rated themselves above average on most measures. They identified the need for assistance with the developing and refining the skills necessary to develop solutions for simple technical issues, allotting funds for the appropriate technology resources, evaluating the efficacy of technology resources, and assessing the change in student technology skills.
	Yu, C., & Durrington, V. (2006). Technology standards for school administrators: An analysis of practicing and aspiring administrators' perceived ability to perform the standards. NASSP Bulletin, 90(4), 301-317.	57 aspiring principals and 16 practicing principals who served as their mentors from Mississippi were surveyed using the Technology Standards for Administrators survey to ascertain their level of preparedness to adhere to technology standards and the types of professional development needed to hone their skills.	Across mentors and mentees, there was no significant difference on the participants' perceived ability to meet NETS-A standards. There was a significant difference between mentors and mentees on the social, legal, and ethical issues standard, with mentees showing a greater desire to pursue professional development in this standard area.
	Richardson, J, Flora, K., & Bathon, J. (2013). Fostering a school technology vision in school leaders	20 principals enrolled in a doctoral educational leadership program were studied to determine how their instructional technology leadership practices evolved over time.	Over the course of an instructional technology leadership course, participants' instructional technology leadership practices evolved to align more closely to NETS-A standards.
	McCoy-Thomas, T. (2012). *Principals Matter-Principal Technology Proficiency: Creating a Culture of Technology Competence*.	150 principals and their faculties in K-12 schools in Louisiana were studied to investigate the role of leadership in developing a culture of technology competence within a school. Principals and teachers provided assessments of their technology prowess using state-level technology surveys and the Vanderbilt Assessment of Leadership in Education (VAL-Ed),	Results showed that the level of teacher proficiency was correlated to the level of principal proficiency. The more proficient a principal was with technology, the more proficient the teachers within the school were.

Table 2.2 Continued

	Source	Sample/Study Description	Main Findings
	Davidson, G., & Maurer, M.M. (1995). Leadership in instructional technology.	The researchers present an overview of the creation of a course at Butler University specifically designed for the purpose of developing instructional technology leadership behaviors. The course focuses on three main areas: exploring instructional models and strategies, acquiring the appropriate hardware and software applications, and investigating leadership theory. development in the area of instructional technology leadership	
Instructional Technology Leadership by School Level			
	Grey-Bowen, J.E., (2011). *A study of technology leadership among elementary public school principals in Miami-Dade County*.	103 elementary principals employed with the Miami-Dade County School system were surveyed about their instructional technology leadership behaviors using a survey aligned to NETS-A standards.	The researcher found elementary principals in the sample to be most proficient in the area of Assessment and Evaluation and least proficient in the area of Support, Management, and Operations.
	Macaulay, L.S. (2009). *Elementary principals as technology instructional leaders*.	30 teachers and 50 principals in Maryland and Pennsylvania were surveyed about the level to which principals' instructional technology leadership behaviors aligned to NETS-A.	Principals rated themselves more highly than the teachers rated them. While the results from teachers were less favorable across all of the domains of the NETS-A, none were found to be significantly different from those provided by principals.
	Anderson, R.E., & Dexter, S. (2005**).** School technology leadership: an empirical investigation of prevalence and effect.	Using data from the 1998 the Teaching, Learning, and Computing (TLC) Survey, researchers extracted a sample of 866 principal records to explore instructional technology leadership and technology outcomes.	Technology leadership was measured using eight indicators: budget, district support, grants, intellectual property policy, principal days, principal e-mail, staff development policy, and a technology committee and was rated lower by elementary schools in comparison to both middle and high schools.

	Source	Sample/Study Description	Main Findings
	Dawson, C., & Rakes, G. (2003). The influence of principals' technology training on the integration of technology into schools.	398 principals from the United states were surveyed using the School Technology and Readiness (STaR) Assessment to determine if principal training influenced the level of technology use in teacher classrooms.	Teacher technology integration is greatly influenced by both principals' and teachers' technology training; however, no significant differences were found based on the personal characteristics of a principal (gender, age, numbers of years of administrative experience) or school characteristics (size and level).
	Ertmer, P.A., Bai, H. Dong, C. Khalil, M. Park, S.H., & Wang, L. (2002). Online professional development: Building administrators' capacity for technology leadership.	A case study of eight practicing administrators enrolled in an online course. Researchers used course artifacts to measures participants' level of instructional technology leadership.	The authors presented anecdotal evidence attributed to principals at each school level. The course sheds light on the necessity of being a reflective practitioner to explore ones' own instructional technology beliefs before attempting to lead teachers in their quest to integrate technology.

For many research areas, there is a large body of literature in which to situate studies. However, for this study, the research surrounding the area of instructional technology leadership is narrow. Much of the research on the field is theoretical in nature and lacks empirical evidence. Because of this, results from the study allow an opportunity to grow the knowledge base of instructional technology leadership.

Chapter 3 of this study details the research methodology to be employed. A mixed-methods study will be conducted in an effort to compare instructional technology leadership behaviors among elementary, middle, and high school principals.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

Chapter three of this dissertation study describes the methodology that was undertaken. A mixed methods approach (Curlette, 2006; Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 2003; Thomas, 2003) was utilized to address the issue of instructional technology leadership among principals charged with implementing a structured technology integration program within their schools. Johnson and Onwuegbuzie suggest using "mixed methods as the natural complement to traditional qualitative and quantitative research" and further opine that the methodology should be accepted as the "third research paradigm in educational research" (p. 14). They define mixed methods research as "the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study" (p. 17). "Mixing" quantitative and qualitative data during the research process provides a more comprehensive account of the research phenomenon than either method conducted singularly (Creswell, 2002).

In general, research was guided by the epistemological stance of the researcher. Most researchers engage in specific methodologies in concert with their respective stances. Quantitative researchers coming from a positivist or post-positivist view and qualitative researchers coming from a constructivist or interpretivist view often stand in stark opposition to one another (Johnson & Onwuegbuzie, 2004). "Debates about quantitative and qualitative methodologies tend to be cast as a contest between innovative, socially responsible methods

versus obstinately conservative and narrow-minded methods, or precise, sophisticated techniques versus mere 'common sense'" (Stewart & Shields, 2001, p. 307). Rather than pitting quantitative and qualitative methodologies against one another, mixed methods researchers seek to unify or merge the often opposing perspectives by employing a pragmatic approach or what Howe (1988) describes as "what works". Mixed-methods research allows researchers to craft a combination of strategies to harmoniously explore various variables and units of analyses to answer research questions with a level of depth not possible with a sole research approach (Tashakkori & Teddlie, 1998).

Research Design

Due to the flexible nature of mixed methods research, a myriad of specific mixed methods techniques exist such as concurrent, embedded, and sequential (Johnson, Onwuegbuzie, & Turner, 2007; Morse, 2003). Morse provides a system for symbolically representing the various procedures which includes using an arrow or plus symbol as well as uppercase and lowercase letters to signify the order and priority given to either qualitative or quantitative approaches. This study employed a sequential explanatory design structure (QUAN → QUAL). As signified by the Morse structure of labeling methodology, neither methodology was given deference over the other. Phase I quantitative data was used to contextualize the overall level instructional technology use within the schools in the study. Phase II data was both quantitative and qualitative. Integration of both methodologies resided at the interpretation phase.

Research Questions and Methodology

In an effort to investigate the topic of instructional technology leadership among elementary, middle, and high school principals, four distinct questions were explored using a variety of analysis techniques as displayed in Table 3.1.

Table 3.1

Research Question and Methodology Table

Research Question	Data Source	Analysis Techniques
1. How do IMPACT teachers' perceive the level of instructional technology implementation in their schools, and does variance exist by school level?	STNA Survey	Descriptive Statistics Kruskal-Wallis H Test
2. In which ways do principals become prepared to serve as instructional technology leaders?	Principal Interview	Qualitative Analysis
3. In what ways do principals approach instructional technology leadership, and does variance exist by school level?	Principal Interview NETS-A Survey	Qualitative Analysis Descriptive Statistics Kruskal-Wallis H Test
4. In which ways can principals best meet the needs of their teachers through their instructional technology leadership, and does variance exist by school level?	NETS-A Survey	Qualitative Analysis

Instrumentation

Phase I Instrument Description. Phase I of the study utilized data collected via the School Technology Needs Assessment (STNA) survey instrument crafted by the SouthEast Initiatives Regional Technology in Education Consortium (SEIR*TEC) at the SERVE Center

in collaboration with the North Carolina Department of Public Instruction's Educational Technology Division (Corn, 2009). STNA consists of 86 five-point Likert scale items. The instrument is provided in Appendix A. The instrument draws from the results of past pilot studies, state and national technology standards, including National Education Technology Standards for Administrators (NETS-A), and best practices recommended by researchers and specialists in the field of educational technology. As a result, STNA, and more specifically the construct of Supportive Environment for Technology Use which is directly related to principal leadership behaviors, is appropriate to gauge teachers' perception of principal instructional technology leadership behaviors. The constructs taken in sum paint a picture of the overall level of instructional technology health within the IMPACT schools. Based on factor analyses procedures conducted by Corn (2009) indicated in Table 3.2, items are grouped into four major constructs: Supportive Environment for Technology Use, Professional Development, Impact of Technology, and Use of Technology for Teaching and Learning.

Table 3.2

STNA Constructs

Constructs	Sub constructs
Supportive Environment for Technology Use	1. Vision and Shared Leadership (7 items) 2. Organizational Conditions (10 items) 3. Flexible Scheduling (3 items) 4. Infrastructure (5 items) 5. Staff Support (3 items) 6. Media and Software (4 items)
Professional Development	7. Professional Development Needs: Instruction (7 items) & Planning (8 items) 8. Professional Development Quality (7 items)
Use of Technology for Teaching and Learning	9. Teacher Use: Instruction (7 items) & Planning (8 items) 10. Student Use (8 items)
Impact of Technology	11. Teaching Practices (4 items) 12. Student Outcomes (5 items)

Table 3.2 Source: (Corn, 2009)

Phase II Instrument Description. Phase II instruments consisted of a principal interview protocol and a NETS-A survey given to teachers. The first prong of Phase II entailed a set of interview questions based on NETS-A Standards. The complete interview protocol is provided in Appendix B.

The second prong of Phase II of the study consisted of a teacher survey with questions derived from NETS-A. These questions ascertained teachers' perception of how closely their principals' instructional technology leadership behaviors aligned to NETS-A. Secondly, open-ended survey to garnered teachers' perceptions of leadership characteristics, attributes, and behaviors necessary to assist teachers with implementing meaningful instructional technology integration in their classroom practices at each school level. The NETS-A teacher survey also collected demographic information including school level

taught (elementary, middle, or high school), years of experience, and self-reported technology proficiency level (novice, intermediate, or advanced).

Site Selection and Sample

Phase I

The sample was drawn North Carolina schools engaged in the technology integration project spanning the IMPACT II, III, and IV cohorts who subsequently participated in IMPACT Continuation. There were 11 school districts and 31 schools (12 elementary, 12 middle, and 7 high) that participated in the IMPACT Continuation program. The schools were dispersed across the state of North Carolina with the highest number of schools found in regions 5 and 8 as shown in Figure 3.1.

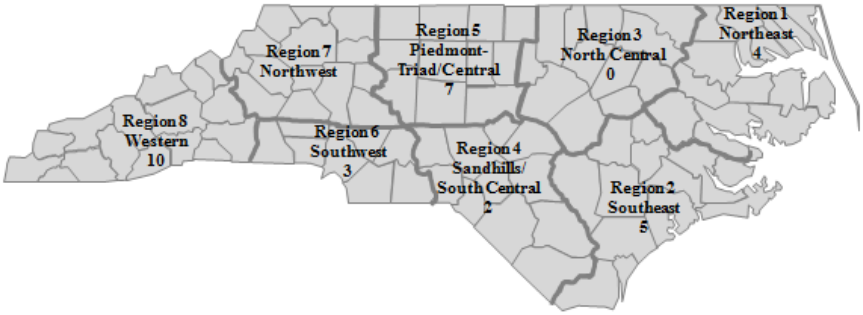

Figure 3.1*: NC Regional Map*

Further, nearly 17,000 students attended the participating IMPACT schools. The demographic distribution of students was 50% White, 29% Black, 14% Hispanic, and 6%

Other (American Indian, Asian, Pacific Islander, and Multiracial). All schools in the study were eligible to participate in the IMPACT program because of their designation as Title I schools, which correlated to the number of students who were eligible to receive free or reduced lunch. 63% of all students in IMPACT schools received free or reduced lunch.

1185 teachers accessed the survey, but four of those declined participation. Teachers classified themselves as undesignated (n=105), elementary (n=262), middle (n=483), or high (n=331) school teachers. Years of experience ranged from 0 to 42 and varied slightly across the various school levels. Elementary teachers reported a mean of 8.03 (SD= 6.6) years of experience; while, middle and high schools reported means of 7.3 (SD=6.3) and 8.5 (SD=8.45) years of experience, respectively.

Phase II

Phase II included two distinct populations-7 principals from IMPACT continuation schools and 116 teachers from a rural district in Northeast North Carolina (Region 1). A table was created to ascertain which principals were in place during the past three school years: 2010-11 through 2012-13 to analyze school leadership patterns across the 31 schools of IMPACT Continuation (selected schools from cohorts II, III, and IV). Fifteen principals who served all three years and the eight who served during the last two of the three surveyed were contacted via email to ask for their participation in the study. After an initial email was sent, it was followed by a maximum of two e-mails and one telephone follow-up. Another principal who served for the first two of the last three years but recently became a principal at another school within the same district was included in the sample due to her intimate knowledge of serving at multiple school levels. In another instance, a school within a district

that did not receive funding to implement IMPACT was included at the request of Central Office Staff. According to district officials, the school was given similar funding and professional development to ensure staff and students would have consistent access to resources across their entire district. In the end, the final sample included one male and six female principals-two from the elementary level, three from the middle school level, and two from the high school level. Two of the participating principals have experience at multiple levels. The experience level varied among the participants with level of experience ranging from three to more than 20 years of experience in the role of principals. The principals hailed from three different regions (Region 1-three, Region 2-one, and Region 5-three) across the state (See figure 3.1). Interviews were conducted via telephone conducted over a month-long period between December, 2012 and January, 2013.

The final portion of the study included 116 teachers from a single district (1 K-2 school, 1 3-5 school, 1 middle school (6-8), and 1 high school (9-12)). They were surveyed about their perception of the degree to which their principals' instructional technology leadership aligns to NETS-A and the administrative support they would like to receive from their principal based on their specific school level. The schools were engaged in implemented the IMPACT model, but all did not receive grant funding. District level leadership received professional development as a part of the IMPACT program and chose to implement many of the strategies using other funding streams or without funding. Teachers' years of experience ranged from 1 to 41 years (M=13.4, SD=9.3). When asked about their own level of

instructional technology expertise, 18.4% classified themselves novice, 67.5% as intermediate, and 14% as expert.

Data Collection: Phase I and Phase II

Phase I data was taken from existing data from a previous administration of STNA as part of EETT required evaluation activities in the schools participating in the structured technology integration project IMPACT. Data from IMPACT II, III, and IV cohorts were utilized. Participating teachers in those schools were given the STNA via a web-based survey tool at various time points in the life of the IMPACT grant. Data were used from the spring 2011 administration of STNA was utilized for the study. Data were downloaded from the web-based system into excel files which were then converted to a SPSS file.

In Phase II, data collection was done via telephone and a web-based survey. The principal interview was conducted via telephone. Each interview was audio-recorded and transcribed by a professional transcription service. The NETS-A survey was administered to teachers via a web-based survey tool to determine their own desires for instructional technology leadership characteristics at their respective school level.

Data Analysis: Phase I and Phase II

Quantitative Analysis. Quantitative analysis procedures were used in both Phase I and Phase II. STNA data was vetted to ensure cases with fewer than 50% of a completed survey were eliminated. The data on STNA instrument was recoded due to how the response options were presented. Two different agreement scales were presented to survey respondents based on the nature of the questions-(*Strongly Agree, Agree, Neither Agree nor*

Disagree, Disagree, Strongly Disagree, and Do not Know or Daily, Weekly, Monthly, Once Per Grading Period, Never, or Do Not Know). During analysis, the responses were reverse coded for the agreement scale items as *Strongly Disagree* = 1, *Disagree* = 2, *Neither Agree nor Disagree*= 3; *Agree* = 4, *Strongly Agree* = 5 and for the frequency scale items as *Never* = 1, *Once Per Grading Period* = 2, *Monthly* = 3, *Weekly* = 4, *Daily*=5. Because of the imposed coding scheme, the higher the mean for an item, subconstruct, or construct, the more favorable the phenomenon being observed. Items left blank and answered *Do Not Know* were coded as system missing in SPSS and thus were not included in the response distributions reported in the item-level tables.

Phase I of the study featured univariate descriptive statistical analysis procedures of the STNA data. At the item level mean and standard deviation were calculated as well as frequency of response categories percentages. At the construct and sub-construct-level, mean values and the associate standard deviation was calculated. A new variable was computed in SPSS which represented the composite score (mean score) for each of the constructs.

Data was then analyzed to ensure specific criteria were met: independent observations, normally distributed populations, and homogeneity of variance. This was followed by a comparative analysis at the construct level using the Kruskal Wallis procedure, the nonparametric version of the one-way analysis of variance (ANOVA) test. This procedure was indicated because of the ordinal nature survey questions (i.e., Likert Scale) and the violation of assumptions for some of the survey data (i.e., non-normally distributed data, and unequal sample sizes). SPSS statistical processing software was used to conduct all

analyses. The same quantitative analyses procedures were mirrored in Phase II for the NETS-A Survey-data cleaning, univariate descriptive statistical analysis, and the comparative analysis procedure Kruskal Wallis.

Qualitative Analysis. During Phase II, qualitative analysis procedures were used to analyze the principal interview and the NETS-A survey open-ended questions. Qualitative analysis software, ATLAS.ti, was used to aid the analysis process of Phase II data. Each of the interview transcripts were converted to rich text file formatting and uploaded to ATLAS.ti. Each was labeled with a school level and number.

A two-step process coding process was used to analyze the data. Each statement was assigned a summary label which described theme linked to a specific behavior or action described by each principal. Afterwards, each of the codes was grouped according NETS-A standards. Table 3.3 displays the codes and affiliated NETS-A standards assigned during the analysis process.

Table 3.3

Phase II Principal Interview Codes

Code	NETS-A	Code	NETS-A
Acquire resources-grants and district	Visionary Leadership	Inspect what you expect	Systemic Improvement
Additional PD for ITL	Excellence in Professional Practice	Leadership approaches	Visionary Leadership
Application of model and implementation before hand	Digital Age Learning Culture	Meaningful integration not gimmicks	Visionary Leadership
Attributes of a good instructional technology leader	Visionary Leadership	Modeling	Digital Age Learning Culture
Available resources	Visionary Leadership	New teachers	Excellence in Professional Practice
Benefited from IMPACT		Offer PD to teachers	Excellence in Professional Practice
Budgeting	Visionary Leadership	Offer Support to teachers	Excellence in Professional Practice
Buy-in using application process	Visionary Leadership	Preparation conferences	Excellence in Professional Practice
Communication strategies	Digital Age Learning Culture	Preparation MSA program	Excellence in Professional Practice
Connections to other principals	Excellence in Professional Practice	Preparation school visits	Excellence in Professional Practice
Defining what good tech integration looks like	Visionary Leadership	Preparation to become an instructional technology leader	Excellence in Professional Practice
Distributive leadership	Visionary Leadership	Rating of instructional technology leader	Excellence in Professional Practice
District-level support		Removing personnel	
Ensuring the teachers have access to the right people to help them	Excellence in Professional Practice	Start small- pilot with early adopters	Visionary Leadership
Equitable access	Digital Citizenship	Student access outside	Digital Citizenship
Ethical and legal	Digital Citizenship	Sustain after grant	Visionary Leadership
Evaluation-teachers	Systemic Improvement	Teacher proficiency	Excellence in Professional Practice
Garnering community support	Visionary Leadership	Time as an impediment	Visionary Leadership
How many use tech-teachers		Variance by level	
Interaction with students		Ways to sustain in the absence of a technology facilitator	Visionary Leadership/Excellence in Professional Practice

The analysis procedure for the open-ended responses on the NETS-A Survey was a multi-step process. The open-ended responses from the four schools were downloaded from

Qualtrics, the web tool, used to deploy the survey. The entire survey was downloaded into Microsoft Excel. Next, the open-ended responses were filtered by school and saved to separate rich text format documents. These files were then loaded into Atlas.ti as primary documents. To facilitate filtering at a later stage, each primary document was assigned to a primary document family based on school level—elementary (2), middle (1), and high (1).

Open coding was used to assign codes to teachers' responses to each of the three questions on the survey. Each code was assigned a prefix to designate the question for which the response was derived (*e.g.*, Q1: Principal Support Integration, Q2: Issues by School Level, Q3: Overcome Challenges) and a thematic code (*e.g.*, limited technology tools, literacy, protect planning time). At the conclusion of coding, coding was repeated to ensure consistency across each of the primary documents. To determine the density of codes across each of the school levels, the Primary Document output function in Atlas.ti was used to generate a Microsoft Excel spreadsheet for each of the question which was organized by code and school level.

Tables 3.4-3.6 depict the codes for each open-ended question sorted by the code prevalence and school level. The number of respondents for the survey was uneven across the various school levels, with high school teachers far exceeding the number of teachers from the other two levels. As a consequence, general trends for each question were explored across codes with less emphasis\ placed on the number of codes per school level, however, it is important to note that the most prevalent codes for each of the three questions had coverage across all three levels.

Table 3.4

Question One- Principal Behaviors Which Support Technology Integration Based on School Level Code Distribution

Codes	**School Level**			
	Elementary	**Middle**	**High**	**TOTALS:**
Q1:Principal Support Integration-PD	11	3	17	31
Q1:Principal Support Integration-Tech Tool Resources	2	5	10	17
Q1:Principal Support Integration-Protect Planning Time	4	1	5	10
Q1:Principal Support Integration-Allow Incremental Phase-In	0	0	6	6
Q1:Principal Support Integration-Positive, Encouraging Principal Attitude	0	0	5	5
Q1:Principal Support Integration-Communicate Technology Strategies used by other teachers	0	2	2	4
Q1:Principal Support Integration-Offer Personal Feedback	1	1	2	4
Q1:Principal Support Integration-Technical Support	2	1	1	4
Q1:Principal Support Integration-Technology Not Always Necessary	2	0	1	3
Q1:Principal Support Integration-Instructional Planning Support	0	1	1	2
Q1:Principal Support Integration-Principal Stay Current with Technology Innovations	1	1	0	2
Q1:Principal Support Integration-Provide Written PD Reference Resources	1	1	0	2
Q1:Principal Support Integration-Budget-grants, etc.	1	0	0	1
TOTALS:	25	16	50	91

Table 3.5

Question Two- Challenges Based on School Level Code Distribution

Codes	**School Level**			
	Elementary	**Middle**	**High**	**TOTALS:**
Q2:Issues by School Level-Limited technology tools	3	4	9	16
Q2:Issues by School Level-Socio-economics and exposure and access to technology outside of school	2	4	3	9
Q2:Issues by School Level-Digital Citizenship	1	0	7	8
Q2:Issues by School Level-Funding	2	2	2	6
Q2:Issues by School Level-Infrastructure (wireless)	0	1	4	5
Q2:Issues by School Level-Maturity	0	0	5	5
Q2:Issues by School Level-Student know how	2	0	3	5
Q2:Issues by School Level-Teacher comfort/knowledge	1	1	2	4
Q2:Issues by School Level-Offering different activities in the course of a class period	0	1	2	3
Q2:Issues by School Level-Teacher monitoring of use	0	0	3	3
Q2:Issues by School Level-Lack of tech to match what students had earlier	0	0	2	2
Q2:Issues by School Level-Motivation of students	0	0	2	2
Q2:Issues by School Level-None	1	1	0	2
Q2:Issues by School Level-Not enough PD	1	0	1	2
Q2:Issues by School Level-Student respect of technology tools	0	1	1	2
Q2:Issues by School Level-Time to learn and use tech	2	0	0	2
Q2:Issues by School Level-Youth of students; limited literacy	2	0	1	2
Q2:Issues by School Level-District Support	0	0	1	1
Q2:Issues by School Level-Equipment maintenance	1	0	0	1
Q2:Issues by School Level-Inconsistency in staff	0	0	1	1
Q2:Issues by School Level-Lack of tech support	1	0	0	1
Q2:Issues by School Level-Limited instructional tech support	1	0	0	1
Q2:Issues by School Level-Meaningful technology integration	0	0	1	1
Q2:Issues by School Level-Move from entertainment	0	0	1	1
Q2:Issues by School Level-Policy update	0	0	1	1
Q2:Issues by School Level-Preoccupied with socialization	0	1	0	1
Q2:Issues by School Level-Theft	0	0	1	1
Q2:Issues by School Level-Social promotion- now behind	0	0	1	1
TOTALS:	19	15	51	85

Table 3.6

Question Three-Principal Instructional Behaviors to Overcome Challenges Based on School Level Code Distribution

Codes	**School Level**			
	Elementary	**Middle**	**High**	**TOTALS:**
Q3:Overcome Challenges-Offer more PD	8	1	3	12
Q3:Overcome Challenges-Be a supportive principal	1	3	7	11
Q3:Overcome Challenges-Funding (pursue grants)	3	2	4	9
Q3:Overcome Challenges-Acquire more tech resources	1	3	2	6
Q3:Overcome Challenges-Filtering	0	0	4	4
Q3:Overcome Challenges-Beyond control of principal	0	1	1	2
Q3:Overcome Challenges-Digital Citizenship	0	0	2	2
Q3:Overcome Challenges-Manage Student Behavior	0	1	1	2
Q3:Overcome Challenges-Principal modeling	1	0	1	2
Q3:Overcome Challenges-Protect planning time	1	0	1	2
Q3:Overcome Challenges-Time to use new skills before adding	1	1	0	2
Q3:Overcome Challenges-Work with district	0	1	1	2
Q3:Overcome Challenges-Monitor and adjust policies	1	0	0	1
Q3:Overcome Challenges-More instructional technology support/no dual role	1	0	0	1
Q3:Overcome Challenges-More tech support	1	0	0	1
Q3:Overcome Challenges-Promote home ownership/access	1	0	0	1
Q3:Overcome Challenges-Student training	1	0	0	1
TOTALS:	21	13	27	61

Research Validity and Reliability

Phase I. Corn (2006, 2009) used exploratory and confirmatory factor analyses procedures, subject matter experts, and relevant literature to deem STNA to be a valid and reliable instrument. Social science researchers require a minimum Cronbach alpha value of .70 to classify items as a scale or construct, and obtaining a Cronbach alpha value of .80 or

higher indicates high internal consistency reliability of the items (Miller, 1995). STNA exceeds these minimum standards. The internal consistency reliability ratings for each construct and subconstruct ranged from .807 to .967 (Corn, 2006). When internal consistency reliability analysis was conducted using this study's population, internal consistency reliability values ranged from .921 to.942.

Phase II. Although, the NETS-A Survey was derived from NETS-A standards which were developed by a leading authority on instructional technology-ISTE, internal consistency reliability was computed using SPSS for each of the five constructs of the survey. Because the Cronbach alpha scores ranged from .925 to .950 for each of the survey constructs, they were deemed a reliable measure for each NETS-A standard. Values for each construct are displayed in Table 3.7.

Table 3.7

NETS-A Teacher Survey Cronbach Alpha Internal Consistency Scores

Survey Constructs	**Number of Items**	**Cronbach Alpha**
Visionary Leadership	3	0.937
Digital-Age Learning Culture	5	0.937
Excellence in Professional Practice	4	0.942
Systemic Improvement	5	0.925
Digital Citizenship	4	0.950

During the analysis of the principal interview and teacher open-ended responses it was imperative to ensuring validity and reliability while using qualitative methodology. According to Bogdan and Biklen (2007), "qualitative data researchers tend to view reliability

as a fit between what they record as data and what actually occurs in the setting under study, rather than the literal consistency across different observations" (p. 40). Validity and reliability of the findings were improved by:

- using triangulation (Denzin, 1978) using three distinct data sources (STNA data, Principal Interview, NETS-A Teacher Survey);
- providing thick, rich descriptions which detail the perceptions of teachers of the phenomenon of principals' instructional technology leadership (Gertz, 1973);
- providing a subjectivity statement (Merriam, 1995) which will enable readers to assess any researcher bias based on the researcher's background.

The next section of this chapter entitled, Subjectivity Statement, will provide detailed information about the researcher's background and potential biases.

Subjectivity Statement

Qualitative methodology was used to study instructional technology leadership behaviors of principals. Addressing researcher bias and subjectivity are commonly understood as inevitable and important to qualitative researchers as it emphasizes the importance of looking at variables in the natural setting in which they are found (Bogdan and Biklen, 2007). The researcher serves as the data collection and analysis instrument. As such, several interactions between the researcher and participants and variables of interest will occur during the course of the study. Since it is inconceivable that research can be conducted by someone with no views at all, a researcher should describe his or her personal background

and perspective such that the results of the study can be interpreted accordingly. The following is a brief description of the researcher's background which shapes the lens through which the study will be conducted.

My career has been varied. I have spent time as a chemist, a science and math teacher, a standardized test development specialist, and most recently as an educational program evaluator. As a result of my experiences, I view education from a multidimensional scope. Currently, my work as an educational evaluator focuses on assessing the impact and process of implementing educational innovation activities within schools across North Carolina.

I ascribe to a pragmatist philosophy. I believe that students should be taught relevant material that is practical. Educators are responsible for teaching today's students in a fashion that resonates with societal norms. Twenty-first century learning skills are imperative and students must become engaged and empowered to discover knowledge through the use of emerging technology. As a former science and math teacher, I firmly believe that utilizing inquiry-based lessons to allow students to construct their own knowledge is imperative. While the use of technology is becoming commonplace, I firmly believe meaningful uses should be sought in lieu of using technology just for the sake of using it. In other words, great instruction can occur in the absence or presence of technology.

Limitations of the Study

According to Patton (2002), study limitations should be addressed by the researcher conducting a study. Several limitations of the study will be considered. The teachers

participating in the study represent just one set of schools engaged in a structured technology integration project; thus, the findings of the study may not coincide with that of other schools not engaged in a formalized project.

Secondly, a portion of Phase II of the study had a small sample size (n=7) and was qualitative in nature. This research methodology has limitations which may arise during data collection and analyses procedures. All data in this phase will be collected, coded, and analyzed by the researcher which could lead to one-directional bias. To minimize the possibility of the bias, the researcher coded the interview data multiple times. Another possible limitation is the work status of the researcher. The researcher serves on the evaluation team which conducts yearly summative evaluation procedures for the technology integration project from which the sample was drawn. This was disclosed in the subjectivity statement which informs readers of possible researcher bias.

Next, teacher perception data about their principal was utilized in both Phase I and Phase II of the study. Teachers participating in Phase II of the study were asked to report on the instructional technology leadership behaviors of their principal which could have placed them in jeopardy. They were afforded protection as outlined by the Institutional Review Board (IRB) guidelines. IRB Approval and the associated consent form are provided in Appendices D and E. Each of the principal participants was given a code number. Anonymity during data collection, analyses procedures, and findings reporting were granted in hopes of capturing truthful responses. Ultimately, the validity of the study findings hinged on the honesty and accuracy of each principal and teacher.

Chapter Summary

The implementation of instructional technology procedures is pervasive in schools, today. While teachers act as the main facilitators of such practices, school principals are tasked with ensuring organizational conditions are in place to allow for meaningful technology integration and maximal student learning. This study explored the phenomenon of instructional technology leadership practices of principals across elementary, middle, and high school levels.

In this chapter, the methodological procedures for the study were outlined. The first section explained the mixed-method approach which will occur in two distinct phases, QUAN-QUAL. The next sections of the chapter presented the research questions, featured the instruments to be used, described the sample to be used for the study, outlined data collection and analyses procedures, disclosed the researcher's potential biases in via the subjectivity statement, and offered limitations potential limitations of the study.

Chapter 4 details the findings of the study. Using the QUAN-QUAL methodological sequence employed in the study, Chapter 4 findings are presented in the same manner. Phase I's quantitative findings will be presented followed by Phase II's qualitative findings. The Phase I findings detail teachers' perceptions of their respective principals as assessed by the STNA survey instrument. Finally, qualitative data generated from the open-ended surveys and the interviews of principals at each grade level are presented. Chapter 5 discusses the findings of the study, suggest implications for policy and practice, and offers recommendations for further research.

CHAPTER 4

FINDINGS

In 2003, NCDPI unveiled IMPACT, an instructional technology integration model for schools. Since that time, it has been implemented in several schools across North Carolina. One of the hallmark components of the IMPACT model is the presence of supportive leadership from the school principal. The research questions addressed in the study focused on how principals were prepared to become instructional technology leaders, the types of instructional technology leadership behaviors exhibited by principals, how those behaviors aligned to national standards, and the actual behaviors desired by teachers in these technology-rich environments. This multi-phased study used a sequential exploratory mixed methods design.

Phase I of the study explored the various aspects of IMPACT schools' instructional technology implementation as measured through STNA, an instrument designed specifically to measure school- and principal-level characteristics among IMPACT schools. The items on the first half of the survey measure behaviors linked to instructional technology leadership. Utilizing a principal interview and the NETS-A Survey, Phase II chronicled how a subset of IMPACT principals were prepared to be instructional technology leaders, assessed alignment of instructional technology leadership behaviors to industry standards, and determined the behaviors desired by teachers.

This chapter describes the study's findings beginning with the results from Phase I followed by those from Phase II. Phase I results include the results of descriptive analysis as

well as the Kruskal Wallis H test to determine the differences between each of the school levels. Phase II results included the qualitative data results generated from principal interviews and the NETS-A Teacher Survey open-ended questions. Additionally, quantitative findings (using the same analysis procedures as in Phase I) for the closed-response items on the teacher survey were presented.

Phase I Findings

Data from the STNA instrument administered to teachers in 2011 were analyzed to determine how teachers perceive the level of technology integration within their schools. Special emphasis was placed on the questions which were indicative of exemplary instructional technology leadership behaviors on the part of school administrators. Schools in the study were analyzed overall and then by school level. The Phase I methods included descriptive statistical analysis procedures followed by the Kruskal-Wallis H test to determine if teachers perceived a difference in instructional technology leadership based on school level.

Teachers' Overall Perception Instructional Technology

To answer Research Question 1: How do IMPACT teachers' perceive the level of instructional technology implementation in their schools, and does variance exist by school level?, teachers participating in the IMPACT grant were administered the 86-item STNA instrument with questions aligned to four constructs- Supportive Environment for Technology Use, Professional Development, Use of Technology for Teaching and Learning, and Impact of Technology. Those constructs were further divided into subconstructs. For all

items, the response distribution percentages reflected actual participant selections. During analysis, the responses were reverse coded for the agreement scale items as *Strongly Disagree* = 1, *Disagree* = 2, *Neither Agree nor Disagree*= 3; *Agree* = 4, *Strongly Agree* = 5 and for the frequency scale items as *Never* = 1, *Once Per Grading Period* = 2, *Monthly* = 3, *Weekly* = 4, *Daily*=5. Because of the imposed coding scheme, the higher the mean for an item, subconstruct, or construct, the more favorable the phenomenon being observed. Items left blank and answered *Do Not Know* were coded as system missing in SPSS and thus are not included in the response distributions reported in the item-level tables.

In most instances, *Do Not Know* responses accounted for no more than 10% of total response distribution. The seven items exceeding the 10% *Do Not Know* threshold are presented below in Table 4.1. The vast majority of the *Do Not Know* responses were reported in Supportive Environment for Technology, the construct most closely aligned to measuring principal instructional technology leadership behaviors. Teachers gave their perception of school administrators' behaviors in this construct; whereas, the other three constructs were reflective of their own or their students' behaviors which is more direct, firsthand knowledge. As result, these items may have higher than average *Do Not Know* response selection. Each item is explored in greater detail during the presentation of results in the corresponding construct sections.

Table 4.1

STNA Items Exceeding the 10% Do Not Know Threshold

Construct (*n*=1060-1076)	**Subconstruct**	**Item**	***% Do Not Know***
Supportive Environment for Technology	Vision and Shared Leadership	5. Teachers who are innovators with technology receive material incentives…	13.1%
		7. When administrators are seeking or hiring teachers, they consider technology literacy and leadership…	23.0%
	Organizational Conditions	8. The school technology plan is monitored and updated at least once a year.	10.5%
		12. The amount of money budgeted for technology resources is sufficient for implementing decisions arising from planning.	14.8%
		13. The amount of money budgeted for technology resources is sufficient for continuously updating and replacing technology systems as they become outdated.	14.6%
	Infrastructure	25. Students with disabilities have appropriate and adequate access to adaptive and assistive devices.	16.1%
Professional Development	PD Quality	54. The impact of technology professional development is tracked using data on student learning.	15.7%

To answer research question one, responses from the STNA survey were analyzed using descriptive statistical analyses at the item level as well as the aggregated construct and subconstruct levels. Table 4.2 presents the construct scores for each of the construct and subconstructs on the STNA Survey. Item level responses are organized by each of four constructs and their corresponding subconstructs. To aid readability, survey questions have been abbreviated in this chapter. Complete item stems are provided in Appendix A.

Table 4.2

STNA Construct and Subconstruct Mean Scores

STNA Construct	**Subconstructs**	***M* (*n*=1076)**	***SD***
Supportive Environment for Technology		4.08	0.48
	Vision and Shared Leadership	3.99	0.62
	Organizational Conditions	4.00	0.56
	Flexible Scheduling	4.29	0.70
	Infrastructure	4.12	0.62
	Staff Support	4.04	0.74
	Media and Software	4.26	0.57
Professional Development		3.87	0.58
	Needs: Instruction and Planning	3.84	0.68
	Quality	3.95	0.63
Teaching and Learning		3.71	0.68
	Teacher Use	3.73	0.67
	Student Use	4.02	0.72
Impact of Technology Construct		4.01	0.65
	Teaching Practices	3.99	0.70
	Student Outcomes	4.02	0.72

Supportive Environment for Technology Construct. This construct is directly tied to a school leaders' ability to provide an environment with the appropriate resources (e.g., technology tools, personnel, processes, etc.) which actively enable the successful implementation of instructional technology. With a construct score of 4.08 (SD=.08), this construct was encompassed by six different subconstructs: Vision and Shared Leadership, Organizational Conditions, Flexible Scheduling, Infrastructure, Staff Support, and Media and Software. Of all of the subconstructs in the Supportive Environment for Technology construct, Flexible Scheduling and Media and Software were rated most favorably.

Vision and Shared Leadership Subconstruct. This subconstruct consisted of seven survey items which elicited teachers' perceptions of how well their administrators set and communicate a vision for technology use, model instructional technology usage, and enact

various policies and procedures surrounding technology use and acquiring new staff members. Across this subconstruct, the most highly rated item, with 92.0% of respondents agreeing or strongly agreeing, related to establishment of vision for technology. The least favorable item pertained to the degree to which teachers perceived that teachers as "innovators" were rewarded with incentives; 50.0% of teachers felt that their colleagues in this category received material incentives; 13.1% of teachers reported they were unaware of the degree to which material incentives were provided to colleagues who fall in the technology innovator category. There could be a lack of clarity in terms of which the teachers perceive to be in this category or those who fail to fall into this category may be unaware of the special perks granted.

A second item in this construct exceeding the 10.0% *Do Not Know* threshold in this subconstruct pertains to the hiring practices in which administrators engage. When polled about their belief of technology prowess being a determining factor in the selection of new teachers for employment, 23.0% of teachers responded *Do Not Know* and 20.2% responded *Neither Agree Nor Disagree*. Veteran teachers have a vested interest in the new teachers who will join them in their school. They will serve as formal and informal mentors to their new counterparts and offer some of the necessary support as they navigate the technology landscape at the school. The lower than average rating agreement level on this particular item may not mean that principals do not consider technology know how, but rather point to the lack of transparency in specific schools' new teacher technology ability requirements.

Complete item-level response distributions for all items in the Vision and Shared Leadership Subconstruct are presented in Table 4.3.

Table 4.3

Response Distributions for the Vision and Shared Leadership Subconstruct Items

Statement ***n*=828-1068**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
1. A vision for technology has been developed…	0.6%	2.2%	5.0%	47.5%	44.8%	4.34	0.72
2. The vision for technology use has been effectively communicated..	0.5%	5.0%	10.7%	52.7%	31.2%	4.09	0.81
3. Administrators model effective uses of technology.	0.7%	4.6%	10.9%	49.4%	34.5%	4.12	0.83
4. Administrators support changes …	0.6%	1.9%	7.3%	48.3%	41.9%	4.29	0.73
5. Teachers who are innovators with technology receive **material incentives**…	9.9%	20.2%	19.8%	34.0%	16.0%	3.26	1.23
6. Teachers who are innovators with technology receive **nonmaterial incentives**…	3.7%	10.3%	18.5%	47.0%	20.6%	3.70	1.02
7. When administrators are seeking or hiring teachers, they consider technology literacy…	0.2%	1.6%	20.2%	52.1%	26.0%	4.02	0.74

Organization Conditions Subconstruct. The ten items in the Organizational Conditions subconstruct provide information about technology planning, budgeting, evaluation, and the manner in which a school communicates with student families and the wider school community. Items for this subconstruct had agreement levels ranging from 51% to 90%. Three of the ten survey items within this subconstruct netted over 10% agreement to the *Do Not Know* response category. This implies that there could be a discontinuity in the

actual administrative activities meant to set the tone for the conditions necessary for successful technology integration or the communication of those activities.

The items with the lowest level of agreement were related to budgeting sufficiently to implement various plans (63%) and updating technology resources (51%) also yielded *Do Not Know* response selections above 10%. These agreement levels point to a disconnect between available fiscal resources and the technology teachers perceive they need. The most highly rated cluster of items centered among items pertaining to technology planning. Table 4.4 provides a more complete picture of the item-level responses for the subconstruct.

Table 4.4

Response Distributions for the Organizational Conditions Subconstruct Items

Statement ***n*=903-1032**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
8. An effective long-range school technology plan is in place.	0.7%	2.6%	8.4%	50.4%	37.9%	4.22	0.76
9. The school technology plan is developed through …	0.5%	3.0%	9.3%	53.4%	33.8%	4.17	0.75
10. The school technology plan is monitored and updated…	0.1%	0.6%	9.1%	51.8%	38.3%	4.28	0.66
11. Teachers and other staff members support the school technology plan.	0.2%	1.5%	8.7%	57.1%	32.5%	4.20	0.67
12. The amount of money budgeted for technology resources…	4.0%	14.7%	17.6%	42.3%	21.0%	3.61	1.10
13. The amount of money budgeted for technology resources ..	8.3%	20.6%	20.2%	35.9%	15.1%	3.29	1.19
14. Supplemental sources of funding are actively pursued to support technology…	0.1%	3.3%	16.3%	53.8%	26.5%	4.03	0.75
15. Multiple sources of data are used to evaluate the impact of technology initiatives….	0.7%	3.4%	13.5%	59.0%	23.5%	4.01	0.76
16. Technology is used to communicate and collaborate with families…	0.3%	4.1%	7.8%	58.5%	29.3%	4.13	0.74
17. Technology is used to communicate and collaborate with the community…	0.3%	5.0%	12.0%	56.0%	26.5%	4.03	0.79

Flexible Scheduling Subconstruct. The Flexible Scheduling subconstruct contains three items that measure the degree to which schools enact flexible scheduling in lieu of the traditional system of fixed scheduling (i.e., classes are assigned a set day to use either the media center or technology lab). The IMPACT model encourages schools to allow teachers to use media and technology facilities in concert with their needs which may vary from weekly. As displayed in Table 4.5, the response distributions for this subconstruct items are

largely favorable showing that most teachers find their schools to be in compliance with the IMPACT model component of flexible scheduling.

Table 4.5

Response Distributions for the Flexible Scheduling Subconstruct Items

Statement ***n*=1014-1058**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
18. The media center can be flexibly scheduled…	0.7%	2.8%	4.3%	43.5%	48.8%	4.37	0.75
19. Computer labs can be flexibly scheduled …	0.6%	4.5%	7.1%	42.7%	45.1%	4.27	0.83
20. Mobile computers can be flexibly scheduled …	0.9%	5.0%	6.8%	44.6%	42.7%	4.23	0.85

Infrastructure Subconstruct. The Infrastructure subconstruct gauges teachers' perception about the adequacy and reliability of the technology resources within a school for all teachers and students including those with disabilities. It also provides information about the degree to which schools utilize electronic communication procedures. The agreement level for items in this construct ranged from 80% to 95%. The lowest rated items were regarding the reliability and speed of external connections and the adequacy of resources available to special needs students, while the highest rated items focused on the use of electronic means to communicate within the school and to the families of students and community members. Additionally, 16.1% of teachers reported that they were unsure about the level of access to the appropriate resources of the student with disabilities. This area may

or may not be an area of larger concern for all teachers within the school. Due to the fact that not all teachers surveyed work with students with disabilities, there may not be direct knowledge about all of the tools and resources afforded to teachers who serve this student population. Table 4.6 provides the response distributions for the items in this subconstruct.

Table 4.6

Response Distributions for the Infrastructure Subconstruct Items

Statement ***n*=898-1069**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
21. Teachers and students have sufficient computer hardware …	1.4%	9.9%	6.8%	48.3%	33.5%	4.03	0.96
22. Electronic systems for communicating within the school are adequate…	0.3%	1.1%	2.9%	51.6%	44.1%	4.38	0.63
23. Electronic systems for communicating with families and the community are adequate…	0.3%	2.8%	4.7%	55.2%	37.1%	4.26	0.70
24. Reliability and speed of external connections are sufficient…	2.3%	10.5%	7.2%	52.9%	27.1%	3.92	0.98
25. Students with disabilities have appropriate and adequate access …	1.0%	4.6%	14.1%	53.5%	26.8%	4.01	0.83

Staff Support. This subconstruct captures the degree to which teachers feel there is enough technical and instructional technology assistance available to them. Table 6 shows the distributions for the items in this subconstruct. In general, the vast majority of teachers expressed that they had adequate levels of human resources to assist them with technology integration and technical trouble shooting. The lowest rated item (80% agree or strongly agree) for this subconstruct related to the having a technology facilitator or technology

assistant. At the time of the survey administration, each of the schools had a full-time technology facilitator as a condition of the IMPACT grant. It is likely that the agreement levels were lower due to the absence of technology assistants which may have been eliminated due to lack of funding after the cessation of grant funding.

Table 4.7

Response Distributions for the Staff Support Subconstruct Items

Statement ***n*=1059-1066**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
26. Teachers have ready access to technical support…	1.1%	6.8%	7.8%	54.8%	29.5%	4.05	0.86
27. Library media coordinator and/or media assistant positions…	0.9%	7.0%	5.6%	51.7%	34.8%	4.13	0.87
28. Technology facilitator and/or technology assistant positions…	1.7%	11.9%	6.8%	49.4%	30.2%	3.95	1.00

Media and Software Subconstruct. The Media and Software subconstruct contains four items pertaining to the availability of instructional technology materials to students and teachers. Overwhelmingly, teachers felt their schools have access to the appropriate technology and media resources. Table 4.8 displays the teacher response distributions which range from 86% to 94% agree and strongly agree across all items.

Table 4.8

Response Distributions for the Media and Software Subconstruct Items

Statement ***n*=1030-1061**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	**M**	**SD**
29. Teachers and students have ready access to productivity software…	0.1%	1.7%	5.0%	55.8%	37.4%	4.29	0.65
30. Teachers have ready access to a cataloging system…	0.1%	4.4%	9.7%	52.5%	33.3%	4.15	0.77
31. Teachers and students have ready access to a good collection …	0.0%	2.6%	5.7%	55.0%	36.6%	4.26	0.68
32. When educators are selecting resource media and software, they consider both the curriculum and the needs of learners.	0.0%	0.7%	5.1%	52.6%	41.6%	4.35	0.61

Professional Development Construct. Comprised of two subconstructs, the Professional Development construct assesses the types of professional development needed during the planning and teaching processes, as well as the quality of the professional development that has been provided already. With respect to professional development needs, most were concerned with obtaining training to increase their productivity and to improve their knowledge of online safety, 84% and 83% respectively. The lowest rated item was for acquiring professional development in the area of teaching special needs students with technology (60%). In critiquing the quality of the professional development offered to them, most teachers (91%) agreed that professional development was ongoing; however, a much smaller percentage (68%) of teachers agreed that the impact of the skills acquired during professional development on student achievement was being directly monitored, and an additional 15.7% of teachers responded *Do Not Know*. Because of the high level of

agreement within these subconstructs, this item signals an area that needs to be addressed. Principals must determine mechanisms to monitor the impact of professional development on student-level outcomes. If this this type of analysis is done, principals can ascertain the types of professional development activities that net the greatest level of gains and make a conscience effort to include those in their schools' professional development repertoire. This signals that there is a lack of clarity in tying teacher professional development to student outcomes. Table 4.9 and Table 4.10 show response distributions for each item in the two subconstructs.

Table 4.9

Response Distributions for the Professional Development Needs: Instruction/ Planning Subconstruct Items

Statement ***n*=1044-1059**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
INSTRUCTION							
33. Research-based practices I can use in my teaching.	0.9%	5.9%	15.5%	55.2%	22.6%	3.93	0.83
34. Identification, location, and evaluation of technology…	1.1%	6.7%	12.9%	55.3%	24.0%	3.94	0.86
35. Performance-based student assessment of my students.	1.1%	7.5%	15.9%	54.6%	20.9%	3.87	0.87
36. The use of technology to collect and analyze student …data.	1.2%	6.9%	16.1%	54.3%	21.5%	3.88	0.87
37. Learner-centered teaching strategies that incorporate technology…	0.9%	4.1%	11.8%	55.4%	27.8%	4.05	0.80
38. Online security and safety.	2.9%	17.4%	19.2%	43.6%	16.8%	3.54	1.05
39. The use of technology for differentiating instruction…	0.6%	5.4%	9.9%	55.0%	29.1%	4.07	0.81

Table 4.9 Continued

Statement ***n*=1044-1059**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
PLANNING							
40. Uses of technology to increase my professional productivity.	1.1%	9.3%	12.7%	51.7 %	25.1%	3.90	0.92
41. Ways to use technology to communicate and collaborate with families…	1.0%	11.6%	17.9%	50.0 %	19.5%	3.75	0.93
42. Ways to use technology to communicate and collaborate with other educators.	1.0%	13.4%	17.4%	49.1 %	19.1%	3.72	0.96
43. Alignment of lesson plans to content standards and student technology standards.	1.4%	11.9%	16.6%	49.4 %	20.6%	3.76	0.96
44. Use of research or action research projects to improve…	0.9%	7.4%	14.9%	56.3 %	20.4%	3.88	0.85
45. Use of data for reflecting on my professional practices.	1.4%	11.8%	17.5%	50.9 %	18.4%	3.73	0.94
46. Use of data to make decisions about the use of technology.	1.7%	10.6%	17.8%	52.4 %	17.5%	3.73	0.93
47. Use of technology to participate in professional development …	1.3%	8.6%	15.0%	54.7 %	20.3%	3.84	0.89

Table 4.10

Response Distributions for the Professional Development Quality Subconstruct Items

Statement *n*=886-1057	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
48. Educators in charge of professional development use data to determine…	0.8%	6.3%	14.8%	55.3%	22.9%	3.93	0.83
49. Technology professional development is timely.	0.9%	5.9%	14.0%	57.9%	21.3%	3.93	0.82
50. Technology professional development is relevant.	0.9%	4.0%	12.6%	57.8%	24.8%	4.02	0.78
51. Technology professional development is ongoing.	0.2%	2.4%	6.9%	60.2%	30.4%	4.18	0.67
52. Teachers have an opportunity to evaluate technology professional development activities…	1.0%	5.8%	11.1%	56.7%	25.4%	4.00	0.83
53. The impact of technology professional development is tracked using data on classroom practice.	1.0%	7.6%	23.5%	48.3%	19.6%	3.78	0.88
54. The impact of technology professional development is tracked using data on student learning.	1.2%	6.3%	21.8%	49.9%	20.8%	3.83	0.87

Teaching and Learning Construct. The Teaching and Learning Construct describes how often students and teachers utilize instructional technology during planning, teaching, and learning. This construct contains 16 items split evenly across two subconstructs, Teacher Use and Student Use. Across all items, teachers most frequently reported using technology to improve their productivity and communicate with their colleagues, with 92% reporting daily or weekly use. With regard to student use, teachers reported the greatest area of student use could be found in the area of technology use, more specifically productivity, visualization, research, and communication tools; 76% of teachers reported their students using such tools

daily or weekly. Item-level responses for each construct are displayed for teacher and student usage in tables 11 and 12, respectively.

Table 4.11

Response Distributions for the Teacher Use Subconstruct: Planning and Instruction Items

Statement *n*=992-1047	**Never**	**Once per Grading Period**	**Monthly**	**Weekly**	**Daily**	***M***	***SD***
INSTRUCTION							
55. I consult publications, online journals, or other resources…	10.1%	16.5%	33.1%	30.8%	9.5%	3.13	1.11
56. I identify, locate, and evaluate technology resources..	2.6%	5.6%	17.60%	44.5%	29.8%	3.93	0.96
57. I apply performance-based student assessment…	9.2%	15.0%	30.60%	32.1%	13.1%	3.25	1.14
58. I use technology regularly to collect and analyze student assessment data.	6.1%	11.3%	21.5%	40.4%	20.7%	3.58	1.12
59. My lessons include technology-enhanced, learner-centered teaching…	4.4%	9.5%	21.5%	37.5%	27.2%	3.74	1.09
60. I apply policies and practices to enhance online security and safety.	4.1%	5.4%	13.5%	28.1%	49.0%	4.12	1.09
PLANNING							
61. I use technology to differentiate instruction for students…	5.8%	3.9%	17.8%	37.9%	34.7%	3.92	1.09
62. I use technology to support and increase my professional productivity.	0.3%	1.5%	6.2%	27.5%	64.4%	4.54	0.71
63. I use technology to communicate and collaborate with families…	3.8%	6.0%	19.7%	37.1%	33.3%	3.90	1.05
64. I use technology to communicate and collaborate with other educators.	1.3%	1.5%	7.4%	25.1%	64.7%	4.50	0.81
65. My lesson plans refer to both content technology standards…	13.6%	4.3%	12.9%	34.8%	34.5%	3.72	1.34
66. I do research or action research projects to improve …	15.2%	14.9%	27.2%	25.6%	17.2%	3.15	1.30
67. I use multiple sources of data for reflecting on professional practice.	5.4%	8.2%	23.0%	41.8%	21.6%	3.66	1.07
68. I use multiple sources of data to make decisions…	6.5%	8.1%	23.3%	41.5%	20.7%	3.62	1.09
69. I use technology to participate in professional development activities…	5.6%	21.7%	31.8%	25.6%	15.3%	3.23	1.12

Table 4.12

Response Distributions for the Student Use Subconstruct: Information and Communication Technologies Items

Statement *n*=955-1030	**Never**	**Once per Grading Period**	**Monthly**	**Weekly**	**Daily**	***M***	***SD***
70. Students use a variety of technologies…	2.8%	5.3%	15.8%	42.4%	33.6%	3.99	0.98
71. Students use technology during the school day to communicate and collaborate…	17.6%	8.8%	17.3%	27.1%	29.2%	3.42	1.44
72. Students use technology to access online resources and information…	2.3%	5.6%	19.3%	41.7%	31.1%	3.94	0.97
73. Students use the same kinds of tools that professional researchers use…	15.8%	11.1%	24.9%	30.8%	17.4%	3.23	1.30
74. Students work on technology-enhanced projects that approach real-world applications of technology.	7.5%	13.8%	29.5%	30.8%	18.4%	3.39	1.16
75. Students use technology to help solve problems.	3.8%	5.6%	18.7%	40.6%	31.4%	3.90	1.03
76. Students use technology to support higher-order thinking...	4.4%	6.4%	19.1%	41.2%	28.9%	3.84	1.05
77. Students use technology to create new ideas and representations of information.	4.0%	7.1%	24.5%	38.3%	26.1%	3.76	1.04

Impact of Technology Construct. The Impact of Technology construct explores the effects of implementing an instructional technology project with increased access to media and technology resources. The first subconstruct, Teaching Practices, looks at how teachers use instructional technology in their craft, and the second subconstruct measures how teachers perceive the influence of technology usage on student-level outcomes such as increased confidence, independence, collaboration, engagement, and achievement. Teachers reported high levels of agreement with regard to the impact of technology on their teaching practices, with the percentages of teachers agreeing between 71% and 85%. The mostly

highly rated item centered on the use of technology on their part to enhance instruction. Teachers reported the highest level of agreement in terms of student impact with regard to increased student engagement, with 86% agreeing or strongly agreeing to this item. Tables 13 and 14 provide detailed information about the subconstructs.

Table 4.13.

Response Distributions for the Teaching Practices Subconstruct Items

Statement *n*=1037-1044	**Strongly Agree**	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**	***M***	***SD***
78. My teaching is more student-centered and interactive…	0.7%	4.1%	15.1%	47.0%	33.0%	4.08	0.84
79. My teaching practices emphasize teacher uses of technology skills …	0.3%	3.3%	11.2%	54.6%	30.7%	4.12	0.75
80. My teaching practices emphasize student uses of productivity applications…	1.5%	7.7%	19.9%	48.4%	22.5%	3.83	0.92
81. My teaching practices emphasize student uses of technology…	1.0%	5.8%	15.9%	51.7%	25.7%	3.95	0.86

Table 4.14

Response Distributions for the Student Outcomes Subconstruct Items

Statement *n*=1017-1039	**Strongly Agree**	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**	***M***	***SD***
82. Technology has helped my students become more socially aware, confident, and positive …	1.0%	3.3%	18.5%	49.1%	28.1%	4.00	0.83
83. Technology has helped my students become independent learners and self-starters.	1.0%	5.2%	14.3%	50.5%	29.0%	4.01	0.85
84. Technology has helped my students work more collaboratively.	0.8%	5.9%	17.4%	49.1%	26.8%	3.95	0.86
85. Technology has increased my students' engagement…	1.0%	2.3%	9.8%	51.8%	35.1%	4.18	0.77
86. Technology has helped my students achieve greater academic success.	0.6%	3.1%	20.5%	48.0%	27.7%	3.99	0.81

Analysis of STNA data revealed that the teachers were largely positive about technology integration in their schools. Mean construct scores ranged from 3.70 to 4.08, with the construct most closely linked to principal instructional technology leadership, Supportive Environment for Technology Use, being rated the highest. The high ratings provided by the teachers can be attributed to two distinct reasons. The first of which is data collection and treatment. Because the survey offered a *Do Not Know* response item, teachers were free to opt out of the question in a sense. These items were not included on the agreement scale analysis. If forced to choose an agreement option, the respondents could possibly choose less favorable agreement options (i.e., *Strongly Disagree* or *Disagree*) which could lead to lower mean scores for the items that had high levels of *Do Not Know* responses.

Secondly, the fact that the schools have been engaged in a structured instructional technology program has led to a higher skill level on the part of both principals and teachers. At the time of the survey schools had been engaged in the implementation of the IMPACT model at least two years. The level of experience with model implementation coupled with extensive professional development may have led to the schools to be more poised form successful technology integration as was indicated by the high means on each of the STNA constructs.

The next section presents the findings of the analysis completed to ascertain if instructional technology perception differences exist among elementary, middle, and high school teachers.

Variance of Teachers' Perception of Instructional Technology Leadership by School Level. To determine variance by school level (elementary, middle, or high), responses to the STNA survey were analyzed using the Kruskal Wallis test which is the nonparametric equivalent of one-way ANOVA, with construct means being used as the dependent variables.

Although many of the assumptions required for ANOVA analysis (i.e., independent observations, normally distributed populations, and homogeneous variances) are not required to be met for the nonparametric analog of the test, Kruskal Wallis, procedures were carried out to ensure proper vetting of data. In all cases, the observations were independent as a result of the design of the survey. Teachers individually responded to the items through an online survey instrument. Therefore, how one participant responded had no bearing on how

other participants in the same group responded. The skewness and kurtosis statistics were calculated to detect violations of the normality assumption. For the four constructs of STNA, skewness ranged from -.501 to -0.175 and kurtosis ranged from -0.170 to 0.591. These skewness and kurtosis values were within the expected range of chance fluctuations; therefore the normality assumption is satisfied. The final assumption, homogeneity of variance, was determined using Levene's test. The Levene's test at the .05 level with a null hypothesis that the variances were equal across the different school levels was conducted.

Table 4.15 presents the test of homogeneity of variances when the sample is grouped by school level. For each of the four constructs, the significance of the Levene statistic was greater than .05. Therefore, the variance differences between elementary, middle, and high school teachers on the constructs were not significant and the null hypothesis is retained. All construct scores satisfied the homogeneity of variance assumption.

Table 4.15

Test of Homogeneity of STNA Constructs When Grouped by School Level

Construct	Levene Statistic	*df*1	*df*2	Sig.
Supportive Environment for Technology Use	0.051	2	1073	0.95
Professional Development	0.913	2	1057	0.401
Use of Technology for Teaching and Learning	0.898	2	1047	0.408
Impact of Technology	1.288	2	1046	0.276

The null hypothesis for this analysis assumes there is no difference in the mean STNA construct scores for elementary, middle, or high school teachers. The Kruskal-Wallis test for the Impact of Technology Construct across school levels was not significant, thus the

null hypothesis was retained. For the other three construct scores—Supportive Environment for Technology Use, Professional Development, and Use of Technology for Teaching and Learning, there were significant differences in construct scores across school level. As a result the null hypothesis is rejected. To ascertain which means differed, multiple pairwise comparison testing was conducted for each construct. Table 4.16 displays the significance testing results.

Table 4.16

Kruskal Wallis Significance Test Results for STNA

	N	*df*	H	***p***
Supportive Environment for Technology Use	1076	2	7.473	.024*
Professional Development	1060	2	13.689	.001*
Use of Technology for Teaching and Learning	1060	2	26.173	.000*
Impact of Technology	1049	2	3.375	.185

* $p < .05$

Pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. Post-hoc analysis revealed statistically significant differences in Supportive Environment for Technology Use Construct score between elementary (Mdn = 4.09) and high (Mdn = 4.00) (p = .042) school teachers but not for other sets of comparisons with middle (Mdn = 4.06) school teachers. For the Professional Development Construct score, significant differences existed between the elementary (Mdn = 3.77) and middle (Mdn = 3.91) (p = .009) and for elementary and high (Mdn = 3.95) (p =

.001) school levels but not for middle and high school levels. Similarly, the Use of Technology for Teaching and Learning Construct score was significant for elementary (Mdn = 3.58) and middle (Mdn = 3.78) (p = .001) and for elementary and high (Mdn = 3.91) (p = .000) school level comparisons but not for middle and high school levels.

Phase II Findings

Instructional Technology Leadership Preparation

Portions of the principal interview were utilized to answer Research Question 2: In which ways do principals become prepared to serve as instructional technology leaders? This section details what principals feel is good instructional technology leadership, how they became equipped to provide this type of leadership, how they rank themselves, and how they plan to continue to expand their instructional technology leadership capabilities.

Principals' View of Good Instructional Technology Leadership. To be effective as an instructional technology leader, it is imperative to understand the attributes necessary to be deemed as such. For at least one principal in the study, there was some confusion to what constituted effective leadership. She lamented,

> What do you expect from me as an instructional leader to be? I mean not an instructional, but a technology leader and I don't know if I really have a clear understanding of what is expected of me as an administrator to be able to carry out those duties. (Elementary Principal 2)

The literature suggests that this principal's lack of clarity about the role of an instructional technology leader is not unlike her peers (Redish & Chan, 2007; Yu & Durrington, 2006).

Others were more aware and clear about their beliefs. One principal used the old adage, “Practice what you preach” to describe her view of how a good instructional technology leader should engage in the school setting (High School Principal 1). Principals cited the following characteristics of a good instructional technology leader: knowledgeable of technology, possesses relevant technology skills, models technology, empowers others to become knowledgeable of technology, highlights teachers with good practices, supports them, offers professional development, and stays abreast of current technology and trends. Two other principals posited,

> Well first of all a great instructional technology leader is knowledgeable of technology. And not only are they knowledgeable of technology but they have the appropriate skills and ability to number 1, model it but number 2, to share it with others and train others (Elementary Principal 1).

> With the instructional piece, I’m trying to coach them along the way, find those folks that are teaching the way they ought to teach in the 21st century and sending folks to go watch them, to talk to them that kind of thing because there are a few of those in our building (High School Principal 2).

Preparation Mechanisms. When asked about how they learned to serve in the role of instructional technology leader, principals cited attending professional development sessions, experience as a teacher, receiving support from district-level leadership, using self-discovery, attending conferences, and networking with other school leaders.

One principal developed some of his technology expertise through professional development he received while he was still a classroom teacher. He stated,

> I think that, I was fortunate enough to still be in a classroom when our district was getting all this technology. I received a lot of in-services, and I was going through the classroom when we still had the TPL program going on from the state I think and so I don't know. I think I just tried to replicate the training I received (Middle School Principal 1).

Further, another principal discussed that her preparation was from entailed support for district-level staff. She seeks resources so that she can best support her staff.

> I think the expectations dropped down [from the district level. I mean in our district that's just one expectation of the building leaders, to be an instructional leader and part of that involves technology. So I think the expectation from the superintendent to the assistant superintendent is being the one to it's our role or our job or our responsibility to find resources and be the one to model best practice for our teachers (High School Principal 1).

Those overseeing the IMPACT grant offered professional development to principals and other school staff during the grant cycle. One of the principals shared that this professional development was instrumental in her preparedness. When asked how she had

honed her skills she stated, “Going to all of that staff development with DPI and that kind of thing, and it happened before we actually got the grant” (High School Principal 2).

Another principal shared that her preparation was through a combination of professional development and networking with other school leaders. She stated,

> …I think it’s through staff development, training that I’ve been introduced to or opportunities that I’ve had to go to workshops, to network with teachers from other districts and other counties, to work with our instructional facilitators here in the district. You know the principal that we dialogue and have our own PLC’s. I think that’s more of how I’ve been prepared to work best with my teachers. (High School Principal 1)

Principal Pre-Service Preparation Programs. All of the principals failed to mention pre-service principal preparation programs when asked how they developed skills to become an instructional technology leader. As a result, the researcher specifically asked about the degree to which principals felt their principal preparation programs were helpful in preparing them to serve as instructional technology leaders varied; however, more cited their programs were not beneficial in assisting them with tackling the role of instructional technology leader.

Of her experience in the Master of School Administration (MSA) program, one principal shared that she felt the program, “thrust over it [instructional technology leadership]. It was very small, not really significant at all (Middle School Principal 2).” Another principal shared, “I definitely would say none of my graduate courses have prepared

me for technology. So everything that I have learned or kind of know is merely by me being in it and seeing it and asking questions (Elementary Principal 2).” Further another principal at the middle school level expressed,

> No. They totally I got the old school type principal classes you know. There wasn’t a lot of technology integration. I took one class where we did some things like on a web quest and so forth but that was about it. There was there was nothing otherwise that I received in my training to be a principal (Middle School Principal 1).

Two of the principals have been out of school for extended period of time or obtained principal credentials through an add-on license procedure. The sentiments of these principals mirror the findings in a study conducted by Militello, Gajda, and Bowers (2009). The researchers assert that the general preparation for the role of principal is misaligned to the actual work tasks with the exception of their internship experience if one was afforded. These reasons could have led to their belief that the programs did not adequately prepare them. One of the principal shared,

> …This was in the early 90’s so it’s been a long time ago. My classes—some were excellent, and some were pretty pitiful. I can remember my finance class was the most pitiful. I didn’t really learn much. I learned how to do budget on the job (High School Principal 2)

For one principal, she felt that some of her assignments may have assisted her with raising her level of technological competence; however, it may have been unintentional.

> Well I think by default it did because the requirements of the courses you know we were required to produce certain things. They really didn't teach us how to do it they just gave us the expectation to get it done and turn it in (Elementary Principal 1).

Another shared,

> We did some blogging and we did these online classrooms where you're virtual in the class you know what I mean. And that was very helpful (Middle School Principal 3).

While these examples point to the principals being satisfied with their training, it is important to note that the functions they describe are limited to mere technology use and do not examine the wider set of skills necessary to function in the role of principal such as budgeting and managing ethical concerns.

Future Growth Mechanisms. Principals in the study mentioned partaking in additional professional development, visiting other schools, attending and presenting at conferences, and maintaining relationships with other principals as ways to continue to grow their skill level as instructional technology leaders.

> I'll go back to just trying to stay up to date on web 2.0 tools. That's probably the biggest one. And then moving into the high school another growth area for me has been to learn that high school curriculum (High School Principal 2).

> I think we do a good job at technology integration here but I'm always open to going to other schools and going through a regular school day and seeing what middle schools do—middle schools that look like us. You know who match our demographics, match our poverty level that kind of thing and, and seeing what they do. You know somebody's out there doing something. You can always learn stuff from other people. I firmly believe in that (Middle School Principal 1).

> I've got connections with those who are in my IMPACT [X] group that I'll email or pick up the phone and talk to them right now who are in particularly middle and high schools. And so tell me what you did when this happened and that kind of thing particularly the folks in [X District].

> I've gone to NC Ties and ISTE. It was actually in California this year. Both of those are always enlightening and eye opening. I mean sometimes you feel like its information overload but I always find a lot of great resources that I can use and these are things that people are using across the country.

Degree of Preparedness. When the seven principals in the study were asked to rate their level of preparedness to be an instructional technology leader on a scale from 1 to 10, principals offered the following ratings: 6, 7, 7.5, 7 or 8, 8, 8, and 8. When asked what prevented them from scoring themselves higher, a majority of principals felt they lacked the time necessary to remain current with technological developments. To this point, a principal

shared, “I think the time factor is still a big part of it.” Other reasons limited access to resources while a teacher and attending to other responsibilities within the school. Sample comments include.

> I personally did not have all the technology that we have here at my school so I think it’s more of not really a fear or a lack of wanting to know but because that’s not my main thing right now. My main thing is not just you know me working on the active board and things like that. I’m constantly in the building and doing things so I don’t have the opportunity to use the active boards or to use all the great technology that we have in our district.

> If I had more time to concentrate on it; you know what happens is the thing about being a head principal is you try to be an instructional leader and, and it would be great if you could just worry about you know student learning all the time but you know in a school like ours I’d be able to do some discipline once in a while.

Principals in the study shared their understanding of the evolving role of instructional technology leaders, the various opportunities used to prepare them, how well they feel prepared, and the methods they plan to use to continue to grow their skills. The next section addresses research question 3 which explores principal instructional technology leadership behaviors.

Principals’ Instructional Technology Leadership Behaviors

The Principal Interview and NETS-A Teacher Survey were used to explore research question 3: In what ways do principals approach instructional technology leadership, and does variance exist by school level? Principal interview findings were presented first. Principals shared how they approach their role of instructional technology leader in their schools. Findings were organized by each of the NETS-A Standards. Findings from the teacher survey will be presented after those of the principal interview.

Visionary Leadership. Principals in the study conveyed the manner in which they define, disseminate, and fund their vision for instructional technology in their schools. The next three sections express how principals exhibited visionary leadership.

Developing a Clear Picture of What Meaningful Instructional Technology Looks Like. To lend the necessary instructional technology leadership, principals cited the need to first clearly define what constituted meaningful technology integration within the confines of their school. Principals used terms such as “purposeful”, “students using it”, “natural”, and “seamless” to describe their desires for instructional technology usage in their schools. More explicitly, when asked about her view of teachers who engage in meaningful instructional technology integration, a high school principal shared,

> I would have to definitely refer to new teacher evaluation instruments because that’s what we use to evaluate our teachers here at [X School] this year. But a great leader is someone that would probably be in the distinguished category would be 1, in a classroom where technology is readily available for the students. It’s facilitated by the students where the teacher may begin instruction or begin direction and then the

> students are left to kind of feel their way or explore and find out and research and do things on their own using the technology. It is one when the students have been introduced and they know what tools are going to be the most successful, the most beneficial for the research or the project or whatever it is, the information that they're trying to find, I think it is one that allows students to share in and outside the classroom and that maybe whether we're networking with other schools here in our district (High School Principal 1).

Another high school principal shared,

> For me it should be seamless and it should not look staged or it should be part of the day. Like back when I taught 100 years ago kids would pull out their books and their paper or whatever. And now they pull out their net books or their iPads or their iPods or whatever and it's just very seamless and it's just natural. The first time I used the words digital native, our kids are digital natives and very natural. And it should be natural to the teacher. Everybody has access and the other piece with that is to ensure that my teachers understand how to use instructional technology in their classroom so what are the tools that are out there that are appropriate for their discipline (High School Principal 2)

Principals desired to have meaningful technology integration in lieu of gimmicks. A middle school principal shared her thoughts on blogging and virtual worlds, while an

elementary principal shared her desire for her teachers to use appropriate resources to provide meaningful classroom experiences.

> We've done some blogging in the past. I can't say that I've done blogging this year. Last year we did blogging with a cultural diversity book that we were reading together. I just haven't, like I said this year I got away from it. I really haven't done that this year…The virtual world I can't see an application for us here. It would be fun but seems like an extra you know what I mean a burden. If you don't integrate it well it just comes across as something else to do so (Middle School Principal 3).

> I want to be able to see them in integrating not just watching like brain pop videos and I know brain pop videos are good but at the same time how are you using it to guide your instruction? So when I go in the classroom and even though the lesson plans, and I look at lessons plans as teachers put in there you know I'm doing this, going to this link or I'm going to this link. I always ask how long is it and what's the purpose? Because there's nothing worse than to just put on something from the website and you have no type of purpose behind it. It's just because I want the kids to look at it. So just making sure that they truly are integrating it in their instruction and making sure that it's purposeful (Elementary Principal 2).

Communicating the Vision for Technology Integration. Once the image of desired instructional technology has been generated for a school, it is necessary for the instructional

technology leader to communicate this to the all stakeholders--teachers, support staff, students, and parents. Principals shared using committees such as a technology or school improvement team as a forum for discussing the direction of technology use within their schools. One principal shared her use of the school improvement team as a vehicle for developing her vision for how she should proceed. This same group was then used to disseminate the direction the school would take in terms on instructional technology.

> But a lot of that stems from our school improvement team. It has come from holding our staff, getting information from my school improvement team, our leaders in the building to see what are the needs, what are your expectations and how can I assist you and that's kind of led my professional growth of ok here's what I'm going need to do or what I'm going need to become proficient with to effectively lead my staff just based on their needs from the school improvement team, from the teacher working conditions survey, just using documents and those things together. Ok where are my teachers right now? What is it that they're going to need to support their professional growth in the classroom and in this school? Where is the school as a whole with technology, and what's going be the next step for us (High School Principal 1)?

One principal has taken advantage of community-based opportunities to share the word about technology use in her school in hopes of eliciting financial and moral community support.

> We have a local fair education summit. I spoke there to talk about distribution of laptops. I've met with numerous civic groups like a night time guest speaker kind of thing (High School Principal 2).

Ensuring Adequate Funds are Available for Instructional Technology. Principals are keenly aware of the need to acquire additional fiscal resources to acquire devices and expand the infrastructure in their schools. Many are seeking additional grant funds to sustain or extend their resources beyond what was provided through the IMPACT grant. Others are also seeking local funds from their district to enhance their suite of tools. One principal stated, "I'm going to my superintendent next week to see if even though we're applying for the grant if he can buy a couple more carts of computers for me (High School Principal 2)."

Several of the principals spoke of the need to include teachers in technology budgeting decisions as a way to ensure they feel invested in the decisions made at the school.

> Me and my teachers have a say so in how our budget is spent and even though we don't have much money. What are the kinds of things you need? What are your needs? There's really and I'll be honest with you and this might not be a principal for long but there's never ever been one single thing that a teacher has asked for that I haven't been able to get for them (Middle School Principal 2).

Digital Age Learning Culture. In this study, principals shared some of the ways in which they assist with providing a dynamic environment for technology. Many of them set the tone by modeling technology use in a number of ways.

Modeling Technology Usage. Principals share that they felt it was imperative to model technology use. They have done this through leading professional development sessions, using devices in their everyday work, and creating digital content on websites or blogs. One middle school principal shared her belief in the importance of modeling instructional technology use. She shared,

> I think it's important for me to also model the behaviors that I expect from them and the children to, to use whether I'm in the classroom observing or whether I'm just creating my own blog or whatever or tweeting. I think it's important for me to model that, too (Middle School Principal 2).

Another middle school principal models instructional technology usage through a variety of modes. When asked how he models effective instructional technology, he replied,

> You know I think when I lead PD sessions I always use technology. And I do flip charts and so forth. I know a lot of stuff we've done here with technology as far as teacher evaluation and walkthroughs is we use the, we use an online walk through system that we use. All the administrators we have I Pads or I phones (Middle School Principal 1).

Communicating using Technology. Another way in which principals modeled technology use was through the use of a variety of communication modes (email, website, phone messaging systems, social media sites [e.g., Twitter, Facebook, etc.], and internet conferencing) to remain connected to all stakeholders throughout the course of the year.

> I try to communicate using as much technology as possible, using internet, email, filling out a lot of our agendas for staff meetings electronically. Our newsletters are all electronically. Also, our parent communication, we send it hard copy but we also send out communication by email, maintaining and updating our school web page and so forth (Elementary Principal 1).

Excellence in Professional Practice. Principals endeavored to provide environments in which staff members had the opportunity to engage in ways to enhance their instructional technology skills. They ensured access to high quality professional development and individuals within their schools who had the necessary technical and instructional expertise.

Providing Instructional Technology Professional Development for Teachers. Professional development to enhance teachers' technology integration skills is imperative to the success of any technology integration project. One of the principals shared her desire to increase the level of professional development she will provide to teachers in the future based on her experience in the IMPACT grant. As she plans her next grant, she plans to increase the amount of money earmarked for professional development.

> I've learned from the IMPACT grant. I think we were at 20 or 25% of the budget had to be used for staff development. And I remember when we got that. I mean that was a huge chunk of money and I was like there is no way we'll ever be able to spend that much money on staff development and once we got going I was like oh we need to double it. (High School Principal 2)

Schools deployed instructional technology professional development in a variety of formats—summer boot camp, after school and planning period sessions, dedicated weekly days to professional development (Technology Tuesdays and Technology Thursdays), Lunch and Learns, Expos (e.g., Hot Topics-district level, Swap Meet-school-level, etc.), Just-in-Time, and digital access. Two examples of instructional technology usage were:

> We have our technologist from the district come out who is instructional technology trainer. He trains probably every, he comes out every month or every two months depending on his schedule. We schedule him probably 6 or 8 times throughout the year and he does whatever they need done at that time so he just came up the other day and did another training on the on Google docs and before that he came out and was just doing troubleshooting with them so that's basically what we do (Middle School Principal 3).

> We do have a about once a month we let teachers present about whatever topics they want to each other. We call it our Swap Meet. They sign up to do that and so it does involve technology. They're welcome to show some technology…(Middle School Principal 3).

Principals noted that sessions were facilitated by district staff, technology facilitators, media specialists, principals, teachers, technology assistants, instructional coaches, and in one case, a data manager. Topical areas that surfaced were: Google products, blogs, social media, interactive white board use (e.g., Promethean and SMART), subject specific software,

Edmodo, and ethical issues. A middle school principal specifically shared a session she requested to ensure the ethical use of source material, “We do a PD [session] here with our teachers our ethical use and stuff and like licensing to make sure nobody is plagiarizing…” (Middle School Principal 1).

Because many of the schools have been engaged in high levels of technology, principals have had an issue with integrating new teachers into their schools. One principal shared that her school offers intensive training for teachers at the onset of every school year. All teachers are invited to attend, but new teachers have found it beneficial. She stated,

> Well it’s not easy but what we do at the beginning of every year we have a two day boot camp, technology boot camp. And anybody that’s new or anyone that just wants some refreshing and we pay them a stipend. They come in and we do two days of what they need to know. It’s like a survival camp. What they need to know to get through the school year and it might be as simple as training them on a promethean board because they’re brand, brand new and if they’ve never seen one they have a lot to learn. (Middle School Principal 2)

Enabling Support Mechanisms. Ensuring the teachers have a high level of support has been crucial to the successful integration of technology. Informal and formal support opportunities were made available to teachers by a variety of staff members. This support primarily came from technology facilitators. A middle school principal shared,

> Making sure that my technology facilitator is truly an instructional resource for my teachers. And he is a resource almost, we check him out just like the book. I mean

> he's all day in the classroom helping these teachers and helping the children and I think that is key for my teachers to make the most out of you know their classrooms. (Middle School Principal 2)

Upon transitioning to a school without a technology facilitator on staff, the principal exercised the option to convert a traditional teacher position into that of a technology facilitator. "I have added a position at the high school. I turned in a teacher slot and I have added a technology facilitator at the high school" (High School Principal 2).

Due to budget cuts, some of the schools have not been able to continue to employ a technology facilitator as they had in the past. Some now rely on technology assistants.

> That person is a technology assistant rather than a technology instructional facilitator so it it's not quite the support we used to have. We used to have a certified teacher who knew technology so that helped the teachers really integrate it. What we have now is more of a troubleshooting kind of person who can repair machines and, help them keep things running and that person actually resigned to take a better position. (Middle School Principal 3)

Another principal ponders what it would be like to support teachers in the absence of a technology facilitator. She shared that she felt the level of support would not be up to par with what teachers are accustomed to receiving,

> It would not work as we currently use a tech facilitator but I know that one day we will not have a tech facilitator and we do have to come up with other ways to do the kinds of things that he does do in the classrooms and then you know the, the way he

> does help to facilitate the teachers you know instruction but to me it would not be ideal. (Middle School Principal 2)

Contrarily, others feel like the level of expertise within the school has risen to the point that support can be received from other staff members. Because the schools have been engaged in enhanced technology integration as a result of the grant, other staff members have developed their skills to the point of being able to adequately assist others. Middle School Principal 2 shared, **"**As far as where we are with technology and anything that we need at this point we have so many people on staff that we help each other."

Systemic Improvement. Principals in the study were engaged in activities that would improve the teaching and learning in their schools. They actively monitored and assessed teacher practice to ascertain the types of supports necessary to improve instructional technology use.

Monitoring Teacher Instructional Technology Usage. The North Carolina Teacher Evaluation process affords principals the ability to incorporate technology use as part of teachers' professional obligation. Substandard 4.04, teachers integrate and utilize technology in their instruction, explicitly calls for technology use; principals shared that other portions were applicable as well. A middle school principal shared,

> I think it helps so much that there is one element that is specifically in technology [on the Teacher Evaluation Instrument] but if, if you when you put that technology in the hands of the kids and you really use it as a as a tool for instruction it can also hit on several other elements like the 21st Century, the collaboration piece, the real world

> application. Which helps with critical thinking skills so when teachers use it well it, it, it really helps many parts of the evaluation. It empowers students so then there's a good climate so it can even help under standard number 2 so I believe that it can really make a difference. (Middle School Principal 3)

Principals spoke about the need to ensure teachers are using technology. One such mechanism is to review lesson plans submitted by teachers. One principal explained the process of checking weekly lesson plans for technology integration by her administrative team (herself and two assistant principals).

> When we look at the plans, we are looking to see how are they are integrating technology, and also, a lot of times we'll ask questions about how [the activity] is going to lead to making instruction better using this technology. (Elementary Principal 2)

Principals shared their use of formal and informal observations of teachers' instructional technology practice to ensure the spread of increased technology integration. One principal shared her process for conducted classroom observations and providing rapid feedback.

> And we do walkthroughs there and then we do learning walks with teachers and we get teachers in our instructional leadership team does walkthroughs. We all do those online so we get instant feedback. We could walk right out of the classroom and email the walkthrough directly to the teacher so we're getting real time feedback for the most part. (Middle School Principal 1)

Because of intensive monitoring, at least one principal encouraged staff members to leave her school because they did not buy into the vision of instructional technology use set forth by the principal. The principal described her desire to have everyone working toward common goal of enhanced instructional technology use.

> So [technology use] is building, building the momentum as I go and getting people on board as, as we move through it. Now with that I need to tell you that a lot of people have left this school in the last 12 months…It will be a high turnover rate. When you look at my data over time, you're going see this March's data and next March's data it will be high but as my superintendent tells the board that's not a bad thing. It is going to be a high turnover rate and anybody looking from the outside not knowing anything what's going on they'll say what in the world happened but it is what needed to happen and most have chosen to go on their own. I have not had to dismiss anybody yet, although I may have one or two dismissals this year. (High School Principal 2)

This principal was willing to forgo an acceptable level of teacher turnover, one of the metrics by which school stability is measured, to ensure that everyone at her school make effective instructional technology a priority.

Assessing Teacher Instructional Technology Proficiency. One principal desired to know the proficiency of her staff so that she could offer the necessary support to improve their practice. As a result, she conducted a needs assessment to ascertain their perception of

their own instructional technology skills. Upon surveying her staff two years later, she noted marked improvement. She stated,

> We survey the staff. Ok, where do you think you are? If you had to, on a scale of 1 to 10 where would you consider that you are performing as a technology leader in the classroom? And it was interesting, interestingly enough about two years ago, well about three years ago we surveyed our staff and we had more falling in the 0 to 5 category of how comfortable they felt with the use of technology. But, through putting it in their hands more regular, making it regularly available, providing staff development, modeling, peer coaching, setting them up in departments with peers, with colleagues to work through some of these issues or to share Best Practice. We did the same survey again last year but just in a two year period we had probably about 70% of our teachers who are now in the 6 to 8 range of how proficient and how confident they feel with the use of technology. (High School Principal 1)

Digital Citizenship. Principals in the study shared their desire to create an atmosphere in which all teachers and students have access to instructional technology resources and utilize them in a fashion that gives credence to behaving in a safe, ethical, legal, and socially acceptable manner.

Equitable Access. Many of the principals discussed their quest to ensure that teachers had the same access to instructional technology resources. Many cited outfitting the classes in a similar fashion. Others spoke about the incremental acquisition of resources. One of the principals desires to see her school become a one-to-one laptop school. She decided to begin

the project this school year with a pilot using a select group of teachers. To determine who should get resources in a school, an application process was used. This process ensured that teachers who were most interested in piloting new technology resources.

> I made them write their own grant actually. I took a lot of the questions that we had to answer when we did the IMPACT grant. And I put it out there to the entire staff and I said we're going to have a pilot and if you'd like to participate here's what you've got to, here are the questions you've got to answer and it first of all it separated the people who were going to take the time to write the grant, their little mini grant versus those who didn't…I had 7 people apply for three Chromebook carts. My instructional leadership team… took the top three and gave them a cart. Two other people are using it when one of the top three has a planning period. (High School Principal 2)

Through the application process, the principal learned an important lesson when she discovered that not everyone who appears ready for enhanced technology integration is ready to make the leap. This example underscored the need to rely on data to make informed decisions.

> So we had two teachers that we thought were qualified and ready and they did not want to touch it with a 10 foot pole and I said I am so glad that I went at it by saying you've got to apply because I would've chosen those two teachers and the pilot would've flopped right then because I thought they were ready and they really aren't. (High School Principal 2)

There are plans to expand the program to other teachers and eventually, once enough devices are acquired, students will be able to take them home.

Enacting Policies and Procedures for Safe, Legal, and Ethical Use. Principals discussed many of the policies in place to govern student and teacher use. All of the districts rely on sophisticated filtering systems to ensure students do not access content that is inappropriate. Most of them agree that their district leadership takes the lead in area; however, all are tasked ensuring with the application of the policies.

> …Our district is really good about that. They have like all kinds of blocks on it and of course you know there's always a loop hole but any time the kids are on the computer we have people in there monitoring (Elementary Principal 2).

One principal spoke about using her instructional facilitator to monitor student activity.

> So that ties in with our instructional technology facilitator and so they know that when they're in the labs doing stuff that its stuff they're supposed to be doing and … not surfing the internet and that kind of thing. And then as far as being ethical you know we have the AUP stuff. AUP, everybody has to sign acceptable use at the beginning of the year and all that. And then we have various monitoring things in place for people in labs. We have the software where the teacher can be at the active station and they can monitor what's going on in classes and you know shut the whole lab down at once if they need to.(Middle School Principal 1)

Another principal shared that her media coordinator trains teachers on copyright policies each year. It is also expected that this information is filtered down to students.

> They're all on top of that but you have to keep bringing that in front of people because it's very easy to just click on a picture and you know borrow it as your own. We encourage kids to do that in all classes, but we train the teachers. We specifically train the teachers. Well we review the, the policy with them every year, I mean the coordinator does and, and we especially review it with the teachers so that they will review it with the students and our media coordinator also has a piece when the kids come in there. She also talks to them about that that as well. I feel like, I feel like she does a good job on that. (Middle School Principal 3)

Promoting Student Responsible Use. Several principals in the study felt instructional technology needed to be in the hands of the students to be most effective. It is crucial that they be taught to utilize instructional technology in a responsible and productive manner. This is amplified when schools are tasked with incorporating student-owned devices. One principal found it necessary to address school- and district-level policies to allow for student-owned devices.

> So I went to this high school that I mean they have pretty much, they knew kids had cell phones and that kind of thing, but they banned them. We do not see them or whatever and they're fighting the kids constantly with them. You know I very quickly turned that around and even one teacher said, 'That's not what's in the handbook.' I just looked at her and said, 'I don't care what's in the handbook.' They tried to embrace their technology, the kid's technology where they are and then using it in the

> classroom in meaningful ways and teaching them with that when it's not being used what's appropriate for you as a student. This is your workplace you know. Should you have your phone on? Should you be texting? When is it ok to listen to music and when is it not. All of those kinds of things and that has been a tremendous learning curve for my faculty because number 1, they don't know how to use those smart phones to their benefit as a whole. There are conflicts to people who are doing things. And then number 2 is you have the other extreme where you have and this is a couple of my first year teachers. They just let them use their technology, listen to music you know text whatever all during class when they shouldn't be. (High School Principal 2)

Because the principal began her tenure mid-year, she used the partial year to gather information about the use of student-owned devices. During this time, she worked with district leadership to develop policies that would support this type of use. The policies, along with appropriate professional development for teachers, were enacted at the beginning of the next school year.

The next section presents finds on the degree to which principals feel as if instructional technology leadership varies across elementary, middle, and high schools.

Variance in Instructional Technology Leadership by School Level. Principals were asked if their instructional technology leadership would vary if they were to become principal at another level. Most stated that they believed that instructional technology would remain the same across all school levels. High School Principal 2 emphatically stated,

"Leadership is leadership." Similarly, High School Principal 1 shared, "Well I think it's a consistent one, its high expectations at every level." Elementary Principal 2 further expressed, "I don't know if it would be different and I think that regardless of what level you're at you have to, to know and understand the importance of the tech technology and how to integrate it within your school."

Two of the principals have served at multiple levels since the onset of the IMPACT grant, but most have only served at the level at which they are currently employed and both felt instructional technology leadership should not vary. One principal shared that she is very hands on and makes it a point to be very visible. After moving to the high school level, she learned that this conflicts with how teachers in the school had experienced leadership in the past. She shared that many of them were accustomed to retreating to their classrooms to be left alone by school administration. She stated,

> And that's what this school is used to, and this is very different for them and sometimes they'll throw it in my face they say you're being elementary or whatever and I say, 'Oh no, you know differentiation and 21st century skills and data analysis…that runs through K-12. Don't tell me that. I might not know your content but all this other it's the same in every school no matter what.' They're getting there you know and I've got people who seem to be behind me 100% and you know we'll build it as we go. (High School Principal 2)

The other principal, who served across multiple levels, expressed that she did not vary her instructional technology leadership behaviors across levels. When asked about if her

leadership was different at each level, she answered, “I don’t think so…I will say this as an administrator in the past for both middle school and high school (Middle School Principal 3).”

Contrary to the other principals in the study, one principal who felt that his leadership may vary across school levels based his opinion on how he could potentially arrange time for collaboration and professional development as well as the degree to which teachers possess deep content knowledge:

> I’ve been a middle school principal only. All my teaching experience is at the high school level. And so one thing that was different for me is that I probably had to make adjustments concerning not only the capacity of my faculty but also the capacity of my teachers and their and their specialty areas…I think I would probably have to make adjustments as far as what I expected and, and the length of time it took me to implement stuff based on the planning time that was available. I think the tasks that I would want them to do would do differently but my goal would still be to make sure they got the technology in the hands of the kids. (Middle School Principal 1)

Although this principal felt his leadership would vary in some ways, his goal of ensuring students are the drivers of technology use was echoed across each of the principals who participated in the study. The next section addresses the degree to which teachers perceive their principals engage in instructional technology leadership behaviors that align to NETS-A standards.

NETS-A Alignment-Teacher Survey. Teachers were surveyed to determine how their principals' instructional technology leadership behaviors align to industry standards as expressed by NETS-A. Survey items were grouped by each of the five NETS-A standards and will be referred to as a construct for description purposes. Respondents were asked to express their level of agreement to which they felt their principal exhibited elements of the NETS-A standards. The following agreement scale was presented to survey respondents: *Strongly Disagree* = 1, *Disagree* = 2, *Neither Agree nor Disagree*= 3; *Agree* = 4, *Strongly Agree* = 5. Missing responses were coded as system missing in SPSS and were not included in computations. Descriptive statistics were run for each of the construct scores. Extremely high levels of agreement were noted for each of the NETS-A Survey constructs. Mean construct scores ranged from 4.19 to 4.34. Each of the means for the NETS-A constructs are displayed in Table 4.17.

Table 4.17

NETS-A Survey Construct Descriptive Statistics

Survey Constructs	**M**	**SD**
Visionary Leadership	4.27	0.76
Digital-Age Learning Culture	4.23	0.64
Excellence in Professional Practice	4.20	0.72
Systemic Improvement	4.19	0.67
Digital Citizenship	4.34	0.64

Overall there was an extremely high level of agreement (agree and strongly agree) among the teachers in the study. They felt their principals exhibited instructional technology

leadership behaviors that were in alignment to each of the five NETS-A standards. The high scores may be attributed to the fact that the four schools in the district are served by principals who have significant experience serving as a principal in a technology enhanced school. For example, one of the principals was a part of the IMPACT IV cohort which began during the 2008-2009 school year. In the five years since the onset of grant participation, the principal has been able to hone her skills as an instructional technology leader through on the job experience, networking with other administrators, and seeking professional development opportunities.

The next five sections present the descriptive statistics finding for each of the items on the survey. Findings are presented by each of the NETS-A standards.

Visionary Leadership. For the items nested under the Visionary Leadership standard, agreement levels ranged from 82.5% to 92.3%. The lowest rated item concerned teachers' belief that principals seek policies, programs, and funding to support technology integration. For the item with the highest level of agreement, the vast majority of the teachers in the study felt their principal had indeed engaged in developing and communicating a shared vision. Item-level data for the construct are presented in Table 4.18.

Table 4.18

Response Distributions for Standard 1: Visionary Leadership Survey Items

Statement ***n*=103-104**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
1. Inspire and facilitate among all stakeholders a shared vision …	1.9%	0.0%	5.8%	50.0%	42.3%	4.31	0.75
2. Engage in an ongoing process to develop, implement, and communicate technology-infused strategic plans …	2%	0.0%	7.7%	43.3%	47.1%	4.34	0.78
3. Advocate on local, state and national levels for policies, programs, and funding ….	2%	1.9%	13.6%	43.7%	38.8%	4.16	0.87

Digital Age Learning Culture. The second set of standards explores the extent to which a Digital-Age Learning Culture is created within a school. Of this group of standards, the lowest level of agreement among teachers (86.5%) was for the standard pertaining to principals participating in learning communities that encourage innovation, creativity, and digital age collaboration, and the highest level of agreement was for principals modeling technology use (93.2%). Table 4.19 displays the entire set of responses distributions for each of the items in the construct.

Table 4.19

Response Distributions for Standard Two: Digital Age Learning Culture Items

Statement ***n*=103**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
4. Ensure instructional innovation focused on continuous improvement	1.0%	0.0%	9.7%	51.5%	37.9%	4.25	0.71
5. Model and promote the frequent and effective use of technology…	1.0%	0.0%	5.8%	54.4%	38.8%	4.3	0.67
6. Provide learner-centered environments…	1.0%	1.0%	10.7%	54.4%	33.0%	4.17	0.73
7. Ensure effective practice in the study of technology…	1.0%	1.0%	8.7%	51.5%	37.9%	4.24	0.73
8. Promote and participate in local, national, and global learning…	1.0%	0.0%	12.6%	51.5%	35.0%	4.19	0.73

Excellence in Professional Practice. The Excellence in Professional Practice set of standards elicited agreement levels ranging from 85.4% for allocation of resources for instructional technology professional growth to 89.3% for exhibiting effective communication and collaboration using technology. Table 4.20 presents the detailed information about each of the standards on this particular topical area.

Table 4.20

Response Distributions for Standard Three: Excellence in Professional Practice Items

Statement ***n*=103**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
9. Allocate time, resources, and access to ensure ongoing professional growth	1.0%	3.9%	9.7%	48.5%	36.9%	4.17	0.83
10.Facilitate and participate in learning communities	1.0%	2.9%	9.7%	51.5%	35.0%	4.17	0.79
11. Promote and model effective communication and collaboration	1.0%	1.9%	7.8%	52.4%	36.9%	4.22	0.75
12. Stay abreast of educational research and emerging trends	1.0%	0.0%	12.6%	47.6%	38.8%	4.23	0.74

System Improvement. When asked about their belief as it related to Systemic Improvement, 87.2% of teachers felt that their principals provided the appropriate technology infrastructure, and 91.1% of teachers demonstrated the use of data-driven decisions in an effort to advance school staff performance and improve student learning. The results for each of the standards in this grouping are presented in Table 4.21.

Table 4.21

Response Distributions for Standard Four: Systemic Improvement Items

Statement ***n*=100-103**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
13. Lead purposeful change to maximize the achievement of learning goals …	1.0%	2.0%	6.9%	52.9%	37.3%	4.24	0.75
14. Collaborate to establish metrics, collect and analyze data…	1.0%	0.0%	7.8%	52.9%	38.2%	4.27	0.69
15. Recruit and retain highly competent personnel	1.0%	3.9%	10.7%	51.5%	33.0%	4.12	0.82
16. Establish and leverage strategic partnerships…	0.0%	1.0%	9.0%	56.0%	34.0%	4.23	0.65
17. Establish and maintain a robust infrastructure for technology	1.0%	3.0%	8.9%	54.5%	32.7%	4.15	0.78

Digital Citizenship. Rated the highest among all of the NETS-A standards was Digital Citizenship. Over 90% of respondents agreed or strongly agreed that their principals exhibited all of the characteristics outlined in this standard. The lowest rated item, at 90.1% agreement, was related to equitable access to technology resources for all learners, and the two highest rated items (95.1%) pertained to the safe, legal, and ethical use and socially responsible use. Item-level response for each standard in this section is located in Table 4.22.

Table 4.22

Response Distributions for Standard Five: Digital Citizenship Items

Statement ***n*=101-102**	**Strongly Disagree**	**Disagree**	**Neither Agree nor Disagree**	**Agree**	**Strongly Agree**	***M***	***SD***
18. Ensure equitable access to appropriate digital tools and resources	1.0%	0.0%	8.9%	53.5%	36.6%	4.25	0.70
19. Promote, model and establish policies for safe, legal, and ethical use	1.0%	0.0%	3.9%	47.1%	48.0%	4.41	0.67
20. Promote and model responsible social interactions	1.0%	0.0%	3.9%	49.0%	46.1%	4.39	0.66
21. Model and facilitate the development of a shared cultural understanding…	1.0%	1.0%	5.9%	52.9%	39.2%	4.28	0.71

NETS-A Standards Alignment Variance by School Level. To ascertain if teachers view alignment to national standards differently across various school levels, the NETS-A survey data was analyzed using the Kruskal-Wallis Test. As conducted in Phase I data analysis procedures, teacher survey data was explored to determine if it met assumption criteria (i.e., independence of observations, normal distribution, and homogeneity of variance). Independence of observation was met; however, when the data was explored, it exhibited a non-normal data distribution. The data were within acceptable skew limits with the data ranging from -1.689 to -1.320; however, the data exhibited leptokurtic properties with kurtosis ranging from 3.276 to 6.014. The Kruskal Wallis is a robust comparative test and can withstand deviance from many of the assumptions required of ANOVA. Because of this, the analysis conducted.

The Kruskal Wallis statistical procedure was run to determine if there were differences on each of the NETS-A Survey construct scores and school level. The null hypothesis for the analysis is: There is no difference on each of the NEST-A Survey construct scores across school levels. After the analysis was conducted, the null hypothesis was rejected as significant differences were discovered for each of the five construct. The findings are displayed in Table 4.23.

Table 4. 23

Kruskal Wallis Significance Test Results for NETS-A Teacher Survey

NETS-A Construct	***N***	χ^2	**Df**	**p**
Visionary Leadership	104	21.827	2	.005*
Digital Age Learning Culture	103	10.525	2	.000*
Excellence in Professional Practice	103	12.573	2	.002*
Systemic Improvement	103	17.627	2	.000*
Digital Citizenship	102	10.851	2	.004*

Because significant differences for the median values were noted for each of the NETS-A constructs, pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons (shown in Table 4.24). Construct median values for each level are provided in Table 4.25.

Table 4.24

Kruskal Wallis p values for NETS-A Constructs Pairwise Comparisons by School Level

Pairwise Comparisons	**NETS-A Constructs**				
	Visionary Leadership	Digital Age Learning Culture	Excellence in Professional Practice	Systemic Improvement	Digital Citizenship
Elementary-Middle	.000*	.047*	.007*	.004*	.004*
Elementary-High	.001*	.006*	.006*	.000*	.078
Middle-High	1.000	1.000	1.000	1.000	1.000

*p < .05

Table 4.25

NETS-A Construct Medians by School Level

	Visionary Leadership	**Digital Age Learning Culture**	**Excellence in Professional Practice**	**Systemic Improvement**	**Digital Citizenship**
All	4.17	4.00	4.00	4.00	4.25
Elementary	4.00	4.00	4.00	4.00	4.00
Middle	5.00	4.40	4.50	4.60	4.75
High	4.67	4.40	4.25	4.40	4.50

Across all constructs, median values were lower for the elementary level than those for middle and high school. The lower values for the elementary school level could be attributed to a number of factors. The principals in the two elementary schools have less total time as administrators than those at the middle and high school levels in this district.

Additionally, a few barriers exist due to student skill level such as limited reading and typing ability. For four of the five constructs, significant differences were noted for the elementary-middle and elementary-high school level comparisons. The fifth standard, Digital Citizenship, revealed only a significant difference in the elementary-high school level comparison.

The final section presents information about the needs of teachers as they implement instructional technology techniques.

Instructional Technology Teacher Support Needs

Responses to the open-ended teacher survey were used to answer Research Question 4: In which ways can principals best meet the needs of their teachers through their instructional technology leadership, and does variance exist by school level? The three open-ended response items were: (1) In which ways can your principal best support you as a teacher *as* you strive to implement technology integration strategies in your classroom? (2) Based on what you know of other school levels, what unique challenges exist at your school level (elementary, middle, high)? and (3) How can your principal help you to overcome those challenges?

In response to the question which asked teachers to offer ways their principal could best support them with technology integration strategies, teachers most frequently reported: (1) the need for principals to enable the offering of quality, (2) relevant professional development, ensure the acquisition of the appropriate technology resources, and

(3) safeguard teachers' time so that planning time is sacred. Table 4.26 shows actual teacher responses to these themes.

Table 4.26

Summary of Teachers' Open-ended Comments: Principal Behaviors Which Support Technology Integration

Common Themes (Listed in Order of Popularity)	**Illustrative Quotes**
Provide Professional Development	• Continue to provide meaningful and relevant staff development on technology integration in the curriculum. • Continue to provide technology training. More in depth training would be helpful. We currently have a 10 - 15 minute presentation at staff meeting. A longer session would be more helpful for a novice like me. • She can continue to support our endeavors to attend quality conferences to both present our abilities and to learn from others. • Professional development where we can learn a new tool and have time to incorporate it into a lesson that can be used the very next day. • Provide staff development time aimed at creating usable activities and units. • Provide specific course content professional development in place of general professional development.
Acquire a sufficient number technology resources	• Continue to work to provide 1:1 technology for each student. • Continue to support our ideas and visions and to advocate for ways to purchase technology to prepare our students in ALL academic areas for the 21st century. • By getting the technology for every student in their hands on a daily basis. • Adaptive technology • By maintaining the equipment and updating outdated equipment. • Provide technology appropriate for the courses I teach. Provide SMARTboards for each classroom. • Make sure that we have access to the technology so that we can meet her expectations .
Ensure Sufficient Planning Time	• Allow for me to spend less of my planning time in meetings and more of my planning time PLANNING and PRACTICING the use of technology as an instructional tool. • Allotting time to plan, research, and use the technology in order to effectively implement it in the classroom environment. • Continue to allow us to have time to meet as grade levels to work and share technology. • Time (outside of scheduled professional development) to work with colleagues. • By providing extra planning time to put these tools into action. • Provide the time. Always in meetings takes away that time. • Give teachers time to plan lessons. • Continue to offer Lunch and Learn sessions during school to free up after school time.

The second open-ended response item asked teachers to cite issues that impacted the implementation of technology at their particular school level—elementary, middle, or high. The most frequently cited issue was scarcity of technology tools. The teachers also reported the issue of access to technology outside of school which was confounded by the socioeconomic status of the community at large. The final issue raised by teachers was the need to explore digital citizenship. Table 4.27 provides the top themes with corresponding teacher responses.

Table 4.27

Summary of Participants' Open-ended Comments: Challenges Based on School Level

Common Themes (Listed in Order of Popularity)	**Illustrative Quotes**
Limited number of technology tools	• The middle school lacks a sufficient number of computers for students to use during the school day and lack of internet access at home for a large number of our students. • Most classrooms do not have access to a smart board....we are using laptops and projectors. • Getting access for each student in my class to work on a computer for a class activity is difficult because of the limited access. As an EC teacher, I could provide much better focused, individualized intervention is I could allow for every child to have access to a computer at the same time in my room...right now I only have two desk top computers and up to 12 students in my room at one time • Enough computers or computer labs for all students on a daily basis • Accessibility and adequate inventory of technological devices.
Socio-economic status and rural nature of the community prevents exposure and access to technology outside of school	• Rural area. Low connectivity. • Lack of internet access and to technology in the home environment of students • We strive to meet the needs of all students. One problem in our community is the lack of computers in our students' homes and the lack of Internet. We have great support from our administrators to support the teachers and the students. We do lack computers. • Some families still do not have internet access at home so we have to teach the basics. • Lack of technology support at home. • Extreme differences in socio-economics.

In response to the final open-ended question which gathered information about how a principal can assist teachers with overcoming the challenges associated with each school level, participants emphasized the need for principals to: (1) arrange professional development to assist them with acquiring additional instructional technology skills and techniques, (2) demonstrate support to teachers, and (3) pursue additional funding to acquire additional technology resources. Table 4.28 displays the top three themes along with teacher responses.

Table 4.28
Summary of Teachers' Open-ended Comments: Principal Instructional Behaviors to Overcome Challenges Based on School Level

Common Themes (Listed in Order of Popularity)	**Illustrative Quotes**
Offer additional professional development	• Professional development over multiple sessions would help me. • Supply the teachers with multiple training and/or workshops throughout the year. • More in depth technology training with practice time built in. Follow up by building level tech support or system level tech support. • Ensure that tech support individuals are supporting teachers and that high-quality training occurs not fly-by training. • Continue to provide professional development to keep our staff informed and skilled in the latest technological advances that many of our students are exploring and mastering on their own. • By providing professional development to help me become a better technology leader within my class. There are also ways we can limit students wandering on computers, as I've heard about in seminars, so perhaps my principal can find other ideas.
Be a supportive principal	• Keep doing what they are doing in being supportive of "out of the box" instruction. • Our principal is involved with the community and does her best to get what is possible and sometimes impossible. • [X Principal] moves ahead on when issues arise with her teachers. Challenges to us become hers as well. • The principal can help with strategies that work effectively for all curriculum and with workshops targeted to teacher's individual knowledge and comfort level with technology. • Maintain approachable demeanor, insist on accountability OF ALL STAKEHOLDERS (not only teachers), avoid hollow threats and empty consequences.

Table 4.28 Continued

Pursue additional funding	• Hopefully obtain grants so that we can put a computer in the hands of each of our students. • Start updating our technology....seek funds to add more computer class carts to our campus... • Continue to look for grant opportunities. • She can look for grants to support our technology needs. • We need to seek grant funding. • Continue to secure grants to alleviate these problems

Chapter Summary

This chapter presented findings about principals' instructional technology leadership, their levels of preparedness, and the needs of teachers to integrate technology. When exploring instructional technology leadership, the STNA survey instrument provided insight as to teachers' perception of the instructional technology leadership within their schools. The instrument explored four areas that are impacted by principal efforts—Supportive Environment for Technology Use, Professional Development, Technology Use, and Impact of Technology. Data was analyzed using descriptive statistics and the nonparametric comparative statistical procedure, Kruskal Wallis. Teachers expressed generally positive beliefs about the level of leadership with significant differences across school levels being noted for three of the areas measured by STNA. Differences primarily existed between the elementary and middle and elementary and high school levels. Only the Impact of Technology construct returned no significant differences between each of the levels.

According responses given during interviews, principals in the study felt prepared to serve in the role of instructional technology leaders. They attribute their preparedness to professional development provided to them through the IMPACT grant, their district, and

other mechanisms. Most reported that principal preparation programs provided little benefit to readying them to be a true technology leader. They plan to continue their growth in this area through taking additional professional development courses, attending conferences, and visiting high technology use schools.

NETS A provided the conceptual framework for which principals' instructional technology leadership behaviors were explored. The principal interview and teacher survey provided data to explore this area. The principal interview was coded for specific behaviors and then subdivided by each of the five NETS-A Standards. Instructional technology leadership behaviors described by the principals were in keeping with NETS-A standards. As leaders who exhibit visionary leadership, they described seeking to craft and communicate a clear vision for what meaningful instructional technology means within the bounds of their school. They also assisted in crafting a culture that supports technology by modeling technology use and offering professional development along with the appropriate technical and instructional technology assistance. Principals monitored teacher technology usage in formal and informal ways and ensured that elements germane to digital citizenship were addressed.

To verify the accounts given by the principals, the teacher survey provided another measure of the degree to which there was alignment to principal instructional technology behaviors and actual NETS-A standards. Using the same analysis strategies as used for the STNA data, it was found that teachers had a high level of agreement across each of the standards that their principals acted in accordance to NETS-A standards. When analyzed

across each level, significant differences were noted for each of the NETS-A standards between elementary and secondary (middle and high school) teachers. No differences were noted between middle and high school teacher perceptions.

Ultimately, teachers are the ones who implement instructional technology in their classrooms. They voiced how their principal could assist with their honing their level of instructional technology integration through open-ended questions on the teacher survey. Teachers felt their principals could best support them overall by providing them with adequate professional development, acquiring a sufficient amount of technology resources, and protecting the time allotted to them to plan for instruction. Teachers were also asked to weigh in on challenges and how their principal could assist them at their particular level; however, the issues raised transcended each school level. Implementation challenges aligned to each grade level included: limited number of devices, the rural nature and socio-economic status of the district prevents access to technology outside of school for some, and the need to address issues in the area of digital citizenship. Lastly, when polled about overcoming those challenges specific to each school level, teachers again mentioned offering additional professional development as the most important support mechanism they desire. They also suggested that their principal be a supportive principal as evidenced by numerous actions and pursue additional funding to enhance the level of access to instructional technology devices for all.

The next chapter will review the key findings, describe the limitations of the study, describe its theoretical and practical implications, and propose directions for future research on instructional technology leadership for principals.

CHAPTER 5
DISCUSSION

Improving student achievement and meeting student needs remain at the core of education. The use of technology to do so has become commonplace and has galvanized schools to seek ways to make certain it is widely available for teacher and student use. MacNeil and Delafield (1998) posit, “Technology is not a panacea for educational problems, but by combining technology with applicable learning models the overall quality of education is enhanced” (p. 299). Similarly, Lesgold (2003) contends, “Technology is generally not a direct cause of change but rather a facilitator or amplifier of various educational practices” (p. 8).While teachers are tasked with creating conditions that enable high quality, student-centered instructional technology use, principals are charged with giving the needed support to promote this meaningful technology integration. Principal instructional technology leadership can manifest itself in a myriad of ways.

The Instructional Technology Division of the North Carolina Department of Public Instruction designed the IMPACT model to provide a comprehensive media/technology program that could be implemented in any school, even those who were not recipients of grant funding (Bradburn, 2005). The model consists of seven strategic requirements: supportive leadership, structured collaboration, technology integration, flexible access to the media center and technology labs, professional development, resources/equipment, and key personnel (e.g., media coordinator, technology facilitator, technology, and media assistants). While all components are important to successful implementation, the principal has the

propensity to set the tone in creating an atmosphere ripe with meaningful and effective technology integration.

This study explored principal instructional technology leadership. Instructional technology leadership encompasses the activities necessary to support technology integration. Those activities included, but are not limited to acquisition of technology resources, providing access to professional development and technology support, modeling technology use, monitoring teacher practice, and ensuring safe, legal, ethical use. By engaging in these behaviors, it can be assumed that principals place their schools in a position to more thoroughly and efficiently integrate technology.

Utilizing a mixed methods study design, IMPACT schools' overall degree of technology implementation, principals' modes of preparation for instructional technology leadership, principals' instructional technology leadership behaviors, and teachers' desired instructional technology leadership needs were examined through four distinct research questions:

1. How do IMPACT teachers' perceive the level of instructional technology implementation in their schools, and does variance exist by school level?
2. In which ways do principals become prepared to serve as instructional technology leaders?
3. In what ways do principals approach instructional technology leadership, and does variance exist by school level?

4. In which ways can principals best meet the needs of their teachers through their instructional technology leadership, and does variance exist by school level??

While Chapter 4 presented both the quantitative and qualitative findings in two distinct phases, this chapter addresses each of the topical areas spurred by the four research questions. Evidence from each of the study's data sources is tapped to provide a comprehensive view of instructional technology integration health of IMPACT schools, principal instructional technology leadership preparedness and behaviors, and teacher instructional technology leadership needs. Lastly, the implications for policy and practice for the study and possible directions for future research are detailed.

Overall Technology Integration Health-STNA

Determining the overall technology integration health of the schools in the study was conducted as a way to determine the context in which schools operationalize instructional technology strategies. The STNA instrument provided information for all of the schools participating in the IMPACT grant. This instrument provided a comprehensive view of the capacity of this group of schools to implement technology (Corn, 2006, 2009). It measured the level to which conditions were in place to implement a structured instructional technology program from teachers' perspectives. According to ISTE (2008), providing a mechanism to ensure the necessary conditions are in place allows schools to be poised to integrate technology more successfully. McLeod and Richardson (2013) provide specific behaviors for each of the 14 essential conditions presented by ISTE. Many of these "leadership actions" were espoused in many of the statements on the STNA instrument.

Teachers expressed a high level of agreement with the statement on the STNA instrument. The mean scores across the entire survey were above the mid-range value (3) for all items. The high values can be attributed to the fact that the schools in the study were actively engaged in IMPACT model implementation for at least three years at the time of the survey. The IMPACT model provided a clear framework for schools to follow. The experience level of the teachers in these schools skewed the results in a more positive direction. It is not likely that these results would be replicated in schools without a model or framework for which to base their technology integration implementation.

Additionally, the STNA instrument offered a *Do Not Know* response option. This provides important information, but could also lead to inflation of some of the scores in that these response items were removed during the calculation of mean scores. A *Do Not Know* response reflects a lack of knowledge about school-level practices and conditions. All of the responses exceeding 10% were found in the areas most germane to instructional technology leadership behaviors-Supportive Environment for Technology Use and Professional Development. This signals a lack of communication or transparency about certain policies and practices for some teachers; however, those who were aware of the instructional technology leadership actions were favorable. These results underscore the need to ensure a systematic process for creating a shared vision (Anderson & Dexter, 2005; Fishman & Pinkard, 2001; Flanagan & Jacobsen, 2003).

Questions on the survey were aggregated to four distinct constructs to provide a summary view. Two of the measures (the Supportive Environment for Technology Use and

Professional Development Construct) on the STNA instrument served as proxies to determine the level of instructional technology leadership behaviors exhibited by school leaders across the grant. The other two constructs (Use of Technology for Teaching and Learning and the Impact of Technology) served as indicators of how well technology integration was implemented by teachers and students. Significant differences between some of the school levels were discovered for three of the constructs on the STNA instrument. Only the Impact of Technology construct yielded nonsignificant results across the different school levels.

Supportive Environment for Technology Use. This construct measured principals' capacity to ensure their schools were poised to successfully implement the use of instructional technology at a high level by providing staff and students with the appropriate resources (e.g., technology tools, personnel, processes, etc.). Across the four constructs on the survey, it boasted the highest level of agreement among the teachers responding to the survey items (M= 4.08, SD=.48) but excludes responses from teachers who provided the *Do Not Know* response option.

Elementary teachers expressed the highest level of agreement on this construct with significant differences being found only between the elementary and high school levels. Findings from one of the participating principals who transitioned from the elementary to the high school level support the STNA results. The principal sought to provide the same level of hands on support for each school level at which she served. Her hands-on leadership style

elicited negative responses from those at the high school level. In fact, she was accused of "being elementary".

This evidence falls in line with information presented in the Anderson and Dexter (2005) study. The researchers suggested that the differences in teacher perceptions of instructional technology leadership across school levels to less formalized structures being in place due to smaller school size at the elementary school level. In other words, the lower number of teachers allows principals to personalize their approach for supporting teachers.

In this study, differences were unearthed on the student survey as well as through anecdotal evidence provided by principals during interviews. According to a high school principal who has served at multiple levels, teachers would like to feel supported in their instructional technology integration; however, teachers at the high school level appeared to desire less support or at a minimum a different type of support.

Professional Development. Split into two subconstructs that measured future needs and the quality of past efforts, the mean score for the Professional Development Construct exhibited a high level of agreement among teachers (M= 3.87, SD=.58). Elementary teachers rated their level of agreement with items on the Professional Development construct significantly lower than those of middle and high school teachers. Significant differences were not discovered between middle and high school teachers.

In response to one of the open-ended question on the teacher survey which asked how principals can help them overcome challenges facing them at their specific school level, providing additional professional development for teachers surfaced as one of the themes for

12 respondents. When this theme was disaggregated, it revealed that far more elementary (67%) than middle (8%) or high (25%) school teachers deemed offering additional professional development could be a viable vehicle of support. While increasing professional development is warranted to meet the needs of teachers, Militello et al. (2011) contend that professional development for teachers in its current format, the “one-day seminar approach”, does not meet the needs of teachers. Replacing this dated type of professional development with job-embedded professional development paired with high-quality coaching offers the best return on investment.

Improving the level and type of professional development options are key to technology integration fidelity. Darling-Hammond and Richardson (2009) suggest providing sustained and ongoing, embedded professional development that is fully integrated into teachers’ daily activities. Because there a link between the level of professional technology professional development offered and the ensuing level of technology use, it is imperative that schools place emphasis on creating opportunities for growth (Baylor & Ritchie, 2002).

The elementary level presents challenges that can inhibit professional development delivery during the body of the school day. The time allotted to elementary teachers for engaging in individual and common planning activities and participating in professional development is small in comparison to that of their middle and high school counterparts. Finding creative scheduling solutions should be the aim of elementary principals if they are to provide ample time for professional learning activities.

Use of Technology for Teaching and Learning. The Use of Technology for Teaching and Learning construct was rated the lowest across each of the STNA constructs (*M*= 3.71, *SD*=.68). The results for this section are reflective of actual student and teacher use. A limited number of respondents selected the *Do Not Know* response option due the fact that the teachers are providing a firsthand account unlike their responses to some of the questions on the first two sections of the survey. The construct describes the frequency of which teachers and students utilize technology for planning, teaching, and learning activities.

Reporting the lowest frequency for this construct were elementary teachers. Their mean construct score was significantly lower than those of high and middle school teachers. Dawson and Rakes (2003) found that teacher use to be correlated to principals' level of leadership support and training. Bolstering principal capacity could be one way to improve the level of use for elementary teachers. Similar to the two prior constructs, significant differences were not found between the middle and high school levels. These differences may reflect a measured implementation due to student technology ability which increases with age. On a separate survey (NETS-A), teachers provided other reasons for limited use-lack of devices and the need for more professional development.

Teachers expressed their need for additional technology devices. This was evidenced by responses to all three open-ended questions on the survey. When asked how their principal could assist them with integrating technology, teachers shared, "by getting the technology for every student in their hands on a daily basis" and "maintaining the equipment and updating outdated equipment". If teachers do not have access to technology that is of

suitable quantity and quality, they cannot implement technology integration strategies. Lack of access coupled with teachers' need for additional professional development could inhibit teachers' and students' ability to use technology.

Impact of Technology. The degree to which teachers feel that technology has affected their teaching practices and how they view the influence of technology usage on various student-level outcomes (e.g., increased confidence, independence, collaboration, engagement, and achievement) is captured through the Impact of Technology construct. The mean construct score for the Impact of Technology was the second highest of the four STNA constructs (M= 4.01, SD=.65). When comparing differences across the three school levels, the STNA instrument returned an important nonsignificant finding on this construct. This is a positive finding in that teachers feel that the use of technology is impactful to teacher and student indicators regardless of the school level. The mechanisms of support may vary by school level; however, the perceived impact did not.

The use of technology to mediate effects on student achievement remains a goal. The Enhancing Education Through Technology (EETT) Act provided a mechanism to provide funds to make such impacts (United States Department of Education, 2007).

One of the main mechanisms used to measure the effectiveness of technology projects is the use of student achievement data. To date, technology integration projects have netted mixed results—negative, no, or positive effect. While some researchers have found a positive impact to student achievement as a result of the implementation of instructional technology programs, most have been small and in many cases statistically insignificant (Bebell & Kay,

2010; Christmann, 1997; Kulik & Kulik, 1991). Several others have found positive results (Bebell & O'Dwyer, 2010; Dunleavy & Heinecke, 2008; Mollette et al., 2011). To duplicate positive student achievement gains, it is imperative strong instructional technology leadership be provided.

Instructional Technology Leadership Preparedness

The principals rated themselves fairly highly as instructional technology leaders. This differs from what is found in existing literature. For instance, a slim majority of principals surveyed by Leonard and Leonard (2006) deemed their level of preparedness suitable to serve in the role of instructional technology leaders. These findings were in stark contrast to the findings in this study. In the case of IMPACT participating principals, it bears acknowledging that participants in the study were exposed to a variety of professional development opportunities (e.g., DPI sponsored sessions, conference attendance, site visits, access to outside consultants, etc.) that were funded at least in part by IMPACT grant funding. During their interviews, principals linked their preparedness to such professional development opportunities, but not to content afforded to them through principal preparation programs. These results support existing literature which finds many principals underprepared to be instructional technology leaders after the conclusion of principal preparation programs (Barnett, 2004; Flanagan & Jacobsen, 2003; McLeod & Richardson, 2011; Redish & Chan, 2007; Richardson, Bathon, & Flora, 2013;Yu & Durrington, 2006). This begs the question, how do principals without such extensive professional development

support opportunities, such as those offered through the IMPACT grant, learn to meet the demands of an effective instructional technology leader?

While most principals will not have the opportunity to seek the professional development opportunities afforded IMPACT principals, there are still several avenues available for them to hone their skills as instructional technology leaders outside of their principal preparation programs. Principals should strive to participate in teacher level professional development to improve their skill technology skill level and keep abreast of the latest trends in instructional technology practices. This also could lead to greater teacher buy-in due to teachers seeing the principal model technology usage. Attendance at state and national level instructional technology conferences offers principals an opportunity to learn instructional technology content and the ability to network with other administrators. Visits by principals and a select group of teachers to high technology use schools with similar contexts offer principals the opportunity to experience high quality examples of instructional technology integration. Another strategy principals can employ is to access instructional technology material for both teachers and administrators through research articles, practitioner pieces, websites, and blogs.

Principal Instructional Technology Leadership Behaviors

Principals' behaviors were explored through a principal interview and the NETS-A Teacher Survey. Behaviors described by principals aligned to each of the five NETS-A standards- Visionary Leadership, Digital-Age Learning Culture, Excellence in Professional Practice, Systemic Improvement, and Digital Citizenship. With mean construct scores of

(*M*=4.27, SD=.76), (*M*=4.24, *SD*=.64), (*M*=4.20, *SD*=.72), (*M*=4.19, *SD*=.67), and (*M*=4.34, *SD*=.64), for each area respectively, teachers found their principals to exhibit the NETS-A standards in their actions to a high degree. The principal and teacher perspectives of this study echo results from Militello and Ersozlu (2013) in which they found a majority of principals in their study as identifying their practice as aligning to NETS-A-grounded instructional technology leadership style factors—learning based technology leaders, organizational leaders, change-agent leaders, and facilitative leaders.

Principals expressed that there were limited differences based on school level in how they approach their role of instructional technology leader. On the other hand, teachers did perceive differences in how they viewed their principals' instructional technology leadership by school level. Significant differences were found between elementary and both the middle and high school levels, but no significant differences were found between middle and high school teachers' perceptions. Anderson and Dexter (2005) also found that instructional technology leadership was most similar between middle and high schools in their study. Differentiation in leadership techniques may be warranted due to differences observed across some of the school levels. To simplify efforts, significant differences can be aggregated to the elementary and secondary (middle and high) levels rather than keeping them split by all three levels. In doing so, this would a more cost effective strategy to improve principal skills in that only two different levels would need to be addressed.

Teachers' Desired Instructional Technology Leadership Behaviors

Teachers reported the specific behaviors of principals that could bolster the success of technology integration. Five desired instructional technology leadership behaviors surfaced most frequently and were similar across elementary, middle, and high school teachers. All but one, consider the context, were aligned to those specified in NETS-A standards. This particular principal behavior speaks to teachers' desire to have principals tailor their actions based on the specific school setting (e.g., locale, access to resources, socio-economic status, personnel availability, etc.). While not directly tied to NETS-A, it is an important contextual variable that serves to provide the necessary background to ensure success of the other actions. The desired instructional technology leadership behaviors in order of frequency included: provide professional development, be supportive, pursue additional funding opportunities, adjust policies and procedures surrounding digital citizenry, and consider the context.

Provide professional development. Meeting teachers' needs for additional professional development is a high priority based on the NETS-A Teacher Survey. To meet needs in this area, teachers need principals to create opportunities professional development opportunities that are job-embedded, but do not adversely affect time allocated for planning and participation in professional learning communities. The results on the NETS- A survey align to the STNA results pertaining to teachers' desire for additional professional development. Similarly, several researchers espouse the need for principals provide professional learning opportunities as a part of a larger instructional technology plan to

support teachers (Chang et al., 2008;Flanagan & Jacobsen, 2003Macneil & Delafield, 1998 , Oliver et al., 2012; Overbay et al., 2011; Richardson & McLeod, 2011); while, both Darling-Hammond and Richardson (2009) and Militello et al., 2011 lend credence to the importance of principals ensuring the high quality, ongoing, job embedded professional development for their staff.

Be supportive. Teachers desired for principals to provide a high level of moral support to them. Teachers desire encouragement and understanding of successes and failures as they try new instructional technology tools and practices. Principals must provide timely and meaningful feedback as the monitor instructional technology use. Recommendations from the Oliver et al. (2012) study align with the purported needs of this dissertation study's participants. The researchers highlighted

> …the importance of school leaders not pressuring teachers to integrate technology where it doesn′t fit or to change at an uncomfortable pace. Teachers want to remain in control of their classroom environment from the bottom-up, and use technology when it fits as one of many tools in their teaching arsenal" (p. 139)

Pursue funding opportunities. Obtaining funding for additional devices and improvements to the infrastructure is vital to providing equitable access for teachers and students. Securing grant funding or reallocating current funds (e.g., textbook funds, position conversion, etc.) are possible methods of acquiring additional funds. Budget woes were cited as a substantial barrier to technology integration (Chang et al., 2008; Fishman & Pinkard, 2001; Gosmire& Grady, 2007; Macneil& Delafield, 1998; Richardson & McLeod, 2011).

Without the fiscal resources make continual improvements to the level of access to hardware, software, wireless capacity, security features, file storage capacity, and professional development, schools will not be poised to continue expanding their level of technology integration. Oliver et al, 2012 emphasized the need to create a technology sustainability plan at the onset of a technology project to stimulate teacher buy-in of those teachers unwilling to change instructional practices due to fear inaccessible technology in the future, to account for unexpected losses (e.g., theft, breakage) and consumable products (e.g., bulbs for SMARTboards and LCD projectors).

Adjust policies and procedures surrounding digital citizenry. Use of instructional technology necessitates principals monitor and adjust of policies and procedures designed to ensure staff and students behave in safe, legal, ethical, and socially responsible manner. Principals must work in concert with their districts' legal representatives to make sure they keep up with future trends such as school sponsored 1:1 programs, bring your own device, and the use of social media-style sites. Bathon and Brady (2013) provide guidance to principals about how they can navigate the technology landscape in a legal manner. They offer a short primer which covers a wide set of issues spawned by technology use and their associated legal precedents. Issues addressed include: student and teacher free speech, searching student cell phones, filtering and acceptable use policies, assistive technology, copyright, electronic records, open meetings, and online schooling.

Consider the context. A one-size fits all approach will not work. North Carolina is a vast state. As North Carolinians say, "It stretches from Murphy to Manteo." This statement

refers to the east to west width of the state which expanses from the Blue Ridge Mountains to the coast of the Atlantic Ocean, stretching nearly 550 miles. Over this distance, North Carolina rural, suburban, and urban contexts abound. What works well in one setting can often not be duplicated in another without significant tweaking.

The school district in which a portion of Phase II was conducted was located in rural Northeast North Carolina. While all schools face issues, a rural setting provides a distinct set of issues. Richardson and McLeod (2011) conducted a study among Native American reservation schools and found similar barriers to technology integration based on the rural nature of the reservations.

Rural schools face obstacles as they support their teachers' and students' technology use. Many of the students hail from poor families—several of which are eligible for free or reduced lunch. Their socioeconomic status puts them at risk academically. At least one school in the district is actively working to implement a ubiquitous 1:1 program to overcome the lack of devices in the home setting. If students are able to receive a school device for home use, many lack high speed wireless access which would inhibit their ability to use the device in an efficient manner. Access could be limited by inability to pay for internet service. It could also be limited by the type of service available. For many, high speed wireless access is not an option. In these cases, families rely on dial-up internet access or choose to forgo service.

Schools in more urban areas have overcome lack of internet access by partnering with local restaurants or libraries to provide access. The rural setting may prevent this approach

from being as successful due to the limited number of businesses with which to partner and the great distances that students would have to travel to use a particular place of business; however, an effort should be made to make connections because other solutions could be found by engaging and tapping community resources. To overcome barriers to technology access and use, principals must be creative, using research and knowledge gathered from informal networks to craft solutions. For the benefit of their schools, they must continue to seek novel ways to overcome their contextual issues.

Archetypal Effective Instructional Technology Leadership Behaviors

An archetype of an effective instructional technology leader emerges when one juxtaposes the instructional technology leadership behaviors offered by principals and the instructional technology leadership needs suggested by teachers. The intersection of these presents a model of effective instructional technology leadership. The following behaviors represent the actions of the archetypal effective instructional technology leader. An effective instructional technology leader will:

- Consider the school's context (e.g., location, population of students served) when determining the school's instructional technology vision and implementation plan. Research other schools' or districts' best instructional technology practices and select the components that fit school specific teacher and student needs;
- Create and communicate a shared instructional technology vision and implementation plan that is updated regularly;

- Remain abreast of the latest trends in educational technology through scholarly and practical literature, professional development, networking, and school visits;
- Acquire additional funds and be creative with existing funds to purchase additional devices and maintain existing ones;
- Ensure the creation of robust infrastructure to support reliable use of school- and student-owned devices;
- Attend to legal and ethical concerns through crafting policies and procedures and offering professional development for staff and students;
- Model technology use for students, staff and the community through the use of instructional technology tools such as Google Docs and Edmodo and electronic communication through the school website, email, newsletters, and the use of social media such as Twitter;
- Offer meaningful job-embedded professional development for staff. Show up and be an active participant in the sessions; and
- Provide support for teachers to grow at their own pace through feedback loops. Be visible. Complete formal and informal observations, lesson plan review and formative assessment of teacher and school progress.

Recommendations for Future Research

The study's findings pointed to the need to incorporate mechanisms to develop instructional technology leadership skills in while principals participate in Master's level-preparation programs. This will ensure future principals begin their administrative tenure

with the requisite instructional technology leadership skills. A comprehensive study of how principal preparation programs incorporate instructional technology leadership is a possible area for future research. Findings can help institutions of higher learning implement the necessary changes to ensure the programs principal preparation programs meet the needs of 21st century school administrators.

Further analysis of the differences across school levels is another area of possible research. Studying instructional technology leadership as well as leadership at the various levels is warranted. Study data showed differences on both of the study surveys between the elementary and secondary levels. Principals are trained to serve K-12, and often serve in areas in which they do not possess teaching experience. Just as teachers receive specialized training for the level at they teach, principals might benefit from additional training based on the differences inherent to each school level.

As schools begin to harness the forms of new forms of technology, it is important to study how they can influence school practices and culture related to digital citizenship as well as the reviewing the legal ramifications that could ensue. Conducting a widespread review of how policies and procedures governing access contribute to or hinder instructional technology use would provide information to policymakers and practitioners.

Implications for Practice

During the 2012-13 school year, there were 2,526 schools employing principals in North Carolina (Public Schools of North Carolina, 2013). The principals in these schools coupled with those in the pipeline—those in principal preparation programs and those

serving as assistant principals—would not have access to any modified instructional technology principal preparation content that may be developed by colleges and universities in the future. As such, there is a great need to ensure that those principals have access to professional development in instructional technology leadership.

Content produced by the Instructional Technology Division and provided to participating IMPACT schools and districts could be made widely available for schools seeking to integrate technology more fully. These materials could help fill a void in teacher and principal instructional technology knowledge. While a guide for implementing the IMPACT model within schools is available on the internet, the ancillary materials used in professional development over ten years the project has been in existence are not.

NETS-A Standards are written to address leadership practices across all school levels. Because differences were noted in the manner in which elementary and secondary teachers perceive their principals, supplemental information may be necessary to allow leaders at different levels to reach their maximal level of instructional technology leader effectiveness.

The ever-changing technology landscape places schools in a position to need to make updates to hardware and software on a frequent basis. Schools are not able to implement technology if their access is limited. Securing high quality devices paired with a robust technology infrastructure is expensive. Limited funding places an undue financial burden on many schools and districts. Without additional funding from federal, state, and local sources, school districts will not be able to meet current and future technology demands without pursuing other funding opportunities such as grants or corporate donations.

Conducting needs assessments within schools on a regular basis will enable principals to zero in on areas that are most pressing to their teachers overall well-being as professionals. Addressing the needs of teachers is crucial if a culture of success is to be bred within a school. Developing a mechanism to determine school needs allows principals to develop the necessary plan of action to meet such needs. Conducting needs assessment activities on a regular basis ensures a cycle of continuous improvement.

Chapter Summary

The analysis of instructional technology leadership preparation and practice offered evidence of the need to ensure principals are adequately prepared to meet instructional technology needs within their schools. This study concludes that principals who participated in IMPACT tended to possess a high level of skill in the area of instructional technology leadership and that their behaviors were in alignment with nationally accepted standards outlined in NETS-A. When compared across school levels, teachers viewed how their principals engage in technology leadership differently, but principals felt their leadership practices would remain consistent. Teachers also weighed in on the specific actions they need from their principals to make them successful when integrating technology in their classrooms. Teachers wanted principals to provide professional development, be supportive, pursue additional funding opportunities, adjust policies and procedures surrounding digital citizenry, and consider the context. Further, the scarcity of information about how to effectively and successfully manage high levels of instructional technology within principal

preparation programs as described by participants underscores the need for comprehensive, thoughtful professional development for practicing principals.

Ultimately, the impetus for this dissertation was to provide analysis of instructional technology leadership preparation and practices and ultimately offer ways in which they can be enhanced by institutions of higher education, school district administrators, and practicing and aspiring principals. As new technology evolves, schools must embrace it as a mechanism for relevant to its prime constituents—students. To create a healthy technology environment, strong leadership from the principal is crucial. The actions of the principal impact those of teacher, and likewise, the actions of teachers impact students, a true trickle-down effect. In the end, if schools are to make the progress they desire, it is through reaching students. To move students, principals must embrace and not suppress students' inherent technology prowess and use it as springboard to govern their instructional technology leadership actions and decisions.

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APPENDICES

APPENDIX A – School Technology Needs Assessment

School Technology Needs Assessment Spring 2011

The School Technology Needs Assessment (STNA, say “Stenna”) is intended to help school level decision makers—administrators, technology facilitators, media coordinators, or technology committee members—collect data to plan and improve uses of technology in teaching and learning activities. The STNA is designed to be completed by teachers and other educators working directly with students, and should be administered to the entire staff of any school for which needs are being assessed. STNA results are not scored or reported for each individual respondent. Instead, each person’s responses are combined with those of other educators in their building, and reported at the school level in terms of how many times each possible response is selected for each item. Pilot testing indicates that it should take approximately 25 minutes to complete the STNA.

CONSENT: "I have read and understand the above information. My decision to participate is as follows":

In which school are you employed? _____

How many years have you been teaching at this school? _____

IMPACT ID Number (for IMPACT 2 schools only please leave this field blank if you are at an IMPACT 3 or 4 school)

SUPPORTIVE ENVIRONMENT FOR TECHNOLOGY USE

Selecting Responses:
1. For each item, check the box below the response that best matches how much you agree with the statement “
Strongly Agree," "Agree,"
"Disagree," or "Strongly Disagree.”
2. If you do not have enough information to form an opinion about the topic of an item, select “Do Not Know.”
3. If you have enough information to form an opinion but are simply split between “Agree” and “Disagree,” select “Neither Agree nor Disagree.”

The following statements pertain to VISION AND SHARED LEADERSHIP

"In my school..."

	Strongly Agree	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**	**Do Not Know**
1. A vision for technology has been developed through an effective collaboration among stakeholders, e.g., administrators, specialists, teachers, students, and community members.	O	O	O	O	O	O
2. The vision for technology use has been effectively communicated to the community.	O	O	O	O	O	O
3. Administrators model effective uses of technology.	O	O	O	O	O	O
4. Administrators support changes in school-level systems, policies, and practices related to technology.	O	O	O	O	O	O
5. Teachers who are innovators with technology receive **material incentives**, e.g., stipends, perks, waivers, special opportunities.	O	O	O	O	O	O
6. Teachers who are innovators with technology receive **nonmaterial incentives**, e.g., public recognition, special appreciation.	O	O	O	O	O	O
7. When administrators are seeking or hiring teachers, they consider technology literacy and leadership for technology as criteria for selection.	O	O	O	O	O	O

The following statements pertain to ORGANIZATIONAL CONDITIONS.
"In my school..."

	Strongly Agree	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**	**Do Not Know**
8. An effective long-range school technology plan is in place.	O	O	O	O	O	O
9. The school technology plan is developed through an effective collaboration among stakeholders, e.g., administrators, specialists, teachers, students, and community members.	O	O	O	O	O	O
10. The school technology plan is monitored and updated at least once a year.	O	O	O	O	O	O
11. Teachers and other staff members support the school technology plan.	O	O	O	O	O	O
12. The amount of money budgeted for technology resources is sufficient for implementing decisions arising from planning.	O	O	O	O	O	O
13. The amount of money budgeted for technology resources is sufficient for continuously updating and replacing technology systems as they become outdated.	O	O	O	O	O	O
14. Supplemental sources of funding are actively pursued to support technology, e.g., external grants, collaboration with community or parent groups, support from businesses.	O	O	O	O	O	O
15. Multiple sources of data are used to evaluate the impact of technology initiatives on student outcomes.	O	O	O	O	O	O
16. Technology is used to communicate and collaborate with families about school programs and student learning.	O	O	O	O	O	O
17. Technology is used to communicate and collaborate with the community about school programs designed to enhance student learning.	O	O	O	O	O	O

The following statements pertain to FLEXIBLE SCHEDULING
"In my school..."

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Do Not Know
18. The media center can be flexibly scheduled to provide equitable access to resources and instruction.	O	O	O	O	O	O
19. Computer labs can be flexibly scheduled for equitable access to resources and instruction. (Leave this item blank if your school has no computer labs.)	O	O	O	O	O	O
20. Mobile computers can be flexibly scheduled to provide equitable access to resources and instruction. (Leave this item blank if your school has no computer labs.)	O	O	O	O	O	O

The following statements pertain to INFRASTRUCTURE
"In my school..."

	Strongly Agree	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**	**Do Not Know**
21. Teachers and students have sufficient computer hardware available for their use, e.g., computers, digital cameras, projection devices, scanners, printers.	O	O	O	O	O	O
22. Electronic systems for communicating within the school are adequate, e.g., e-mail among teachers and staff, network drives to upload lesson plans and grades to the main office.	O	O	O	O	O	O
23. Electronic systems for communicating with families and the community are adequate, e.g., e-mail, teacher, and/or school Webpages.	O	O	O	O	O	O
24. Reliability and speed of external connections are sufficient, e.g., connections to the Internet, online databases, and other resources.	O	O	O	O	O	O
25. Students with disabilities have appropriate and adequate access to adaptive and assistive devices.	O	O	O	O	O	O

The following statements pertain to STAFF SUPPORT
"In my school..."

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Do Not Know
26. Teachers have ready access to technical support, e.g., to troubleshoot hardware or software problems, maintain systems.	O	O	O	O	O	O
27. Library media coordinator and/or media assistant positions are adequately staffed.	O	O	O	O	O	O
28. Technology facilitator and/or technology assistant positions are adequately staffed.	O	O	O	O	O	O

The following statements pertain to MEDIA AND SOFTWARE
"In my school..."

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Do Not Know
29. Teachers and students have ready access to productivity software, e.g., graphic organizer, word processing, slide presentation, or drawing applications.	O	O	O	O	O	O
30. Teachers have ready access to a cataloging system they can use for searching and locating teaching materials.	O	O	O	O	O	O
31. Teachers and students have ready access to a good collection of print, multimedia, and electronic resources.	O	O	O	O	O	O
32. When educators are selecting resource media and software, they consider both the curriculum and the needs of learners.	O	O	O	O	O	O

PROFESSIONAL DEVELOPMENT
Selecting Responses:
1. For each item, check the box below the response that best matches how much you agree with the statement "
Strongly Agree," "Agree,"
"Disagree," or "Strongly Disagree."
2. If you do not have enough information to form an opinion about the topic of an item, select "Do Not Know."
3. If you have enough information to form an opinion but are simply split between "Agree" and "Disagree," select "Neither Agree nor Disagree."

The following statements pertain to INSTRUCTION
"I would benefit from professional development on..."

	Strongly Agree	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**	**Do Not Know**
33. Research-based practices I can use in my teaching.	O	O	O	O	O	O
34. Identification, location, and evaluation of technology resources, e.g., websites, that I can use with my students.	O	O	O	O	O	O
35. Performance-based student assessment of my students.	O	O	O	O	O	O
36. The use of technology to collect and analyze student assessment data.	O	O	O	O	O	O
37. Learner-centered teaching strategies that incorporate technology, e.g., project-based or cooperative learning.	O	O	O	O	O	O
38. Online security and safety.	O	O	O	O	O	O
39. The use of technology for differentiating instruction for students with special learning needs.	O	O	O	O	O	O

The following statements pertain to PLANNING
"I would benefit from professional development on…"

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Do Not Know
40. Uses of technology to increase my professional productivity.	O	O	O	O	O	O
41. Ways to use technology to communicate and collaborate with families about school programs and student learning.	O	O	O	O	O	O
42. Ways to use technology to communicate and collaborate with other educators.	O	O	O	O	O	O
43. Alignment of lesson plans to content standards and student technology standards.	O	O	O	O	O	O
44. Use of research or action research projects to improve technology-enhanced classroom practices.	O	O	O	O	O	O
45. Use of data to make decisions about the use of technology.	O	O	O	O	O	O
46. Use of data for reflecting on my professional practices.	O	O	O	O	O	O
47. Use of technology to participate in professional development activities, e.g. online workshops, hands-on training in a computer lab.	O	O	O	O	O	O

The following statements pertain to PROFESSIONAL DEVELOPMENT QUALITY "In my school..."

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	Do Not Know
48. Educators in charge of professional development use data from teachers' needs assessments to determine technology professional development topics and activities.	O	O	O	O	O	O
49. Technology professional development is timely.	O	O	O	O	O	O
50. Technology professional development is relevant.	O	O	O	O	O	O
51. Technology professional development is ongoing.	O	O	O	O	O	O
52. Teachers have an opportunity to evaluate technology professional development activities in which they participate.	O	O	O	O	O	O
53. The impact of technology professional development is tracked using data on classroom practice.	O	O	O	O	O	O
54. The impact of technology professional development is tracked using data on student learning.	O	O	O	O	O	O

TEACHING AND LEARNING

Selecting Responses

1. For each item, check the box below the response that comes closest to indicating how often you do the described activity "Daily," Weekly," and so on.
2. If you do not have enough information to select a number response for an item, select 'Do Not Know."

The following statements pertain to INSTRUCTION.

"In the settings where I work with children…"

	Never	**Once per Grading Period**	**Monthly**	**Weekly**	**Daily**	**Do Not Know**
55. I consult publications, online journals, or other resources to identify research-based practices I can use in teaching with technology.	O	O	O	O	O	O
56. I identify, locate, and evaluate technology resources, e.g., websites.	O	O	O	O	O	O
57. I apply performance-based student assessment to technology-enhanced lessons, e.g., student portfolios, student presentations.	O	O	O	O	O	O
58. I use technology regularly to collect and analyze student assessment data.	O	O	O	O	O	O
59. My lessons include technology-enhanced, learner-centered teaching strategies, e.g., project-based learning.	O	O	O	O	O	O
60 I apply policies and practices to enhance online security and safety.	O	O	O	O	O	O

The following statements pertain to PLANNING
"In the settings where I work with children…"

	Never	Once per Grading Period	Monthly	Weekly	Daily	Do Not Know
61. I use technology to differentiate instruction for students with special learning needs.	O	O	O	O	O	O
62. I use technology to support and increase my professional productivity.	O	O	O	O	O	O
63. I use technology to communicate and collaborate with families about school programs and student learning.	O	O	O	O	O	O
64. I use technology to communicate and collaborate with other educators.	O	O	O	O	O	O
65. My lesson plans refer to both content standards and student technology standards.	O	O	O	O	O	O
66. I do research or action research projects to improve technology-enhanced classroom practices.	O	O	O	O	O	O
67. I use multiple sources of data for reflecting on professional practice.	O	O	O	O	O	O
68. I use multiple sources of data to make decisions about the use of technology.	O	O	O	O	O	O
69. I use technology to participate in professional development activities, e.g. online workshops, hands-on training in a computer lab.	O	O	O	O	O	O

The following statements pertain to INFORMATION AND COMMUNICATION TECHNOLOGIES
"In the settings where I work with children…"

	Never	Once per Grading Period	Monthly	Weekly	Daily	Do Not Know
70. Students use a variety of technologies, e.g., productivity, visualization, research, and communication tools.	O	O	O	O	O	O
71. Students use technology during the school day to communicate and collaborate with others, beyond the classroom.	O	O	O	O	O	O
72. Students use technology to access online resources and information as a part of classroom activities.	O	O	O	O	O	O
73. Students use the same kinds of tools that professional researchers use, e.g., simulations, databases, satellite imagery.	O	O	O	O	O	O
74. Students work on technology-enhanced projects that approach real-world applications of technology.	O	O	O	O	O	O
75. Students use technology to help solve problems.	O	O	O	O	O	O
76. Students use technology to support higher-order thinking, e.g., analysis, synthesis, and evaluation of ideas and information.	O	O	O	O	O	O
77. Students use technology to create new ideas and representations of information.	O	O	O	O	O	O

IMPACT OF TECHNOLOGY

Selecting Responses:

1. For each item, check the box below the response that best matches how much you agree with the statement "
Strongly Agree," "Agree,"
"Disagree," or "Strongly Disagree."
2. If you do not have enough information to form an opinion about the topic of an item, select "Do Not Know."
3. If you have enough information to form an opinion but are simply split between "Agree" and "Disagree," select "Neither Agree nor Disagree."

The following statements pertain to TEACHING PRACTICES
"In the settings where I work with children…"

	Strongly Agree	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**	**Do Not Know**
78. My teaching is more student-centered and interactive when technology is integrated into instruction.	O	O	O	O	O	O
79. My teaching practices emphasize teacher uses of technology skills to support instruction.	O	O	O	O	O	O
80. My teaching practices emphasize student uses of productivity applications, e.g., word processing, spreadsheet.	O	O	O	O	O	O
81. My teaching practices emphasize student uses of technology as an integral part of specific teaching strategies, e.g., project-based	O	O	O	O	O	O

The following statements pertain to STUDENT OUTCOMES
"In the settings where I work with children…"

	Strongly Agree	**Agree**	**Neither Agree nor Disagree**	**Disagree**	**Strongly Disagree**	**Do Not Know**
82. Technology has helped my students become more socially aware, confident, and positive about their future.	O	O	O	O	O	O
83. Technology has helped my students become independent learners and self-starters.	O	O	O	O	O	O
84. Technology has helped my students work more collaboratively.	O	O	O	O	O	O
85. Technology has increased my students' engagement in their learning.	O	O	O	O	O	O
86. Technology has helped my students achieve greater academic success.	O	O	O	O	O	O

APPENDIX B – Teachers Desired Instructional Technology Leadership Behaviors Survey

Principal Instructional Technology Leadership Behaviors Survey

As a teacher in an IMPACT school, you are tasked with increasing the level of technology integration within your classroom. As part of a dissertation study, I am studying how you perceive your principal could best assist you as you strive to meet this goal. The estimated time to complete this survey is 15-20 minutes.

About You

School Level: O Elementary O Middle O High

Years of Experience: _____

My instructional technology expertise as a teacher can be described as:

O Novice O Intermediate O Advanced

Your Beliefs about Your Principal as an Instructional Technology Leader

Each of the statements below represents an area covered by the National Educational Technology Standards for Administrators (NETS-A) produced by ISTE. Each broad area is described and then followed by specific behaviors that may be exhibited by your principal. As you respond to the statements below, think specifically of your school's principal and determine the degree to which your principal engages in the instructional technology leadership behaviors listed below.

Visionary Leadership

Educational Administrators inspire and lead development and implementation of a shared vision for comprehensive integration of technology to promote excellence and support transformation throughout the organization.

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1. Inspire and facilitate among all stakeholders a shared vision of purposeful change that maximizes use of digital-age resources to meet and exceed learning goals, support effective instructional practice, and maximize performance of district and school leaders	O	O	O	O	O
2. Engage in an ongoing process to develop, implement, and communicate technology-infused strategic plans aligned with a shared vision	O	O	O	O	O
3. Advocate on local, state and national levels for policies, programs, and funding to support implementation of a technology-infused vision and strategic plan	O	O	O	O	O

Digital Age Learning Culture

Educational Administrators create, promote, and sustain a dynamic, digital-age learning culture that provides a rigorous, relevant, and engaging education for all students.

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
4. Ensure instructional innovation focused on continuous improvement of digital-age learning	O	O	O	O	O
5. Model and promote the frequent and effective use of technology for learning	O	O	O	O	O
6. Provide learner-centered environments equipped with technology and learning resources to meet the individual, diverse needs of all learners	O	O	O	O	O
7. Ensure effective practice in the study of technology and its infusion across the curriculum	O	O	O	O	O
8. Promote and participate in local, national, and global learning communities that stimulate	O	O	O	O	O

Excellence in Professional Practice
Educational Administrators promote an environment of professional learning and innovation that empowers educators to enhance student learning through the infusion of contemporary technologies.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
9. Allocate time, resources, and access to ensure ongoing professional growth in technology fluency and integration	O	O	O	O	O
10. Facilitate and participate in learning communities that stimulate, nurture and support administrators, faculty, and staff in the study and use of technology	O	O	O	O	O
11. Promote and model effective communication and collaboration among stakeholders using digital age tools	O	O	O	O	O
12. Stay abreast of educational research and emerging trends regarding effective use of technology and encourage evaluation of new technologies for their potential to improve student learning	O	O	O	O	O

Systemic Improvement
Educational Administrators provide digital age leadership and management to continuously improve the organization through the effective use of information and technology resources.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
13. Lead purposeful change to maximize the achievement of learning goals through the appropriate use of technology and media-rich resources	O	O	O	O	O
14. Collaborate to establish metrics, collect and analyze data, interpret results, and share findings to improve staff performance and student learning	O	O	O	O	O
15. Recruit and retain highly competent personnel who use technology creatively and proficiently to advance academic and operational goals	O	O	O	O	O
16. Establish and leverage strategic partnerships to support systemic improvement	O	O	O	O	O
17. Establish and maintain a robust infrastructure for technology including integrated, interoperable technology systems to support management, operations, teaching, and learning	O	O	O	O	O

Digital Citizenship

Educational Administrators model and facilitate understanding of social, ethical and legal issues and responsibilities related to an evolving digital culture.

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
18. Ensure equitable access to appropriate digital tools and resources to meet the needs of all learners	O	O	O	O	O
19. Promote, model and establish policies for safe, legal, and ethical use of digital information and technology	O	O	O	O	O
20. Promote and model responsible social interactions related to the use of technology and information	O	O	O	O	O
21. Model and facilitate the development of a shared cultural understanding and involvement in global issues through the use of contemporary communication and collaboration tools	O	O	O	O	O

Open-ended Questions

In which ways can your principal best support you as a teacher as you strive to implement technology integration strategies in your classroom?

Based on what you know of other school levels, what unique challenges exist at your school level (elementary, middle, high)?

How can your principal help you to overcome those challenges?

Thank you for your participation in this study!

Please click the "Next" button to ensure your responses are submitted.

APPENDIX C – Instructional Technology Leadership Principal Interview Protocol

Introduction

First, let me say thank you for taking time out of your very busy schedule to talk with me today. I value your effort and promise not to go over the allotted time.

My name is LaTricia Townsend, and I am a graduate student at NCSU. I am conducting a dissertation study on instructional technology leadership. There are 9 schools participating in this study.

Before we begin, I'd like to tell you that:

- Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate, or to stop participating at any time.
- The interview will be digitally recorded in order to have a complete record of our discussion. The discussion will be kept completely confidential; any information obtained from you that can identify you will be disclosed only with your permission. We will use code numbers in the management and analysis of interview data and your name will not be associated with any interview results.
- The interview will last about an hour.

    1. Please give me a picture of what you believe a great instructional technology leader would look like.
    2. How did you come to form this image?
    3. What are the specific behaviors in which you engage in while performing the duties of an instructional technology leader in your school? Would your behavior vary at a different your school level (elementary, middle, high)?
    4. On a scale of 0 to 10, how well do you feel equipped to carry out the function of an instructional technology leader?
    5. How were you prepared to be an instructional technology leader?
    6. What other professional development would help you to perform the role of instructional technology leader more effectively?

Again, thank you so much for your time today. Your responses will provide critical information to area of instructional technology leadership in schools.

Thank You

I would like to thank you for your participation. Your comments will be very helpful to my dissertation study. I also want to mention again that what you have shared with me is confidential. Thank you for participating in today's discussion. I appreciate you taking the time and sharing your perspective with me.

APPENDIX D – IRB Approval Letter

NC STATE UNIVERSITY

North Carolina State University is a land-grant university and a constituent institution of the University of North Carolina

Office of Research and Innovation
Division of Research Administration

Campus Box 7514
Raleigh, North Carolina 27695-7514

919.515.2444 (phone)
919.515.7721 (fax)

From: Deb Paxton, IRB Administrator
North Carolina State University
Institutional Review Board

Date: November 28, 2012

Title: Principal's instructional technology leadership behaviors

IRB#: 2940

Dear LaTricia,

The project listed above has been reviewed by the NC State Institutional Review Board for the Use of Human Subjects in Research, and is approved for one year. **This protocol will expire on October 25, 2013 and will need continuing review before that date.**

NOTE:

1. You must use the attached consent forms which have the approval and expiration dates of your study.

2. This board complies with requirements found in Title 45 part 46 of The Code of Federal Regulations. For NCSU the Assurance Number is: FWA00003429.

3. Any changes to the protocol and supporting documents must be submitted and approved by the IRB prior to implementation.

4. If any unanticipated problems occur, they must be reported to the IRB office within 5 business days by completing and submitting the unanticipated problem form on the IRB website.

5. Your approval for this study lasts for one year from the review date. If your study extends beyond that time, including data analysis, you must obtain continuing review from the IRB.

Sincerely,

Deb Paxton
NC State IRB

APPENDIX E – Study Consent Form

North Carolina State University

INFORMED CONSENT FORM for RESEARCH

This consent information is valid October 25, 2012 through October 25, 2013

Instructional Technology Leadership Study

LaTricia Townsend Faculty Sponsors: Lance Fusarelli, Ph.D. and Kevin Brady, Ph.D.

What are some general things you should know about research studies?

You are being asked to take part in a research study. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate or to stop participating at any time without penalty. The purpose of research studies is to gain a better understanding of a certain topic or issue. You are not guaranteed any personal benefits from being in a study. Research studies also may pose risks to those that participate. In this consent form you will find specific details about the research in which you are being asked to participate. If you do not understand something in this form it is your right to ask the researcher for clarification or more information. A copy of this consent form will be provided to you. If at any time you have questions about your participation, do not hesitate to contact the researcher(s) named above.

What is the purpose of this study?

The purpose of this study is to investigate instructional technology leadership practices in present in IMPACT schools.

What will happen if you take part in the study?

If you agree to participate in this study, you will be asked to participate in a 45-60 minute interview. The interview will ask questions about your activities as you engage in duties related to instructional technology leadership. The interview will take place via teleconference or videoconference. In addition to your participation, 10-15 teachers from your school should be identified to take a survey about your instructional technology leadership practices and what support needs they specifically have at their given school level (elementary, middle, high).

Risks

Since you will be asked to share information regarding your own instructional technology leadership behaviors as a principal, your responses will be kept confidential as to not cause issues with employment or relationships within your district or school. Direct quotes may be used in the final report, but the identity of respondents and their schools will be masked.

Benefits

The information reported from this study will inform the field of instructional technology as to how to adequately prepare principals to serve as instructional technology leaders in their schools.

Confidentiality

The information in the study records will be kept confidential to the full extent allowed by law. The information in the study records will be kept confidential. Data will be stored securely on a secure server. No reference will be made in oral or written reports which could link you to the study. General trends will be aggregated to the level of school (elementary, middle, and high) and level of technology leadership as measured by STNA for approximately nine schools.

Compensation

For participating in this study you will not receive anything for participating.

What if you have questions about this study?

If you have questions at any time about the study or the procedures, you may contact the researcher, LaTricia Townsend, at, or 919-513-8544.

What if you have questions about your rights as a research participant?

If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Deb Paxton, Regulatory Compliance Administrator, Box 7514, NCSU Campus (919/515-4514).

Consent To Participate

"I have read and understand the above information. I have received a copy of this form. I agree to participate in this study with the understanding that I may choose not to participate or to stop participating at any time without penalty or loss of benefits to which I am otherwise entitled."

Subject's signature_____ Date _____

Investigator's signature_____ Date _____