ELEMENTARY PRINCIPALS' USE OF 21ST CENTURY TECHNOLOGY IN SCHOOLS IN NEW YORK STATE

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ELEMENTARY PRINCIPALS' USE OF 21ST CENTURY TECHNOLOGY
IN SCHOOLS IN NEW YORK STATE

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Abstract

The purpose of this study was to gain insight on the leadership practices of elementary school principals regarding the implementation and use of 21st century technology in school districts in the Capital Region area of New York State. This study was guided by the following research questions: (1) In what ways do elementary school principals identify their actions as supporting effective implementation of 21st century technology? (2) What specific challenges can these individuals identify in carrying out these practices? (3) How do principals interpret the incorporation of technology as an effective support for student achievement? (4) What recommendations would these individuals provide to supervisors and higher educational institutions to better support school principal practices in implementing 21st century technology?

The method of inquiry for this investigative study incorporated a qualitative research design. The strategy of phenomenological inquiry was selected as the research design that would best support school principals in sharing their professional experiences in utilizing 21st century technology and further assist the researcher in analyzing relationships and patterns in data.

The data collected from research participants allowed for the following findings: There is a great need for principal technology behaviors and practices to expand beyond the daily practices of general technology use; building technology leadership needs to be more a priority for school principals without delegation of that role to staff; more autonomy needs to provided to principals by central office administrators for targeted use of building funds and resources; teacher resistance to change should be an expectation for principals in their efforts to develop highly functional technology programs; technology resources can be effective support for student engagement in the effort to improve student achievement; more district level technology support, in the form of technology training and resources, is needed for principals' technology leadership

development; there is a need for higher educational institutions to provide technology leadership support through coursework and administrative training programs to better prepare and continuously engage principals in their role of technology leader.

Key Terms: Twenty-First Century Technology, Model Schools Program, New York State, Northeast Regional Information Center, Elementary Principals.

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Chapter 1: Introduction

As we prepare students to become increasingly competitive in a consistently evolving global job market, there is a critical importance for school principals to fully utilize practices and processes to support the development and use of 21st century technology skills in elementary and secondary schools in school districts across the country. This 21st century approach to teaching and learning enforces building skills associated with computer literacy, problem solving and innovation (Stansbury, 2007a). In order to create and continuously develop these learning environments, school principals must not only have a thorough understanding of 21st century technology resources, but also be able support the consistent use of these resources through their administrative practices.

As suggested by Leithwood and Riehl (2003), there are multiple challenges faced by school leaders in their efforts to establish and sustain highly effective educational environments. Leithwood and Riehl stated:

> Educational leaders must guide their schools through the challenges posed by an increasingly complex environment. Principals must respond to increasing diversity in student characteristics, income disparities and variation in learning capacities. Rapid developments in technologies for teaching and communication require adjustments in the internal workings of schools. These are just a few of the conditions that make schooling more challenging and leadership more essential. (2003, p. 1)

As suggested by Hew and Brush (2006), there are many challenges encountered by school principals attempting to integrate and develop technology into building programs. These obstacles were identified as the following: lack of available resources, prevailing

school culture, attitudes and beliefs, lack of knowledge and skills and infrequent assessment (Hew & Brush, 2006). Langorio (2005) stated:

> The United States is losing ground in education, as peers across the globe zoom by with bigger gains in student achievement and school graduations. Among adults age 25 to 34, the U.S. is ninth among industrialized nations in the share of its population that has at least a high school degree. (p. 1)

Leithwood and Riehl (2003) identified two important functions related to the definition of leadership, which are the leaders' provision of direction and the integration of influence. In referencing these functions, Leithwood and Riehl (2003) highlighted the importance for school leadership in public education in taking the following actions: working in union with stakeholders on a shared vision focused on student learning; creating an educational atmosphere that has frameworks of support for stakeholders to be highly engaged and effective; and being flexible in their role as leaders to support others in the functioning of their various leadership roles.

"Technology is a tool that has the potential to empower educational leaders at all levels, whether they are superintendents, principals, teachers, board members or state officials, as well as to redefine what education means in the 21st century" (Golden, 2004, p. 1). Golden (2004) identified challenges for school leaders as being the ability to completely understand the benefits of technology and being made comfortable with use and implementation of technology through professional development. Golden stated "Ultimately, the challenge is about helping all stakeholders use technology to transform the culture of education to enhance student performance." (2004, p. 1). Stansbury (2007b) stated:

> Americans understand that fundamental changes must be made to the U.S. educational system if the country is to remain competitive in the 21st Century. Americans especially realize the importance of adopting information technology to upgrade schools, connect communities and improve educational content. (p. 1)

Leithwood and Riehl (2003) identified five conclusions about school leadership practices. The first conclusion was that school leadership has the most significant impact on student learning following the effects of quality of teacher instruction and quality of academic curriculum. With this notion, it was stated that the indirect effects of leadership on student learning are significant and are usually evidenced in the forms of leaders providing resources and structuring processes to support program goals.

The second conclusion from this research literature was that different leadership styles provided opportunities for leadership to be distributed among many stakeholders in a school organization across their multiple functioning capacities. These leadership styles were identified as "transformational, instructional, moral and participative models of leadership" (Leithwood & Riehl, 2003, p. 3).

Third, three practices were associated with successful leadership in schools: setting directions, developing people and developing the organization (Leithwood & Riehl, 2003). Fourth, it is important for school leaders to create a framework of practices that address multiple accountability measures. Lastly, the Leithwood and Riehl (2003) identified the importance for school leaders to take proactive measures to support the education of diverse student groups.

Relevance of Research

Public education is a prominent topic among American citizens and serves as an issue of great debate and evaluation in local, state and federal government. At the core of the concern for public education is the existence of the achievement gap that is evidenced in student performance data, graduation rates and college performance data of the various cohorts of students that are educated in the United States public educational system. The Race to the Top Funding Initiative exemplifies the pressure the Federal Government is placing on the State Educational Departments to establish high standards for student achievement. This grant requires public school districts to allocate and incorporate appropriate resources to support the educational needs of all student learners. The increased focus on math, science and technology and the incorporation and development of technology resources has been identified as a vital component of this initiative.

The researcher will examine the practices and behaviors of elementary school principals in implementing and developing technology resources in school buildings to gain insight on how principals can effectively support the implementation and development of 21st century technology. This research will evaluate further the challenges identified by principals in carrying out the practices of technology use and implementation. This researcher will also identify recommendations provided by research participants to central office supervisors and higher educational institutions on how to better support principals in implementing 21st century technology. The information obtained in this research study is important to school principals in developing their technology leadership to support local, state and federal initiatives of improving student outcomes and achievement.

Purpose of the Study and Research Questions

The purpose of this qualitative study was to investigate the understanding of leadership practices of elementary school principals regarding the implementation and use of 21st century technology in school districts in the Capital Region of New York State (NYS). Interviews and observations were utilized to collect information from building principals in identified technology rich and technology poor schools in school districts in the Capital Region. The following questions guided this research study:

1. In what ways do elementary school principals identify their actions as supporting effective implementation of 21st century technology?
2. What specific challenges can these individuals identify in carrying out these practices?
3. How do principals interpret the incorporation of technology as an effective support for student achievement?
4. What recommendations would these individuals provide to supervisors and higher educational institutions to better support school principal practices in implementing 21st century technology?

Chapter 2: Review of Literature

In investigating the research literature related to this qualitative study, a review was conducted to explore the availability of supporting resources related to the leadership practices of K-12 school principals' implementation and use of 21st century technology in technology rich and technology poor schools in the Capital Region area of New York State. In reviewing this research literature, information was analyzed to better support understanding of the following areas related to the four research questions: (1) Identified perceptions of principals' practices in implementing technology (2) Challenges encountered by principals (3) The relationship between principals' practices and student achievement (4) Resources and support for principals' practices in implementing technology.

21st Century Skills

In a report published by the Partnership for 21st Century Skills (P21) and titled *21st Century Knowledge and Skills in Educator Preparation*, Greenhill (2010) outlined the importance of developing 21st century skills within the framework of administrative and teacher preparatory programs to support students' preparation in an increasingly competitive global market. In this report, Greenhill (2010) identified three issues that drove the need for change in the American educational system. These three issues were identified as the following: (1) The dual achievement gap (2) Shifting economy and labor market (3) Shifting labor demands. In referencing the dual achievement gap, Greenhill (2010) stated:

> For the past decade, the United States has focused nationally on closing achievement gaps between the lowest-and highest performing students, and between the poorest and most affluent. Equally important is the global achievement gap between U.S. students and their international peers in competitive nations. (p. 7)

Greenhill (2010) also explained how the shift from an industrial economy to a service-based economy has created a labor market demand for individuals that are knowledgeable and creative in thought. As a result, Greenhill (2010) advocates that U.S. Schools promote the understanding of the 21st century interdisciplinary themes, which he identifies as global awareness, economic literacy, civic literacy, health literacy and environmental literacy. Greenhill (2010) suggests that educators take the following actions to better support this learning by all students: (1) Integrate technology to support academic content (2) Establish standards based instruction (3) Utilize varied methods of instructional delivery (4) Coach and mentor peers (5) Differentiate student assessment strategies.

The availability of technology in schools is often viewed as a measure for the potential of high student achievement. Smith (1996) investigated the association between the level of schools' technological development and principals' technology backgrounds. Smith (1996) identified "technology rich" schools as those organizations that had a minimum of 1 to 14, computer to student ratio and contained a local modem. "Technology non-rich" schools were identified by Smith (1996) as those school buildings with a zero computer to student ratio. Smith (1996) found that a statistically significant relationship existed between a principal's technological competence and the school's level of technological richness. Palak & Walls (2009) identified technology rich schools in his study as being those schools that had high levels of commitment to aligning technology to instruction, continuous professional development, dedication to school reform and had access to sufficient supports and resources.

The definitions of "technology rich" and "technology poor" schools provided by Smith (1996) and Palak and Walls (2009) were used as sources by this researcher to establish the

criteria for school districts moving toward being highly functional technology districts and those school districts that were not moving toward fully developing technology resources. In this research study, the allocation of technology resources to schools, as well as school districts' participation in technology development support programs served as the measure of schools' level of technology richness.

Principals' Practices

The literature related to the practices of principals in implementing technology, supported the notion that the foundation of school improvement efforts are often influenced by the actions of the school principal. Rogers (2007) found that principals' positive perceptions of implementing the Project Lead the Way Technology Curriculum had a positive influence on students' enthusiasm and motivation to learn, which in turn, had a positive influence on program technology teachers. In a study of principals' use of technology by Waterman (2009), it was found that school principals felt it was an important aspect of their technology leadership to ensure that technology was identified and integrated within the short term and long term goals of their building programs. Pasquerilla (2008) investigated the impact of technology integration on the role of principals. Pasquerilla (2008) established the following findings: (1) Principals identified themselves as being highly technologically competent and aware (2) Principals found technology to be an asset in carrying out their daily duties and accessing student data.

Stegall (1998) found that principals' technology leadership was vital to the support of an effective elementary school program. She identified principals' technology leadership as being evidenced through implementation of resources and programming: establishment of a technology committee, creation of a technology plan, establishing of a computer curriculum,

availability of internet access, establishment of a computer teacher position and allocation of building budgetary funds for the purchase and support of technology resources (Stegall, 1998). Stegall (1998) also found that principals had alternative methods of funding technology resources in their schools. These methods included utilizing school based fund raisers, cash reserves, donations, and grant applications. In providing recommendations for practice for school principals, Stegall (1998) suggested that principals engage in the following practices to support the integration and use of technology in schools, model the use of technology, utilize stakeholder technology experts for support, establish a committee to oversee technology, observe how other schools utilize technology, establish a technology plan, provide staff with technology resources and training and insist that staff become technology literate.

Challenges for Leadership

Another theme that became readily apparent in reviewing the research literature involved challenges faced by school principals in implementing and sustaining technology initiatives. MacNeil and Delafield (1998) identified the biggest challenges facing school principals in implementing technology into the school curriculum were the lack of funding to purchase technology resources, lack of time for the appropriate technology training and support for staff on the effective use of technology. Pasquerilla (2008) outlined principal identified barriers to integrating technology as being lack of funding, teacher resistance, and infrastructure concerns.

Brockmeier, Sermon, and Hope (2005) found that principals outlined challenges to implementing technology as being associated with a lack of professional development and practice in the educational setting. Brockmeier, Sermon, and Hope (2005) also found that in

order for school principals to become competent facilitators of building technology development they had to be knowledgeable of the benefits of technology resources, be competent in the use of those resources, understand the relationship between student learning and teacher instruction and being flexible in taking on various technology related roles.

Hew and Brush (2006) identified barriers to technology integration in schools as being the following: lack of resources, under-developed skills and lack of technology knowledge, institutional barriers, staff resistance, inability to align technology with learning and institutional resistance. In referencing the lack of resources as a barrier to integrating technology, Hew and Brush (2006) stated that schools often lack physical technology resources, lack equal accessibility to those resources, lack time to develop and integrate technology and lack technological support. Hew and Brush (2006) highlighted institutional barriers as relating to the failure of organizations to develop an organizational framework to support technology integration. Hew and Brush (2006) referred to the barrier of subject culture as being the embedded institutional practices that have become the standard for operations within the school. Hew and Brush (2006) further explains that teachers attitudes and beliefs are often shaped by the failure of leaders in establishing targeted technology initiatives. Hew and Brush (2006) highlighted the pressure of high -stakes state testing assessments as serving as a basis for resistance from teachers in integrating new technology.

In addressing the obstacles to integrating technology into K-12 teaching and learning Hew and Brush(2006) provided strategies to overcoming these barriers, which consisted of the following: establishing a uniformly accepted building technology plan , developing strategies to effectively pool technology resources, developing a culture of appreciating the

benefits of technology, establishing targeted technology support and training and realigning assessments to obtain the benefits of technology. In summarizing these strategies, Hew and Brush (2006) emphasized the importance for school leaders in analyzing these barriers and obstacles from the first-order and second-order change perspective.

Grimm (2007) utilized the five phases of Rogers' framework for the innovation-decision process in analyzing principals' computer use of technology in schools. Grimm (2007) found that principals expressed a desire to use computer technology more, but consistently identified the lack of time and lack of connected opportunities for use as reasons for not being engaged.

Bridges (2003) highlighted the "three phases of transition" encountered during a change effort: (1) The Ending, Losing, Letting Go (2) The Neutral Zone (3) The New Beginning. Bridges (2003) identified the first phase of the transition process as the release of old ways and identities by individuals in an organization and the period during which the leader supports those individuals in moving past their losses. Bridges (2003) suggested that the success of the leader moving individuals past this phase rests in the realization that the *old* is no longer effective for the organization. The neutral zone was identified as the period of time when the old is gone, but the new is not completely developed in the organization. Bridges (2003) explained the new beginning to be the time period when individuals recognize a new sense of purpose that supports the functioning of the change effort.

Glickman (2003) provides added insight for school leaders in addressing individual resistance behaviors and directing staff thorough change efforts. He identified five factors in the work environment that commonly serve as obstacles to school improvement efforts: (1) one-room schoolhouse mentality, (2) inverse beginner responsibilities, (3) invisibility and

isolation, (4) lack of professional dialogue, and (5) restricted choice (Glickman, 2003, p. 146). Glickman suggests that leaders utilize four specific approaches in aggressively eliminating these obstacles; increase individual's responsibilities, increase individual's visibility, increase professional dialogue, and increase professional choice (Glickman, 2003).

Reeves (2002) expanded on the notion that leaders incorporate individual and organizational resistance to change as expected occurrences in the functioning of the organization. The following passage supports the need for school leaders to embrace these challenges as necessary components of change and organizational growth:

> Each new innovation faces potential resistance not merely from individuals but also from the system of relationships that have developed over time. Even if the proposed change is not resisted by an individual, it almost always has an impact on systemic relationships that involve the individual. Individual resistance to change is inevitable. Each case of individual resistance can be dealt with respectfully and effectively if it is accurately identified. Using the hypothesis –testing model, we can move from emotional argument to rational analysis of data. (Reeves, 2002, pp. 35-36)

Impact on Student Achievement

In analyzing this component of the literature, researchers highlighted the influence of principals' integration of technology on the instruction of teachers and the achievement of students. Schulter (2006) highlighted that transformational leadership is consistently demonstrated in observable principal behaviors such as trust building, inspiring staff, and supporting creative and innovative thought. In identifying these behaviors through principal responses to interview questions, Schulter (2006) measured these factors based on principals' use of the target words, such as the words encourage, build and trust.

Camp (2007) also identified the school administrator's leadership as an influencing factor on the integration of technology to effectively support the instruction and learning in a school program. Camp (2007) found that the principal could be instrumental in influencing the effective implementation of technology in a school program in several ways. One way was for school principals to serve as a positive influence in creating a shared technology vision with staff to allow for individuals to better connect how the technology would support them better in carrying out their individual responsibilities.

Another strategy mentioned by the Camp (2007) was for principals to develop the concepts of teacher leaders and collaboration. Camp (2007) explained that this collaboration would in turn, allow for the establishment of a school environment that fosters teachers learning collectively and encourage the use of the new technology. Camp (2007) also suggested that principal modeling of expected behaviors could greatly support technology acceptance and use. In describing his study and how the researched principal demonstrated leadership, Camp (2007) stated the following:

> He led gently, democratically, with caring, and by example. He led by respecting teachers and expecting them to do their best, but giving them the freedom to find their way. He never forced them to use technology, but made his expectations clear and encouraged them along the way. He gave teachers a voice and always made time to listen. He cared for them as individuals and trusted them to do what is best for children. He modeled the behaviors he wanted the teachers to exhibit. He did all he could to help teachers be the best they could be. He describes his leadership style as participatory, facilitating and collaborative. (p. 107)

Resources and Support

The literature related to resources and support for principals in implementing technology in schools reinforced that preparatory programs and professional development played critical roles for principals in their success in achieving technology implementation goals. Chebbi (2005) investigated the impact of professional development on elementary principal's integration of technology, as it related to the following areas: management and operations, the teaching and learning environment and assessment and evaluation. Chebbi (2005) highlighted several important findings supporting the importance of providing professional development to principals for implementing technology. One finding was that professional development did not significantly impact the use of technology by principals for management and operations, for assessment and evaluation and in the learning environment. Chebbi (2005) did find that professional development for principals had a significant positive impact on media specialists, who worked closely with principals. He also found that professional development for principals did have a significant positive impact on teacher use of technology for assessment and evaluation.

Werner (2007) outlined the importance of analyzing principals' perceptions for elements that should be included in principal preparation programs to support the integration of technology in schools. In her study, Werner (2007) found that principals indicated that factors such as building management, staff relations, pupil management and use of technology were not a part of preparatory programs. She also found that practicing principals with larger student populations were more likely to identify with appropriate training for technology and information systems as part of their preparatory programs. Werner also concluded that principals of larger schools and school districts were more likely

to require specified levels of technology preparation prior to the beginning of their employment as a principal.

Dawson and Rakes (2003) analyzed the influence of principals' technology training on the level of integration of technology in schools. The four variation types of training were identified as the following: basic skills/applications, basic skills/internet, technology integration and specialized training. In their study, Dawson and Rakes (2003) found that the frequency and types of technology training received by school principals had a significant influence on the level of technology integration in schools. Dawson and Rakes (2003) also found that the age of the school principal also had an influence on the level of technology integration in schools.

Past research studies on principals' use and development of technology in schools indicate several important findings that will support this research study. Smith (1996) found there is a significant relationship between a principals' technological competence and the level of technology development of a school. In this research study, the researcher will further investigate the relationship between principals' practices and the level of school building technology development. Stegall (1998) found that principals' technology leadership has a significant influence on the development and support of an effective school program. Pasquerilla (2008) found that principals' perceptions of technology leadership are closely associated with the performance and completion of daily duties. The technology leadership role of the principal will be investigated in this research study, as it relates to the use of technology facilitators.

MacNeil and Delafield (1998) found that principals' technology leadership is challenged by factors such as lack of funding, lack of technology training and staff resistance.

Lack of resources is a factor that will be further investigated in this study to determine the impact on technology development. Camp (2007) found that a school administrators' leadership has an influence on the integration of technology to effectively support instruction and learning in a school program. This researcher will investigate the similarities and differences in practices of technology rich school principals and technology poor school principals. Chebbi (2005) found that professional development for principals has a significant positive impact on teacher use of technology for assessment and evaluation. Werner (2007) found that the frequency and types of technology training received by school principals has a significant influence on the level of technology integration in schools. The preparation of principals for the role of technology leader will be investigated by this researcher to evaluate the level of technology leadership support obtained from district level supervisors and higher education programs.

In this research study, the researcher will investigate the influence of an out-of-district technology support program, the Model Schools Program, on principals' technology leadership in developing highly functional school technology programs. Principals from school districts that are members of and not members of the Model Schools Program will be interviewed to allow the researcher to collect data of the following: building technology resources; principal perceptions' of technology practices; challenges to principals' technology leadership practices; and technology leadership preparation and professional development. This data will be compared and contrasted to evaluate the influence of the Model Schools Program on school principal technology leadership.

Chapter 3: Methodology

The purpose of this qualitative study was to investigate the understanding of leadership practices of elementary school principals regarding the implementation and use of 21st century technology in school districts in the Capital Region area of New York State (NYS). The following questions guided this research study:

1. In what ways do elementary school principals identify their actions as supporting effective implementation of 21st century technology?
2. What specific challenges can these individuals identify in carrying out these practices?
3. How do principals interpret the incorporation of technology as an effective support for student achievement?
4. What recommendations would these individuals provide to supervisors and higher educational institutions to better support school principal practices in implementing 21st century technology?

Research Design

The method of inquiry for this investigative study incorporated a qualitative research design. This research strategy was utilized because it best supported the study of the population and allowed for the effective collection of interview and observational data related to the outlined research questions. Creswell (2003) asserts that the three criteria to be considered for selecting an approach to research are the research problem, the personal experiences of the researcher and the audience who receives the research report information.

In analyzing the three criteria in relation to the investigation of principals' use of 21st century technology in schools, the strategy of phenomenological inquiry was selected as the

research design. It was determined by the researcher that this design would best support school principals in sharing their professional experiences in utilizing 21st century technology and further assist the researcher in analyzing relationships and patterns in data. Creswell states that "Understanding the lived experiences marks phenomenology as a philosophy as well as a method, and the procedure involves studying a small number of subjects through extensive and prolonged engagement to develop patterns and relationships of meaning" (2003, p. 15). This method of inquiry also provides the researcher detailed and specific information of actual principal experiences in their respective school buildings.

Research Population

Research participants for this qualitative study consisted of fourteen elementary school principals from schools located in New York State (NYS), all of which are members of the Northeastern Regional Information Center (NERIC), one of several Regional Information Centers (RICs) serving NYS. NERIC is located in the Capital Region BOCES and serves school districts throughout northeastern NYS. NERIC is an organization that works in association with the various regional BOCES to provide technology support and services to over 140 school districts in 12 counties in the northeast region of NYS.

The importance of this technology support by NERIC is that it directly assists school districts in providing professional development and training for school staff in establishing highly functional building technology programs. Programs and support services provided by NERIC include the following: voice and electronic Communication; web-based applications; distance learning and videoconferencing; instructional technology integration; instructional technology and e-learning (Northeast Regional Information Center [NERIC], 2010). School

districts participating in obtaining support from the RIC in the program area of instructional technology (IT) integration were identified as Model Schools.

Non-probability purposive sampling was utilized for this study to allow the researcher to gain an increased understanding of school principals' practices relative to the integration and development of technology in schools. Schools were selected for this study by the researcher based on the following criteria: schools being located in the Capital Region area of NYS; school districts being a member or non-member of the NERIC's Model Schools Program; principal responses of agreement to participate in the research study. There were a total of 35 elementary school principals in all the school districts involved in this research study. A total of 18 elementary principals were recommended to be contacted by district central office administrators in each district for participation in the study. A total of 14 elementary school principals agreed to participate in this research project. See Appendices A and B for the cover letter and Informed Consent Form. Four of the principals contacted to participate in this research study did not complete or return consent forms.

The researcher established definitions of *technology rich* and *technology poor* schools by utilizing criteria from past research conducted by Smith (1996) and Palak and Walls (2009). School districts moving toward being technology rich school districts were identified as those schools in school districts that were members of the NERIC's Model Schools Program and had an abundance of technology resources within their school districts. Through the Model School Program, support is provided to school districts that are attempting to build highly functional technology systems. Technology rich schools were identified as schools that were technology rich based on having the majority of technology rich resources established in this research study and additionally participated in the Model

Schools Program. School building five, six, eight, nine, eleven, twelve, thirteen and fourteen were identified as schools that were technology rich based on these criteria.

School districts that were not members of the RIC and not a part of the Models School Program were also identified. School buildings that did not have the majority of technology resources in place in their school buildings and additionally did not participate in the Model Schools Program were identified as technology poor schools. The technology poor schools identified in this study by the researcher were school buildings one, two, three, four, seven and ten.

Eight elementary school principals from school districts that participate in the Model Schools Program and six elementary school principals from school districts that are not part of the Model Schools Program were identified based on these criteria and included in the study. Information provided by school principals in school districts participating in the Model Schools Program will be compared and contrasted for similarities and differences in the information provided by school principals from school districts not participating in the Model Schools Program.

Procedures

Interviews were conducted with fourteen building principals at their respective school sites regarding their practices and the implementation of 21st century technology. Participants were interviewed utilizing the interview questions in Appendix C. Technology resource data for each research site was recorded as outlined in Appendix D. The inventory of building technology resource data collected included the following: classroom computers, wireless laptop computers, computer labs, SMARTboards, internet access and palm pilots

(see Appendix D). All interviews were conducted during the time period of March 23 – June 30, 2010.

Data Collection

Data were collected utilizing in-person interviews of the research participants and recorded observations of technology resources at the research building sites. Interviews of research participants were scheduled for a period of 45 minutes, and inventory of building technology resources were completed and recorded on Appendix D during 15 minute interviews with research participants on assessment of technology inventory. All data were shared with research participants once interview sessions were completed to ensure that recorded responses were accurate and could be validated. All interview data obtained in this research study was collected through the scribing of written notes of participant responses by the researcher.

All observation and interview data were secured in a locked cabinet area in a private location known only to the researcher conducting this study. Upon completion of the research study, all recorded data, which consisted of data logs, inventory data, recorded responses and email communication, were immediately destroyed to protect the anonymity and confidentiality of the study.

Data Analysis

Participant responses were coded by the researcher to ensure that data remained anonymous. Number designations were utilized to refer to principals participating in the research study, their schools and their respective school districts. An example of this coding is the reference to research participants as RP1, RP2, etc. For purposes of this study, the

researcher utilized the terms principal and research participant interchangeably throughout the study.

Participant responses from interviews and data recorded by the researcher through observations of research sites were coded by the researcher and reviewed for emergent themes and patterns associated with the four outlined research areas of interest. Emergent themes were identified by the researcher through review of participant responses and categorization of responses under the topic areas associated with each of the four research questions being investigated by the researcher. For research question one, the researcher identified the following emergent themes: (1) Connected views of 21st Century Technology (2) Technology leadership as a shared role (3) Integrated practices and behaviors (4) Professional development, support staff and resources as primary supports for teachers (5) Technology implementation as a district-level driven initiative.

The researcher identified the emergent themes of teacher resistance and lack of resources for research question two. The themes that emerged from interview responses related to research question three were: (1) Student engagement and participation in lessons (2) Common resources for students and teachers. The emergent themes that evolved from the interview responses related to research question four were the following: (1) More professional development and support needed (2) Lack of technology coursework in preparation programs.

The interview and inventory data collected by the researcher was also compared and contrasted to evaluate similarities and differences in school principals' practices and perceptions in relation to the implementation of 21st century technology. In addition, observations of building technology resources were recorded by the researcher for analysis

of congruence of resources. In conclusion, the researcher analyzed similarities and differences in principal responses and building inventory data of schools participating in the Model Schools Program versus those schools not participating in the Model Schools Program.

District technology plans were reviewed and information from those plans was included in the data reporting and analysis. These district plans directly aligned district technology initiatives to the implementation of building technology resources. Building technology resources were identified and reviewed in the data analysis.

Limitations

The following limitations were identified in this research study: (1) The accuracy of school principals' interview responses and technology inventory responses were subject to the ability of the principals to invoke recall of perspective in relation to previous events, occurrences, behaviors and present day resources; (2) This research was conducted by a practicing school principal, who has had some experience with the integration of technology in schools, therefore reporting bias was a factor that was negated through detailed and accurate recording of participant provided responses. This researcher also consistently utilized the same procedural approach of conducting interviews to address this potential bias. This research study was also delimited by the researcher through the intentional research decision to conduct the study in a small geographic area of Upstate NY.

Chapter 4: Findings

This researcher conducted an extensive review of interview data in an effort to gain a thorough understanding of the emergent themes and patterns of participant responses. Commonalities and substantive differences in responses were also evaluated for relative significance to the overall findings of the research questions. The researcher analyzed similarities and differences in principal responses and building inventory data of schools participating in the Model Schools Program versus those schools not participating in the Model Schools Program to gain insight on schools that were moving toward developing technology rich building programs versus those school programs that were viewed as technology poor. All data was evaluated and categorized as it related to the four outlined research questions that guided this study:

1. In what ways do elementary school principals identify their actions as supporting effective implementation of 21st century technology?
2. What specific challenges can these individuals identify in carrying out these practices?
3. How do principals interpret the incorporation of technology as an effective support for student achievement?
4. What recommendations would these individuals provide to supervisors and higher educational institutions to better support school principal practices in implementing 21st century technology?

Table 1 displays the technology rich characteristics associated with schools moving toward developing highly functional technology programs in their school districts. As outlined in Table 1, the following variables were analyzed in each school building by the researcher in identifying technology rich and technology poor schools: the presence of a salaried staff member to serve as a

technology facilitator; the presence of a computer lab, evidence of sustained technology professional development and membership in the Model Schools Program.

Table 1

Characteristics of Technology Rich versus Technology Poor Schools

	Characteristic			
	Paid Technology Facilitator	Number of Computer Labs	Sustained Professional Development	Model Schools Program
Technology rich schools:				
5	Yes	0	Yes	Yes
6	Yes	1	Yes	Yes
8	Yes	0	Yes	Yes
9	Yes	0	Yes	Yes
11	No	1	Yes	Yes
12	No	1	Yes	Yes
13	Yes	0	Yes	Yes
14	Yes	1	Yes	Yes
Technology poor schools:				
1	No	1	No	No
2	No	2	No	No
3	No	1	No	No
4	No	2	No	No
7	No	1	No	No
10	No	1	No	No

School buildings five, six, eight, nine, eleven, twelve, thirteen and fourteen were identified as schools that were technology rich based on having the majority of technology rich resources established in this research study. All of the technology rich schools, with the exception of buildings eleven and twelve, had a paid staff member to serve as the building technology

facilitator. School buildings five, eight, nine and thirteen did not have computer labs in place, but did have classroom computers and wireless laptops available for student and staff use. All of the technology rich schools identified in this study identified continuous embedded technology professional development as part of their building programs and all were members of the Model Schools Program.

School buildings that did not have the majority of technology rich resources in place in their school buildings were identified as technology poor schools. The technology poor schools identified in this study by the researcher were school buildings one, two, three, four, seven and ten. As indicated in Table 1, the technology poor schools had no paid technology facilitators on staff, did not identify sustained embedded technology professional development as part of building programs and were not members of the Models School Program.

Research Question One

In what ways do elementary school principals identify their actions as supporting effective implementation of 21st century technology?

Interview questions utilized regarding this area of the research study were designed to obtain information from school principals regarding their specific practices of implementing and supporting the use of 21st century technology. The interview questions that were incorporated to obtain this data were the following:

1. How would you define technology leadership and 21st century technology?
2. How would you describe your role as the technology leader of your school?
3. What are the important attributes and behaviors needed to be an effective building leader in implementing 21st century technology?

4. What are some specific ways in which you support the implementation of 21st century technology in your building?
5. How much time per week do you allocate toward supporting staff in implementing 21st century technology?
6. How are teachers and support staff supported in integrating and utilizing 21st century technology to support instruction?
7. Does your school have a standing committee that oversees the implementation of technology?
8. How much of your building budget is allocated to the purchasing and implementation of technology?
9. Does your school have a school improvement plan or technology plan that details the implementation of technology?
    a. What does is the main focus of the plan?
    b. How is the plan communicated and reinforced with school stakeholders?
    c. How often is the plan reviewed and revised?

Several themes emerged that were identified by the researcher from the responses to these questions: (1) Connected views of 21st century technology (2) Technology leadership as a shared role (3) Integrated practices and behaviors (4) Professional development, support staff and resources as primary supports for teachers (5) Technology implementation as a district-level driven initiative.

Connected views of 21st century technology. Research participants consistently reinforced the utilization of new resources and practices to improve teacher instruction and student achievement in their identification of 21st century technology. RP9 stated "Twenty-first century

technology relates to resources that open doors to the world especially in education, it has driven the structure of what we do and how we do things and increased the amount of resources available in the workplace." In reference to the importance of 21st century technology, RP7 stated that students should be well versed on the use of technology because it is entrenched in everything we do in society. "Twenty-first century technology is the ability to go worldwide with information, content and resources to support instruction," stated RP10.

RP12 stated that 21st century technology provided individuals the opportunities to use abilities and tools to further the education of students working in a collaborative environment. RP12 further stated, "The use of technology in schools is a marriage of technology resources to the curriculum and instructional practices that we utilize." RP1 also stated "it allows for the use of resources in the workplace to enhance the everyday lives of students and teachers, and further allows people at large to navigate within a global economy." RP11 supported this line of thought by stating "Twenty-first century technology has provided educators and students quicker and more efficient ways of carrying out tasks in the school environment, which is much needed by students to be competitive in the global market." RP11 also stated that 21st century technology "is about using collaborative tools in helping people locally and globally."

RP5 stated "The use of 21st century technology in schools is about identifying current and future resources and incorporating that into classroom." RP5 further provided the examples of practical uses of technology in schools such as the use of MP3 players by students to record books and for listening centers. RP2 reinforced this perspective of 21st century technology by stating "It is moving away from the archaic ways of doing things and utilizing resources such as the use of cell phones in class to search the internet for class research and using iPods for the reading of articles." RP8 also commented on the importance of students utilizing 21st century technology for

research and problem solving in the classroom to make connections to real world applications. In his description of 21st century technology, RP3 stated "It is directly related to educational practices that change the delivery of instruction by utilizing new resources."

Technology leadership as a shared role. Another common theme reinforced the conscious choice of the building leader in sharing the technology leadership role with computer and technology staff within the school building. RP1 explained that the building technology teacher and computer teacher take the lead role in integrating and supporting the use of technology in his school building, but he makes efforts to stay involved in the process. RP1 stated "In my role as principal, I help guide and support the integration of technology in classrooms and further support teachers in making them comfortable in using the technology in their development of lessons."

RP2 stated "Ideally the principal of the school should be the technology leader to support the instructional approaches of teachers in the classroom, but my school computer teacher actively takes on the leadership role." RP2 further explained that he plays a supporting role by staying abreast of the technology available to enhance instruction in the classroom and sharing information.

It was explained by RP14 that his role was to establish the vision for the integration of 21st century technology resources, help secure the appropriate technology resources for his teachers and ensure that staff had the means available to fully implement those resources. RP14 also said "The role of technology leader is a three person role between principal, a full-time building assigned technology specialist and the district director of technology." He also explained that the full-time technology specialist supported teachers directly by pushing into classrooms for guidance, training and workshops.

RP5 stated “Technology leadership is about keeping practices current, collaborating within the school building in sharing those practices and keeping technology resources relevant.” RP5 also stated that he is provided support in the form of two technology assistants, who are full-time staff members that are paid stipends to serve as technology assistants. RP5 explained that the technology assistants take on the day-to-day tasks associated with technology integration.

RP6 stated “To a certain degree the building principal has to be the technology leader of their school by being familiar, comfortable and knowledgeable of the tools and resources available to make the best use of the data.” RP6 also stated that he is provided with two staff members that receive stipends to support building efforts to integrate technology.

RP8 stated “An important component of technology leadership is the ability of a principal to demonstrate to teachers how to integrate technology in the classroom and make learning accessible to all students by tapping into students’ interest.” RP8 also stated “The role of technology leader is a shared role with the instructional technology staff person, who focuses on a different aspect of technology to incorporate into the building program monthly.”

RP7 reinforced the shared technology leadership concept by explaining that no single person is responsible for the integration of technology, with his working with technology savvy staff to make other staff more comfortable utilizing resources. RP7 stated, “In my building, we have a teacher who is very knowledgeable about technology and works with our staff to help them integrate the technology into their instruction.”

RP9 stated “Technology leadership for principals is leading the way in obtaining the information on the most current resources and practices available and making them accessible to staff.” RP9 explained that in his building there was an IT teacher who took the lead role on the direct implementation of technology.

RP11 stated “I am not a big user of technology and I do not consistently engage in leadership practices, but I do support initiatives to bring technology in the building and further support professional development for teachers.” RP11 further stated that his role was to make sure the technology was being consistently utilized by teachers and the building computer teacher was delegated the responsibility of directly assisting students and teachers with the integration, development and use of technology resources.

It was stated by RP12 that technology leadership involved the ability of principals to oversee the use of 21st century technology. RP12 stated, “I believe ideally it is the principal’s role to be the technology leader of a school, but in reality the role is best supported by curriculum or media staff that can better connect the technology with the curriculum.”

Integrated practices and behaviors. There also were some commonalities among the research participants on how they integrated their specific technology leadership practices and behaviors within the scope of their job tasks as building principals. In response to the attributes and behaviors needed to be an effective building leader in implementing 21st century technology, RP4 stated that building principals should have some knowledge of the latest computer programs and software, be computer savvy, and be able to navigate the web.

RP4 also stated:

> My background as a former computer teacher supports me in my technology leadership as principal in being familiar with the latest technology and ensuring that students and staff are trained in utilizing the network and the various resources available to support instruction.

Specific leadership practices and behaviors sited by RP4 included him establishing a computer lab schedule for student use for at least one hour per week, implementation of a robotics program, the

purchase of digital cameras, SMARTboards and audio equipment for student and staff use and the provision of five two-hour professional development sessions each year for staff to be trained on utilizing technology resources. RP4 also stated the he directly employs technology through the use of email communications and the use of LCD projectors, the SMARTboard, the internet and the web to conduct staff presentations. RP4 additionally stated that he chaired the school technology committee, which consists of the school art teacher, music teacher, fifth grade teacher and media specialist.

RP5 and RP6 provided similar responses in identifying the attributes and behaviors of an effective technology leader and their specific leadership practices and behaviors of implementing technology. RP5 stated that he "felt it was important for principals to keep current in their technology practices, current in their knowledge of technology resources and be hands on in knowing how to implement and utilize technology." RP5 stated that his specific technology leadership included his participation in technology conferences, working with building teachers and the building PTA to write technology grant proposals, and directing the purchasing and implementation of technology resources. RP5 identified the implemented technology resources as being classroom computers, SMARTboards, Elmos and MP3 players.

RP6 stated that:

> As an elementary school principal, I want to stay knowledgeable of the technology resources that are out there, so I can build the capacity to support the implementation of these tools to further support students as they move from the elementary level to secondary level and beyond.

RP6 stated that he undertakes the specific technology leadership practices and behaviors of working with building teachers to effectively utilize resources such as SMARTboards and

classroom computers. RP6 also stated that he consistently utilizes his Blackberry phone for communications with staff and providing instant feedback.

RP1, RP3, RP7, RP8, RP9, RP10 and RP14 reinforced the importance for building principals to be consistently engaged in maintaining awareness of most current and relevant technology. RP1 stated the importance of building principals being knowledgeable of the technology resources that are available in the educational arena and being aware of the best methods of implementing that technology into the classroom to support the delivery of instruction. RP1 also stated that he actively engaged in the technology leadership practices and behaviors of routinely reading technology literature, providing staff with technology workshops and in-service training on use of the SMARTboard and utilizing the LCD projector and internet for staff presentations and sharing of documents.

RP3 stated:

> I mainly engage in the technology leadership practices and behaviors of identifying and implementing technology resources to support student achievement. I have not specifically directed the professional development workshops on technology, but did facilitate the scheduling of the workshops and the purchase of the KidBiz Program licenses, SMARTboards, digital cameras and wireless laptop computers with carts."

RP3 also said that he was not as current with technology practices as he could be, but he utilizes email communications and the district eSchoolData Program for attendance and grading.

RP7 stated:

> Principals as effective technology leaders should be using it in their own practices and to become more knowledgeable and effective on how to utilize technology in classrooms. RP7 said they also should have the ability to collaborate with staff members who have

knowledge of 21st century technology and have the ability to communicate effectively to those staff who do not have that knowledge.

RP7 identified the following technology leadership practices and behaviors: using the laptop and LCD projector for staff presentations; utilizing the computer for attendance, discipline, email communications; and scheduling of teacher technology professional development on utilizing item analysis data.

RP8 stated:

> Principals should be familiar with current technology and be able to find a venue to share that information, share the vision of why it is important and be able to use model classrooms to showcase and reinforce technology learning and use.

In reference to his specific leadership practices, RP8 stated that he has facilitated the purchase and integration of SMARTboards into the school program and consistently models the use of the Elmo, SMARTboards and video clips in making presentations to staff. RP8 also mentioned that during curriculum meetings every two weeks, he meets with each teacher individually to evaluate technology integration.

Similar to RP8, RP9 stated that he models the use of the SMARTboard, Elmo and laptop during faculty meetings and building presentations. RP9 also stated that as part of his practices, he regularly obtains information on professional development and training related to technology and forwards that information to teachers. In reference to the importance of principal practices and behaviors, RP9 stated, "we need to know what technology is available and know how to utilize it. Maneuverability and familiarity are very important."

"Technology awareness is important for principals in seeing the big picture of how technology fits with the curriculum and how that information is communicated to students and

staff," stated RP10. RP10 also stated that his technology leadership behaviors and practices included the use of email communications and the use of a computer laptop and SMARTboard for school presentations. In addition, RP10 mentioned his facilitation of the purchase and integration of wireless laptop carts, KidBiz Program and SMARTboards for student and staff use.

In reference to principal technology leadership practices and behaviors, RP14 stated that it was important to understand the 21st century skills learning framework, but also have access to resources as well. RP14 also stated "I support implicit and explicit modeling of technology use. We showcase our school technology projects, web projects for immediate use and provide support to teachers who want to secure and incorporate technology resources."

Primary technology supports. All of the principals interviewed made direct mention to a designated staff member, specific technology equipment and professional development as the primary technology resources utilized in their integration of 21st century technology in their school buildings. All 14 research participants identified specific staff members who served as instrumental resources in the integration and development of 21st century technology in their buildings. RP5 and RP6 stated that the technology assistants were full-time staff members who received stipends for taking on the additional responsibilities of providing direct technology assistance to staff, providing monthly in-services, technology training and professional development to staff and implementing and integration technology resources into the building program. RP5 and RP6 also stated that they each had two technology assistants in their buildings.

RP8, RP9 and RP13 identified the individuals in their buildings who are responsible for the integration and development of resources as IT staff. Similar to the technology assistants described by RP5 and RP6, the IT staff was described by RP8, RP9 and RP13 as being building staff members who receive a stipend to provide IT support to building staff. RP8 stated, "The IT

staff identifies and brings in technology resources and is trained by the district. Every month the IT tries to incorporate a different element of technology into the building program." RP8, RP9 and RP13 stated that they each had one IT staff person in their respective buildings.

RP14 stated that his building, as the sole elementary building in his district, had a full-time staff member under the title of technology specialist who served the role of supporting building technology development. RP14 stated "the technology specialist pushes into classes to provide direct training and support to staff in integrating technology." The remaining eight research participants identified individual staff members who were either informally designated or assumed the role of technology leader in their school buildings with no compensation. All of the research participants commonly identified these individuals as being of one of the following backgrounds; computer teacher, media specialist, and tech savvy grade level teacher.

All of the research participants commonly identified the integration of SMARTboards, wireless laptop computers and classroom computers as key components of their 21st century technology initiatives. All research participants also stated that professional development was a central component of their building technology development initiatives.

District driven technology initiative. Another central theme of the collected data was the identification of technology integration and development as primarily a district-level driven initiative. All of the research participants stated that the primary source of funding, training, monitoring and implementation was through the actions of central office administration and clearly outlined district technology plans. RP8, RP9 and RP13 stated that there were no building-level technology committees in place, but they did state that their respective Building Leadership Teams (BLT) and IT staff were designated the responsibility of implementing initiatives of district technology committee, such as grant proposals and professional development.

It was additionally stated by these research participants that the focus of the district technology plan was the implementation of a grant for each school building to receive one classroom set of thirty wireless laptops, along with iPod touches for eBooks for listening to text. RP8 said "there was no building budget for the purchase of technology resources, but the district technology plan, which focused on utilizing testing data to improve achievement, outlined the purchase and implementation of iPods and wireless laptops through grant funding." RP8, RP9 and RP13 also stated that the building IT person communicates information to staff from the district technology committee formally once a month at faculty staff meetings.

RP5 and RP6 stated they had a formal building-level technology committee in place to oversee the integration of technology. This group consisted of the Technology Assistant, principal, a teacher and librarian that met approximately once every three months. RP5 and RP6 also stated that approximately 25% of the building budget was designated for the building technology purchases, but the majority of resources were allocated through the District Technology Plan. RP5 and RP6 further explained that the district IT plan outlined replacing computers throughout the school district to better support teacher instruction. These research participants also stated that the building technology assistants consistently communicated district technology initiatives to building staff at faculty meetings and additionally facilitated technology training.

RP2, RP3 and RP10 stated that they had no standing building technology committee or district technology committee to facilitate the integration and development of building technology and were primarily supported with technology resources from the district level administrators and the technology department. These research participants also stated that technology resources such as SMARTboards, computers for computer labs and computer software were provided through

district budget allocations for schools through the director of technology. The RP2, RP3 and RP10 also stated that the office of curriculum and instruction coordinated technology professional development in the forms of KidBiz training, eSchoolData training and SMARTboard training. RP2 stated, "Our school improvement plan did not specifically mention technology as a core component, but it was mentioned as a resource for improving instruction." RP10 stated, "We have no standing committee, but the integration of technology into the curriculum is a large part of our school improvement goals."

RP1 and RP4 stated that they had active school-based technology committees that consisted of the principal, media specialist, computer teacher and technology focused classroom teachers. RP1, RP4 and RP7 also stated that their involvement with the district technology committee was delegated to their building technology staff. RP1 identified a fourth grade teacher as the liaison to the district technology committee, while RP4 identified a fifth grade teacher and RP7 identified a grade level teacher. These research participants stated that their school improvement plans incorporated technology for data collection to support improvement in student achievement in English Language Arts and enrichment of student computer literacy. RP4 stated, "It is important for students to know the basics of desktop computer and be computer literate prior to graduation."

Relative to the purchase of technology resources, RP7 stated, "The district technology office does the major purchase of equipment. For our building this year, they purchased one SMARTboard and donated LCD projectors to teachers in the building who participated in district training." RP7 also stated there was no building level technology committee and all building technology implementation was guided through the district level committee and the district

technology plan. RP4 stated, "I allocate about 10% of the total building budget to the integration of technology. This year I purchased a SMARTboard, microphones and stands."

RP11 and RP12 stated that most of the technology initiatives taking place in their respective buildings were possible through district-level obtained grant funds. These participants further stated that they did utilize some building funds for small expenditures, such as computer software. RP11 stated that his school building did not have a school technology committee, but he did serve on the district technology committee.

RP11 stated that he actively communicates district technology initiatives with the computer lab teacher and collaborates on technology implementation. RP11 identified the responsibilities of the computer teacher as providing direct assistance to students and staff in serving as a reference, lesson development and professional development. RP11 and RP12 also stated that the district technology plan was currently implementing a grant initiative of providing elementary schools in the district with two SMARTboards and document cameras.

RP14 stated that as being the sole elementary building in the school district, he had a full-time technology specialist and a director of technology housed in his school building. RP14 stated that the technology specialist regularly pushed into teacher classes to provide technology support and training and the director of technology facilitated and monitored the connection between performance data and technology resources. In reference to the district technology committee, RP14 stated they were currently implementing a technology plan that was responsible for the following building resources; SMARTboard in each classroom, two class sets of digital cameras, desk book carts and four desk top computers per class.

Principals of both technology rich schools and technology poor schools provided similar responses in defining 21st century technology and making connections to the importance of

technology in preparing students to compete in a global labor market. Technology leadership as a shared role was also a consistent theme observed in responses from principals from both technology rich and technology poor schools. Six out of the eight technology rich school principals identified the importance of sharing the technology leadership role with a salaried building technology facilitator. The two remaining technology rich school principals, along with all principals from the technology poor schools, identified sharing the technology leadership roles with building staff members who voluntarily took on this additional role because of their technology related backgrounds and interests.

Principals from technology rich and technology poor schools were similar in their responses regarding their technology practices and behaviors, which were closely aligned and integrated with their daily principal duties. These behaviors included the general practices of email communications, the use of laptops, Blackberry phones, LCD projectors, SMARTboards and computer programs for student data programs. Principals from technology rich and technology poor schools were also similar in identifying technology facilitators, technology resources and technology professional development as the primary supports for teachers.

Technology implementation and development was identified by both technology rich school principals and technology poor school principals as primarily a district driven initiative. Technology rich school principals did however indicate a higher level of involvement, awareness and knowledge of district technology initiatives and district technology plans.

Research Question Two

What specific challenges can these individuals identify in carrying out these practices?

Interview questions were constructed to obtain information from research participants regarding specific challenges they faced when carrying out their practices of implementing and

supporting the use of 21st century technology. The interview questions that were utilized to obtain this data were the following:

1. What are some specific challenges you face when caring out practices that support the implementation of 21st century technology in your building?
2. What are some ways in which you address these challenges?
3. How are you supported district administrators in addressing these challenges?
4. What are some specific challenges faced by teachers and staff in integrating 21st century technology to support instruction?
5. How do you support your teachers and staff in addressing these challenges?

The emergent themes that evolved from the interview responses to the questions related to the challenges faced by the research participants in implementing and supporting the use of 21st century technology in schools were the following: (1) Teacher resistance (2) Lack of resources.

Teacher resistance. In responding to the challenges faced by school principals, many of the research participants commonly identified teacher resistance as being a significant challenge to their implementation, integration and development of technology within their respective school buildings. RP2 stated, "Teachers are entrenched and set in their ways and are not always willing to get comfortable with the technology, for example sending paper memos instead of emails." In reference to this teacher resistance, RP2 further stated that teachers have difficulty in dealing with their own personal biases on the uses of technology and that discomfort usually surfaces in the form of resistance against technology initiatives. RP2 explained that he addresses this challenge through the practices of utilizing data and research to reinforce positive aspects of utilizing technology to improve teaching and instruction and modeling the use of technology. RP2 also

expressed the importance of communication, listening, follow up and encouragement in addressing teacher resistance.

RP1 also stated that staff resistance was a challenge to technology integration. RP1 stated, "Every individual is at a different level of technological comfort, competency and development. Some staff needs more embedded technology professional development and support." In addressing how they support teachers in meeting this challenge, RP1 stated that he actively seeks out individuals in need of help and makes efforts to provide them immediate support.

In response to teacher resistance, RP8 said, "There is resistance from veteran teachers who do not see the need for technology integration." RP8 identified the following factors as contributing to this resistance: lack of familiarity, lack of time, lack of comfort with new technology and lack of understanding by teachers for the practicality and use of the technology. RP8 further explained that he addressed the challenge of teacher resistance by utilizing staff with knowledgeable technology backgrounds to model the benefits of technology integration. RP12 stated, "Resistance to technology comes from the senior staff." RP12 reinforced the notion of utilizing staff to address teacher resistance to technology. RP12 explained that he utilizes a senior staff member who has a technology background to be the point person in supporting the resistant staff members.

RP4 attributed teacher resistance to technology integration to the following factors: teachers not being fully accepting of the benefits, fear of having to learn something new and the fact that technology might not be part of their knowledge base or skill set. RP4 identified the use of direct assistance from the principal and professional development as the resources utilized in addressing these factors. RP5 stated, "The adults get frustrated about using technology." RP5 provided an example of when he advocated for the fifth grade team of teachers to submit grant

proposal requests for net books and the teachers exhibited frustration about the amount of time the process would take to get the resource and time it would take to learn to utilize it. RP5 stated that he incorporates clear communication and technology in-services as practices to address this challenge.

Lack of resources. Another common thread found with participant responses was the identification by principals of a lack of building and district resources to support technology integration and development and the principal practices incorporated to address those challenges. Principals of both technology rich and technology poor schools agreed that there was a lack of technology resources within their school buildings. In identifying the lack of resources, research participant responses uniformly included the resources of time, funding, equipment, staffing and professional development. In reference to the lack of technology equipment, RP6 stated, "It was impossible to give everyone what they wanted and the challenge was finding the balance between the technological wants and needs of staff in order to improve student achievement." RP6 explained that he utilizes approximately 25% of his building budget on small technology expenditures, while the major technology expenditures are funded through district grants, such as the current initiative of the district computer replacement program to support instruction. RP6 also stated that it was important for building leaders to advocate for more resources and finances in their planning and preparation for technology integration.

RP8 and RP9 stated that there were no funds available in their respective building budgets for expenditures. RP8 specifically stated, "There us no money available in the building budget for technology. I formerly received strategic planning funds, but that has been eliminated from the budget." RP9 stated, "There are not enough resources to go around. I don't ask for more technology resources because there is no funding available." RP9 provided an example of the

limited resources by explaining that he had to return a color printer to the technology office because it was needed somewhere else in the district. RP9 also explained that the technology resources in his building became available primarily through grant applications and pilot programs and the district level technology office was not very supportive of supporting his schools' needs by providing them the best technology.

In responding to the challenges of technology integration, RP10 stated that there were not enough resources for the student population and the lack of technology maintenance support made it even more difficult to develop a school culture that consistently utilized technology. In reference to the building budget, RP10 stated no funding was used toward the purchase of equipment. RP10 also stated that he supported the practices of staff collaboration, sharing of resources and in-building professional development for reinforcement.

RP3 stated that he uses a portion of the five thousand dollar building allocation for equipment purchases to integrate technology into the building program. "Technology implementation is not a priority of the school district," RP3 explained. He sited the lack of building resources and limited technology professional development as evidence of his belief. RP3 further stated that he addresses these concerns through his encouraged practices of encouraging staff to pool and share resources and utilizing staff with technology expertise to facilitate the learning and use of technology resources.

RP2 stated, "Professional development and training for staff is not always provided in an adequate time period. Because of that, there is usually a discomfort among staff with using the technology." In response to the challenges faced when integrating technology RP11 characterized the challenges in the following ways: most staff does not share equipment and resources, staff are sometimes intimidated by the technology and therefore shy away from using it, and the amount of

technology equipment is limited. RP11 stated that he advocates for resources from district technology committee grants, utilizes staff developers to train teachers and created a central sign out location for staff to obtain technology equipment.

RP13 stated that the challenges to technology integration in his building were finding the time and availability to make technology a bigger part of the school program, having access to funds to purchase technology resources and maintaining adequate technology support staff. RP13 explained that he had no building funds available and received technology resources in the forms of SMARTboards, laptop carts and a listening center through district grants. RP13 also stated that he had a stipend for an IT staff position that was taken out of the budget for the next school year. In addressing these challenges, RP13 stated that he incorporated staff collaboration and building-wide professional development sessions.

"There is a supervisor for instructional technology and support for schools, but there is no time for that individual to actually be in the building to assist staff and principals," stated RP7. RP7 identified additional challenges to the integration to technology as being the following: staff familiarity with the technology; knowing the appropriateness of use and when to use it, a lack of technology resources and a lack of funding for resources. In explaining the difficulty in getting teachers to understand when to use technology, RP7 sited the textbook computer program that was implemented, but never utilized by staff.

RP7 also stated that he has no building funds to allocate toward technology integration and development and that all technology resources were obtained through district grant applications and pilot programs. "Everything is district generated and the details are not always shared," explained RP7. RP7 identified the practices of the use of teaming of staff and planning for embedded professional development to reinforce the use of technology.

Teacher resistance to the use of technology was consistently identified by principals of technology rich and poor schools as a significant challenge to their efforts of implementing and developing 21st century technology in their school buildings. Technology rich and poor school principals also were uniform in identifying the lack of technology resources as being a challenge to building technology development. Lack of building funds for targeted principal technology resources and initiatives was also consistently mentioned by all principals interviewed as a significant challenge to technology development.

Research Question Three

How do principals interpret the incorporation of technology as an effective support for student achievement?

Interview questions utilized regarding this area of the research study were designed to obtain information from research participants regarding how they perceived the incorporation of technology as being an effective support for student achievement. The interview questions that were incorporated to obtain this data were the following:

1. In what ways do you feel that the implementation of 21st century technology has been an effective support for student achievement?
2. What are some specific examples where you can directly link implemented technology with efforts to improve student achievement?
3. What are some ways in which you support students in utilizing technology?
4. In what ways do you feel that implemented technology has supported teacher instruction?

There were several emergent themes that were identified by the researcher from the collection of interview responses related to school principals' perceptions of the incorporation of

technology as being an effective support for student achievement. The themes that emerged from these interview responses were: (1) Student engagement and participation in lessons (2) Common resources for students and teachers.

Student engagement. A common theme in this area of research was the consistent reinforcement by school principals that use of technology by staff allowed students to be highly engaged in the educational process. RP9 stated, "Our technology resources provide easier access to more information. Students are naturally tech savvy so it opens the doors to the world faster. Technology is a tool that allows them to work together which promotes learning." RP9 additionally stated that technology resources directly supported student learning in the core subject areas in the following ways: by providing access to text and graphics and providing computer math programs for Academic Intervention Services (AIS). RP9 stated, "This technology provides correlation between practice and achievement." RP3 stated that he found that the teachers that are comfortable and utilized technology are better able to address student learning styles and improve student engagement. In reference to direct links of technology to student achievement, RP3 identified the Achieve 3000 KidBiz computer program and laptop computers as the most important resources for support. RP2 and RP10 also identified the use of these resources as effective supports for student achievement.

"Technology has been an excellent support for student achievement. It gives the students the ability to monitor their own learning and monitor their own intervention. Students become participatory in lessons," stated RP1. RP1 also stated that the building technology also varied the delivery of instruction for teachers and supported different learning styles. RP1 stated, "The technology connects global issues directly to the classroom." RP9 identified direct links of the use of technology to student achievement as being the implementation and use of the computer labs for

student enrichment, word processing and research. RP1 also described building technology resources as being supportive of the following: benchmark, formative and interval student assessments; item analysis of student English Language Arts and Math performance data and use of SPSS software program to evaluate student progress and designing of instruction.

RP11 stated, "Students are excited and motivated by the presence and use of technology. It is interactive and students stay engaged and involved. Technology is extrinsic motivation for student learning," he explained. RP11 identified the school computer lab and the integration of SMARTboards as tools that exemplified this phenomenon. RP8 reinforced this notion by stating, "With the use of technology to support instruction, I have seen the students come a long way. Our teachers can demonstrate problems on the SMARTboard, which makes the lesson hands on and interactive," he explained. RP8 identified the integration of SMARTboards, iPods and wireless laptops as serving as resources that connected technology with student achievement outcomes.

RP6 stated, "Our technology resources allow teachers to better grasp how to utilize data and allows them to make better informed decisions on designing curriculum to increase student achievement." It was additionally stated by RP6 that teachers have the responsibility to support students in being ready for the expectation for use of technology. RP6 identified the technology resources of the educational programs DataMate and Educational Vista as being effective supports for the student achievement.

RP13 stated, "The technology reaches learners by allowing teachers to differentiate instruction and allows access to information through data collection and analysis." RP13 identified the use of computer laptop carts, SMARTboards and listening centers as effective supports for student achievement. RP14 stated, "The use of technology has greatly supported

student achievement in that it addresses critical thinking skills and allows teachers to design projects to incorporate technology resources to support student achievement."

Common resources. Research participants were similar in their responses to questions regarding the resources utilized for the integration of technology to support teacher instruction and student achievement. An inventory of school building technology resources was taken in all 14 buildings involved in this research study. All research participants directly assisted in providing the data on resources available for use by students and staff in their respective school buildings. All research participants commonly identified the integration of the following technology resources in their school buildings: classroom computers, office computers, SMARTboards, wireless internet access, televisions and digital cameras. Ten out of the 14 research participants additionally stated that they had computer labs in their buildings.

Table 2 displays the building technology inventory characteristics obtained from research participants. The school building numbers represent the corresponding number of the research participant contributing the resource data. RP5, RP6, RP8, RP9 and RP13 all identified stipend paid or salaried technology staff members as being central figures in supporting the development and integration of building technology resources. RP5, RP8, RP9 and RP13 indicated that they did not have building computer labs as building technology resources. Participants identified stationary classroom computers as the primary technology resource in all school buildings involved in this research study.

Wireless laptops were identified as developed resources in most buildings, with the exception of school buildings one, five, six, seven, eight and twelve. School building four was the only building involved in this research study that did not have at least one SMARTboard available for utilization by staff. School buildings two, four, five, six, eight and fourteen identified the

largest amount of total technology resources available for use by staff. RP9 identified the least amount of total technology resources available among all school buildings inventoried in this study.

Table 2

Building Technology Inventories of Technology Rich versus Technology Poor Schools

	Technology Inventory Item				
	Computer Labs	Total Computers	Laptops	Technology Staff	SMART boards
Technology rich schools:					
5	0	120	0	1	3
6	1	176	0	1	6
8	0	100	30	1	2
9	0	18	30	1	1
11	1	86	15	0	5
12	1	83	0	0	5
13	0	70	60	1	5
14	1	242	25	2	30
Technology poor schools:					
1	1	106	1	0	2
2	2	103	50	0	1
3	1	58	25	0	1
4	2	158	38	0	0
7	1	94	0	0	1
10	1	89	25	0	1

Table 3 displays the specific school building characteristics obtained from research participants. The school building numbers represent the corresponding number of the research participant contributing the resource data.

Table 3

School Building Characteristics of Technology Rich versus Technology Poor Schools

	Characteristic			
	Student Enrollment	Support Staff	Teaching Staff	Model School Program
Technology rich schools:				
5	351	20	20	Yes
6	480	30	50	Yes
8	397	20	17	Yes
9	167	24	45	Yes
11	525	25	35	Yes
12	530	30	42	Yes
13	300	10	20	Yes
14	521	51	47	Yes
Technology poor schools:				
1	501	20	40	No
2	318	22	26	No
3	280	15	30	No
4	428	11	40	No
7	347	15	50	No
10	375	27	36	No

School buildings five, six, eight, nine, eleven, twelve, thirteen and fourteen were identified as the technology rich schools, which received technology resources and technology support as members of the Northeastern Regional Information Centers' Model Schools Program. All other schools involved in this research study were identified as technology poor schools and were not associated with the Model Schools Program. The largest student enrollments and numbers of staff were associated with schools one, four, six, eleven, twelve and fourteen. The lowest student

enrollment and staffing were seen with schools three, nine and thirteen. School building 14 was the only school to have more identified support staff than teaching staff within the school building. School 14 also had the single highest number of total staff when compared to all other school buildings inventoried during this research study.

Research Question Four

What recommendations would these individuals provide to supervisors and higher educational institutions to better support school principal practices in implementing 21st century technology?

Interview questions were constructed to obtain information from research participants regarding recommendations these individuals would provide to supervisors and higher educational institutions to better support school principal practices in implementing 21st century technology. The interview questions that were utilized to obtain this data were the following:

1. In serving in the role of technology leader, do you feel adequately prepared through your educational experiences in serving as a facilitator in the implementation of 21st century technology?
2. Have you been provided professional development opportunities by district level administrators to support you in the role of technology leader in your building?
3. Have you been fully engaged in the development, review and revision of the district technology plan?
    a. How often do you engage in this practice?
4. What recommendations would you provide to higher educational institutions and district administrators to better support you in implementing 21st century technology?

Two themes were predominant in the responses: (1) More professional development and support needed (2) Lack of technology coursework in preparation programs.

Professional development and coursework. Ten of the 14 research participants stated that they did not feel adequately prepared to utilize and integrate technology through district level professional development opportunities and training and through their educational coursework. All participants additionally stated that they needed more district level support in obtaining embedded professional development on principal use and integration of technology to support data collection and analysis of student performance. All research participants also identified that higher educational institutions needed to incorporate more technology preparatory courses and programs on principal use and integration of technology.

RP1 stated that he did not feel proficient or adequate in utilizing and implementing technology in the school program and further explained more support should be offered to administrators by the district. "I am not to the level of proficiency, and training and professional development should be provided as needed for navigating programs for data," explained RP1. RP1 did identify some district level support of technology integration through efforts of providing computer equipment and resources, but stated that administrator training for the use of technology was not consistent. In response to educational preparation for the integration of technology, RP1 stated that higher educational institutions needed to offer more technology related courses to better prepare principals on the effective use of these resources to support student learning.

"There is a lot of technology learning by error on my part," RP6 stated. "We are provided great tools by the district, but not always given the training and education on how to best utilize these tools," RP6 further explained. RP6 stated that the school district needed to more closely examine the support for administrators in utilizing technology for the vertical alignment of instruction and learning as students progress from through their educational experiences from the elementary level to the secondary level then to higher educational level.

RP4 stated that he was not adequately prepared to integrate technology through employer training, stating, I am almost ten years removed as a computer teacher and since technology is constantly changing, I now feel I need more professional development to keep up. Currently there is no relevant professional development for technology offered," he stated. RP4 further stated that district level administrators needed to provide more continuous technology professional development and training. In response to his educational preparation, RP4 stated that higher educational institutions could better support practicing school principals by making technology relevant coursework part of the theoretical and practical preparation and training requirements for school administrators. RP4 also stated that he felt that higher educational institutions should offer refresher technology courses for practicing administrators.

In response to the question regarding whether they felt adequately prepared to integrate technology in their school program, RP11 stated, "I feel inundated by other issues and I do not engage in professional development opportunities. I feel this is mostly my fault because I have not set learning technology as a priority," he stated. RP11 further stated that the school district does offer a variety of technology workshops and training sessions during the course of the school year. In reference to the role of higher educational institutions, RP11 stated that 21st century technology courses should be a part of required coursework for administrative certification and that higher educational institutions should provide continued training for the use of technology by school principals.

RP9 stated he did not feel adequately prepared to facilitate the integration of technology, but that was not a concern because of the IT staff and their role. RP13 also stated that he was too far removed from district-offered technology training and that he relied on the IT staff person to carry out technology development. RP9 additionally stated that school district administrators did

provide some professional development on the use of tablet laptops for instructional observations of teachers, but he did identify the need for district offices to provide more technology training and updated technology resources for principals, students and staff. It was further stated by RP9 that higher educational institutions should provide some refresher courses and required technology coursework to better prepare principals for the role of integrating and developing the effective use of technology in schools.

RP2, RP3 and RP10 stated that school district administrators offered limited technology professional development opportunities for principals in the forms of eSchoolData training, SMARTboard training and the Achieve 3000 KidBiz Computer Program. "No, I have not had any other training for the use of technology," stated RP3. RP2 further explained that his knowledge and use of technology was established through personal and professional experiences that supported his technology learning. RP2 sited the use of smart phones, Skyping, the reading of articles and teleconferencing as examples of his gained technology knowledge.

In making recommendations for central office administrators, RP2 stated that they should provide continuous professional development for principals on the use of technology for data collection and analysis and additionally develop a comprehensive technology plan that supports student achievement. In reference to recommendations for higher educational institutions, RP2, RP3 and RP10 stated that there is a great need for educational administration programs to offer required course work related to technology use. RP2 provided examples of potential courses as being Technology for Principals or Technology and Academics. RP10 stated, "Administration programs need more courses to keep administrators aware of the latest technology and the relevance of that technology to the educational setting."

RP7, RP8, RP12 and RP14 stated that they felt adequately prepared through their educational experiences to effectively serve as facilitators of technology integration in their respective school buildings. RP8 stated that he took optional technology courses in college in educational technology, which allowed him to become familiar with technology as a teacher and further reinforced his technology leadership role as a principal. RP8 also stated that he recognized the need for his school district to provide more support for school principals that have not taken technology courses to support their leadership in integrating technology. RP8 further explained that principals could benefit from additional district-level directed training and professional development to make principals more familiar with technology resources and to make the connection to the importance of integrating and utilizing the technology. It was also stated by RP8 that higher educational institutions incorporate technology coursework as part of standard administrative training.

In response to the question regarding district level technology support for principals, RP12 stated, "All administrators need in-service training and overview of technology, reinforcement of what is available and access to it." RP12 stated that he gained experience utilizing technology through his teaching experiences and personal interest, which allowed him to feel comfortable facilitating the integration and development of technology in his school building.

RP7 also stated that he gained vital technology experience through work experiences that prepared him for the role of technology leader. RP7 reinforced the need for central office administrators to increase technology support for principals by stating, "At the district level, technology needs to be included in the curriculum so students use it for class projects and to increase comfort level." In response to his preparation to serve as a leader in implementing technology, RP14 stated, "I am very capable, but I have not maximized my abilities to the point

where I can report what is out there. I am doing the best of what I have been exposed to," he explained.

School principals of both technology rich and technology poor schools agreed that there was a lack of technology leadership preparation in their administrative preparatory coursework and there was a need for this training for future administrators. Both groups of principals also commonly sited that central office supervisors did not provide targeted and consistent technology professional development within the district to support their abilities to consistently engage in the role of building technology leader.

Summary of Findings

The information presented in chapter four represents the perspectives and experiences of 14 elementary school principals from schools located in the Capital Region of Upstate NY. The elementary principals participating in this study provided information based on their professional preparation and experiences with the use, development and integration of 21st century technology resources in elementary school buildings. The school principals further highlighted their actions in supporting the implementation of 21st century technology, the specific challenges they encounter when carrying out their practices and their perspectives on how the incorporation of technology resources has supported student achievement.

Table 4 compares and contrasts participant responses by emergent themes. Common practices identified by school principals in supporting the implementation and development of technology included the following: sharing the building technology leadership role with a designated staff member; the integration of technology leadership practices within the daily principal role; the utilization of SMARTboards, laptops and classroom computers as the primary technology supports; and the reliance on district level initiatives to support building technology

development. Challenges encountered by principals in integrating 21st century technology resources in schools were identified as teacher resistance and lack of technology resources in school buildings.

Table 4

Summary of Responses by Emergent Themes for Technology Rich versus Technology Poor Schools

	Summary of Participant Responses		
Emergent Theme	Technology Rich Schools	Shared	Technology Poor Schools
Research Question One			
1. Technology views		Beneficial to instruction	
2. Technology leader role		Delegated and shared	
3. Practices		Integrated with daily duties	
4. Professional development (PD)	Continuous		Aligned with initiatives
5. Technology plans		District centered and controlled	
Research Question Two			
1. Teacher resistance		Challenge to technology integration	
2. Resources		Lack of resources	
Research Question Three			
1. Student engagement		Beneficial to instruction	
2. Resources	Paid Tech Staff, Computers, laptops, & SMARTboards		
Research Question Four			
1. District PD and support		More needed	
2. Higher education support		More courses and training needed	

School principals commonly identified incorporated technology resources and additionally highlighted the importance of these resources in increasing student engagement in lessons in further supporting teacher instruction and student achievement. The technology resources identified by the research participants were computer labs, classroom computers, laptops, technology staff and SMARTboards. In this research study, it was found that the schools that were identified as technology rich schools had both the highest and lowest computer to student ratios, which directly challenges earlier research by Smith (1996), who defined technology rich schools as those organizations that had a minimum of 1 to 14, computer to student ratio and contained a local modem.

The elementary principals participating in this study also provided recommendations for central office administrators and higher educational institutions in better supporting school principals in their educational preparation for the implementation of technology and the continued support for principal practices in implementing and developing the effective use of technology in schools. Principals recommended that central office supervisors provide support for principals in the form of sustained technology professional development opportunities for principals in the area of the use of technology to support data collection and analysis of student performance.

Principal recommendations for higher educational institutions in supporting principal practices of the implementing developing of technology in schools focused on colleges providing technology preparatory courses as part of administrative training and additionally providing technology refresher courses for practicing principals.

Chapter 5: Summary of Findings and Conclusions

This research study allowed the researcher to gather information to support an increased understanding of the behaviors and practices of school principals relating to the implementation and development of 21st century technology resources in schools in the Capital Region area of New York State. The information obtained from these research participants was generated from the following four research questions that guided this study:

1. In what ways do elementary school principals identify their actions as supporting effective implementation of 21st century technology?
2. What specific challenges can these individuals identify in carrying out these practices?
3. How do principals interpret the incorporation of technology as an effective support for student achievement?
4. What recommendations would these individuals provide to supervisors and higher educational institutions to better support school principal practices in implementing 21st century technology?

Research Question One

In what ways do elementary school principals identify their actions as supporting effective implementation of 21st century technology?

Interview questions related to research question one were designed to obtain information from school principals regarding their specific behaviors and practices in implementing and supporting the use of 21st century technology in their schools. Several emergent themes became apparent from the analysis of interview responses to these questions. These themes were identified as: (1) Connected views of 21st Century Technology (2) Technology leadership as a shared role

(3) Integrated practices and behaviors (4) Professional development, support staff and resources as primary supports for teachers (5) Technology implementation as a district-level driven initiative.

Connected views of 21st century technology. All of the principals participating in this research study identified 21st century technology resources as playing an integral role in supporting teacher instruction. There was a common understanding expressed by elementary school principals that use of technology in schools was important to curriculum development and instructional practices of staff. Principals offered common threads of examples when making this connection. The examples provided by principals included the use of SMARTboards, wireless laptops and computers for instruction enrichment in the subject areas of English Language Arts and math. The use of MP3 players for listening centers, and the use of the internet and iPods for reading articles was also mentioned.

Principals also made frequent references to the importance of preparing students for working in local and global markets when providing operable definitions of 21st century technology. All principals interviewed frequently mentioned the words global, world and worldwide when making the connection of the importance of implementing and developing technology resources to short-term and long-term goals of student instruction and learning. This common expression by the principals of becoming less traditional and more progressive and transformational in instructional practices through the use of technology was thematic in principal responses. All principals interviewed made direct mention to the importance of using and developing technology in schools to better prepare students to operate and function in a technology driven society. This finding is supported by Greenhill (2010), who confirmed the importance of changing educational practices in the U.S. to address the dual achievement gap, a shifting economy and a changing labor market.

Technology leadership as a shared role. All of the respondents spoke directly to the point of sole leadership. Six of the fourteen principals interviewed made direct mention to technology staff who received stipends for taking on this additional formal role of building technology leader. These principals referred to these individuals as either technology assistants or instructional technology staff. These six principals also noted that their school districts were members of the Northeastern Regional Information Centers' Model Schools Program.

The principals of the remaining eight schools that were involved in this research study identified individual staff members who informally took on the role of technology leaders within their respective school buildings, receiving no financial compensation. These school principals commonly identified these staff members as computer teachers, media specialists and knowledgeable technology staff. Two of these eight schools were identified as members of the Northeastern Regional Information Centers' Model Schools Program.

All of the elementary principals interviewed viewed staff serving in these technology roles as being vitally important to the success of the implementation and development of 21st century technology resources in school buildings. It was a frequent theme among all school principals that the demands of the many different aspects of the being a school principal made it too difficult for building leaders to serve as the primary technology leader in developing technology initiatives in schools. Most of the principals interviewed felt that designated staff members best filled this primary technology role. This occurrence is supported by Stegall (1998) in research that suggested that principals use building technology experts to better support the integration and use of in schools.

Integrated practices and behaviors. The majority of school principals interviewed identified their practices as facilitators of technology implementation and development as being an

integrated component of their daily practices and behaviors as building leaders in their respective school buildings. All principals interviewed stated that they engaged in the following basic technology practices; utilizing email communications; sending and receiving email messages via phone; utilizing their computers for review of attendance data, discipline data and student information; using the internet, web and laptops for research and staff presentations. This finding supports earlier research by Pasquerilla (2008) who found that principals' perceptions of technology leadership are closely aligned with the performance of daily management duties. Most school principals additionally stated that they occasionally utilized LCD projectors and the SMARTboard for staff meetings and presentations.

A major issue expressed by school principals was the inability to find time to make technology integration and development a priority. Most principals identified their personal use of technology as integrated in their daily leadership activities. Most principals stated that they provided support to staff through the purchase of technology resources and the planning and scheduling of technology professional development opportunities.

The eight principals involved in this study, whose school districts were members of the Northeastern Regional Information Centers' Model Schools Program stated that they received continuous support from technology professional development staff from the Model Schools Program. They stated that this support was in the form of technology resources for staff, technology training, and support for the use of technology equipment. The six principals involved in this study, whose school districts were not members of the Model Schools Program, stated that technology training and professional development were primarily district driven initiatives and were not consistently provided.

Primary technology supports. All of the research participants involved in this research study commonly identified their primary technology resources as being designated technology staff members who served in the pivotal role of directly assisting school principals in facilitating the development and use of technology resources within school buildings. RP5 and RP6 stated that the technology assistants were full-time staff members who received stipends for taking on the additional responsibilities of providing direct technology assistance to staff, providing monthly in-services, technology training and professional development to staff and implementing and integration technology resources into the building program. RP5 and RP6 stated that they each had two technology assistants in their buildings.

RP8, RP9 and RP13 identified the individuals in their buildings who are responsible for the integration and development of resources as Instructional Technology (IT) Staff. Similar to the technology assistants described by RP5 and RP6, the Instructional Technology staff was described by RP8, RP9 and RP13 as being building staff members who receive a stipend to provide instructional technology support to building staff. RP8 stated, "The IT staff identifies and brings in technology resources and is trained by the district. Every month the IT tries to incorporate a different element of technology into the building program." RP8, RP9 and RP13 also stated that they each had one instructional technology staff person in their respective buildings.

RP14 stated that his building, as the sole elementary building in his district, had a full-time staff member under the title of technology specialist who served the role of supporting building technology development. The remaining eight research participants identified individual staff members who were either informally designated or assumed the role of technology leader in their school buildings with no compensation.

District driven technology initiative. All of the research participants involved in this study stated that the primary source of funding, training and implementation of technology was through the actions of the district central office administration and clearly outlined district technology plans. Most of the principals interviewed expressed concerns with financial constraints on building budgets that prevented them from taking direct initiatives as building leaders in the purchase of technology resources and taking the lead on the planning for technology professional development and training. Most principals directly cited the district level technology committee as being the driving force that was responsible for building technology implementation and development.

Principals identified district technology plans as the determining factor of how technology resources were implemented in school buildings and how professional development workshops and training was scheduled for staff during the course of the school year. Technology purchases also appeared to be driven by the district technology plans. As stated by RP8, "There is no building budget for the purchase of technology resources, the district technology plan outlines the purchase and implementation of iPods and wireless laptops through grant funding. This initiative is aimed at utilizing testing data to improve student achievement." RP5 and RP6 also stated that approximately twenty five percent of the building budget was designated for the building technology purchases, but the majority of resources were allocated through the District Technology Plan. RP5 and RP6 further explained that the district instructional technology plan outlined replacing computers throughout the school district to better support teacher instruction.

Research Question Two

What specific challenges can these individuals identify in carrying out these practices?

In responding to research question two, school principals outlined the challenges they faced when carrying out the practices of implementing and supporting the use of 21st century technology. The emergent themes that evolved from interview responses to the questions related to these challenges were the following: (1) Teacher resistance (2) Lack of resources.

Teacher resistance. All of the research participants participating in this research study commonly identified teacher resistance as one of the biggest challenges to the ability of principals to effectively implement and develop the use of technology resources to support teacher instruction and student learning. Principals interviewed cited the sources of this teacher resistance as being personal biases against the use of technology, discomfort of teachers with their own knowledge of technology, and the fear of staff having to change current practices.

RP2 stated "Teachers are set in their ways and were not always willing to get comfortable with the technology, for example sending paper memos instead of emails." RP1 stated, "Every individual is at a different level of technological comfort, competency and development. Some staff needs more embedded technology professional development and support." RP4 attributed teacher resistance to technology integration to the following factors: teachers not being fully accepting of the benefits, fear of having to learn something new and the fact that technology might not be part of their knowledge base or skill set. In addressing these different sources of teacher resistance, all principals interviewed commonly stated that they utilized the following strategies: utilizing data and research to reinforce positive aspects of utilizing technology to improve teaching and instruction; modeling the use of technology; providing direct assistance to staff; utilizing knowledgeable technology staff to provide assistance to teachers; providing technology professional development and in-service workshops.

Lack of resources. Research participants involved in this research study uniformly identified a lack of technology resources as a significant issue impeding principal facilitation of the integration and development of technology in school buildings. Most of the principals interviewed identified a shortage of resources available to them in the following areas: funding, equipment and professional development. In reference to their respective building budgets, all school principals stated that their building budgets only allowed for small purchases of technology resources, with major technology purchases being provided through district level funds, grants and pilot initiatives associated with district technology plans. MacNeil and Delafield (1998) also identified the lack of funding to purchase technology resources and the lack of time for the appropriate technology training as the biggest challenges facing school principals implementing technology.

Most principals stated that they use only small portions of their building budgets on the purchases of technology related resources and services. RP6 explained that he utilizes approximately 25% of his building budget on small technology expenditures, while the major technology expenditures are funded through district grants, such as the current initiative of the district computer replacement program to support instruction.

Most research participants also identified a lack of technology equipment as a common occurrence in their respective school buildings. All principals acknowledged that even though school district initiatives supported the implementation of technology resources such as SMARTboards, wireless laptops, and computers, that these resources were not enough to fully support building programs. RP9 stated "There are not enough resources to go around. I don't ask for more technology resources because there is no funding available, she explained. I had to return a color printer to the technology office because it was needed somewhere else in the district." Most principals identified the practices of the pooling and sharing of building technology resources

among staff to address this issue. This practice is supported by Hew & Brush (2006) who identified the sharing of technology resources as an effective strategy for principals in overcoming a lack of technology resources.

Many of the principals involved in this research study also mentioned a lack of technology professional development and training support for the implementation, development and use of building technology resources. RP2 stated "Professional development and training for staff is not always provided in an adequate time period. Because of this occurrence, there is usually a discomfort among staff with using the technology." Most principals stated that they utilized embedded professional development opportunities and in-building technology training to educate staff on the use of technology resources. These findings to research question two are consistent with Pasquerilla (2008) who identified barriers to integrating technology as being teacher resistance, lack of infrastructure and lack of funding.

Research Question Three

How do principals interpret the incorporation of technology as an effective support for student achievement?

Interview questions related to research question three were designed to obtain information from school principals regarding their perceptions of how they incorporated building technology as an effective support for student achievement. Emergent themes from participant responses to these questions were: (1) Student engagement and participation in lessons (2) Common resources for students and teachers.

Student engagement. All principals interviewed in this research study consistently reinforced the notion that the use of technology resources by building staff supported an increase in student engagement and participation in the learning process. All principals consistently

identified the use of computer based English and math programs, student performance data programs, computers, laptop computers, SMARTboards, and iPods. RP11 stated, "Students are excited and motivated by the presence and use of technology. It is interactive and students stay engaged and involved. Technology is extrinsic motivation for student learning." RP1 stated, "Technology has been an excellent support for student achievement. It gives the students the ability to monitor their own learning and monitor their own intervention and students become participatory in lessons."

In addition to stating that technology resources allowed for students to become more engaged, motivated, and interactive in engaging in their own learning, most principals additionally identified technology resources as being a great benefit to teachers in the preparation, evaluation and design of instruction. Principals described building technology resources as being supportive of the following: benchmark, formative and interval student assessments; item analysis of student English Language Arts and Math performance data and use of SPSS software program to evaluate student progress and designing of instruction. RP6 stated, "Our technology resources allows teachers to better grasp how to utilize data and allows them to make informed decisions on designing curriculum to increase student achievement." RP13 stated, "The technology reaches learners by allowing teachers to differentiate instruction and allows access to information through data collection and analysis."

Common resources. In providing inventory of school building technology resources, all fourteen school principals commonly identified the integration of the following technology resources in their school buildings: classroom computers, office computers, SMARTboards, wireless internet access, televisions and digital cameras. Ten out of the fourteen research participants additionally stated that they had computer labs in their buildings. Participants

identified stationary classroom computers as the primary technology resource in all school buildings involved in this research study. School principals of school buildings five, six, eight, nine, eleven, twelve, thirteen and fourteen were identified as schools that received technology resources and technology support as members of the Northeastern Regional Information Centers' Model Schools Program. All of the model school program principals, with the exception of principals eleven and twelve, stated that they had the additional primary technology resource of a paid technology staff member who facilitated the integration, development and use of technology.

Research Question Four

What recommendations would these individuals provide to supervisors and higher educational institutions to better support school principal practices in implementing 21st century technology?

Interview questions related to research question four were constructed to obtain information from school principals regarding recommendations they would provide to supervisors and higher educational institutions to better support school principals in utilizing, integrating and developing 21st century technology initiatives in schools. The themes that evolved from principal responses to these interview questions were: (1) More professional development and support needed (2) Lack of technology coursework in preparation programs.

Professional support. The majority of research participants participating in this study stated that they did not feel adequately supported by district level administrators in being provided adequate and continuous technology professional development and training. This specific group of school principals stated that they needed more district level support in obtaining embedded professional development on principal use and integration of technology to support data collection and analysis of student performance. Most principals stated that technology professional development for school principals were isolated to specific district technology initiatives,

inconsistent in occurrence, not embedded into building practices and not aligned to specific school building goals. Brockmeier, Sermon, and Hope (2005) also found that principals outlined challenges to implementing technology as being associated with a lack of professional development and practice in the educational setting.

RP1 stated, "There should be more offered to administrators for learning and support by the district. I am not to the level of proficiency and training and professional development should be provided as needed for navigating programs for data. Most learning of technology implementation and use is independent." "There is a lot of technology learning by trial and error. We are provided great tools by the district, but not always given the training and education on how to best utilize these tools", stated RP6. Most school principals commonly stated that their learning, knowledge and use of technology resources was best supported through their personal and professional experiences, such as reading of literature, previous work experiences and interactions with colleagues.

In providing recommendations to district level administrators and supervisors, many of the school principals suggested that school principals be directly involved in consultation of designing of in-service technology training of building administrators and staff. RP14 stated "I am very capable, but I have not maximized my abilities to the point where I could report what was out there. I am doing the best of what I have been exposed to."

Coursework. All principals involved in this research study also stated that higher educational institutions needed to incorporate more technology preparatory courses and programs on principal use and integration of technology. Only one principal, RP4, in this research study stated that they were adequately prepared to implement technology through their higher educational preparation and schooling. RP4 stated "I am almost ten years removed as a computer

teacher and since technology is constantly changing, I now feel the need for more professional development to keep up." All principals stated that higher educational institutions should take a more active role in preparing school principals to utilize, implement and develop technology in schools. MacNeil and Delafield (1998) also found that principals' technology leadership is challenged by factors such as lack of technology training.

Principals made the following recommendations to higher educational institutions: higher educational institutions needed to offer more technology related courses to better prepare principals on the effective use of these resources to support student learning; higher educational institutions should offer refresher technology courses for practicing administrators; that 21st century technology courses should be a part of required coursework for administrative certification. RP10 stated, "Administration programs need more courses to keep administrators aware of the latest technology and the relevance of that technology to the educational setting."

Conclusions

The purpose of this research study was to gain an increased understanding of elementary school principals' behaviors and practices integrating and developing technology in school buildings in the Capital Region area of New York State. In analyzing and comparing school districts that participated in the Region Information Centers' Model Schools Program versus those school districts not participating in the program, additional information was obtained regarding principal practices, technology resources and technology professional development and training.

There is an increased focus by the Barack Obama Administration and Federal Government to ensure that public schools across the country implement and develop the appropriate resources in schools to support all students being fully prepared to compete in a global economy. The focus of student development in the areas of Science, Technology, Engineering and Math (STEM) has

been identified by the Federal Government as one of the six evaluation criteria utilized in the application process to determine which state education departments qualify to receive increased federal support in the form of Race to the Top Funding.

Through interviewing the fourteen elementary school principals from the capital district region of New York State, several conclusions evolved through the course of this research study:

Conclusion one. Principal behaviors and practices of using, implementing and developing technology in school buildings need to extend beyond the general practices associated with daily principal duties. Principals are comfortable with utilizing the technology resources of computers and blackberry phones for email communications, but are not well engaged in the practices of consistently utilizing technology resources to share and utilize student performance data and teacher instructional data to address student achievement outcomes. In this research study, principals' use of technology as a support for teacher instruction could not be evaluated based on the data obtained. Increased principal input on district technology initiatives and consistent attendance and participation of principals on district level technology committee meetings would very much support principals' in being able to develop building technology initiatives to meet building specific needs.

Conclusion two. The role of technology leader of the school building needs to be more of a priority for school principals. The data obtained in my study revealed that principals delegate this leadership role to others. All of the principals interviewed in this study identified a staff member who either formally or informally took on the shared role of technology leader. The designation of a specific building staff member to assist in the technology leadership role is important to the development of building technology programs, but principals routinely rely on these individuals to serve as the primary leaders in providing input to district level administrators,

obtaining resources, scheduling technology professional development and working closely with staff on utilizing technology resources in building programs. Principals should recognize the importance of serving more in these roles to support the development of technology programs in their buildings.

Conclusion three. School district leaders need to provide more autonomy to principals in utilizing building funds for technology resource expenditures. School building technology development is critically dependent on the funding and resources made available through district level resources and is primarily outlined in district technology plans. The primary source for the purchase, implementation and development of building technology resources is district-funded grants with specific areas of technology identified for support. Purchased building technology resources are also specifically identified in long term district-wide technology plans. These above-mentioned occurrences make it challenging for school principals to be creative in their technology leadership in being able to incorporate the specific technology resources needed to best meet the specific needs of their building stakeholders.

Conclusion four. School district leaders need to provide additional support to school principals by participating in out-of-district technology development programs that provide continuous resources to principals to support their technology leadership practices of developing schools that are highly functional in utilizing technology resources to support student achievement. School districts that participate in these programs are continually supported in training staff to utilize technology to support teacher instruction and student learning. These also programs often offer on-site coordinators to further support principals in outlining and supporting building technology goals.

Conclusion five. Teacher resistance to change, as it relates to the use of technology, is a factor that principals need to plan for and address through well developed strategies. Principals should utilize the resources of knowledgeable teacher mentors, in-service training, and direct support for teachers who demonstrate a reluctance to incorporate technology resources into their instruction. In addition, principal modeling of technology use should be a part of common practice for principals in exemplifying technology leadership.

Conclusion six. School building technology resources can be effective supports for increasing student engagement and participation in the learning process. School principals should maximize the utilization of technology resources to further motivate students to take ownership of their own learning. The expanding use of laptop computers, computer programs, IPods and cell phones may contribute to student engagement.

Conclusion seven. School principals are not consistently or continuously supported by district level administrators with sufficient technology resources or technology training. Most technology initiatives are specifically outlined by district technology plans, which school principals have little or no direct involvement in formulating. Without this direct input, designated technology training and resources that evolve from decisions made by district level technology committees don't always align with principals' visions or expertise in building technology development. In addition, the technology resources provided to school buildings are limited by the district funds allocated to school principals.

Conclusion eight. There is a great need for higher educational institutions to provide technology leadership and development coursework for school principals as part of the certification process to better support principals in their role of building technology leader. Support for principal use and development of technology in schools in higher educational

institutions is not currently a part of mandated coursework for administrative certification and technology refresher courses are not widely promoted within school districts. Principals have to actively seek out technology training on their own to become highly skilled in the areas of technology use, integration and development.

Conclusion nine. The amount of school building technology resources available is not a clear indicator of schools moving toward building highly developed technology programs, but rather the effective and efficient use of the total resources available. The analysis of the amount of school building technology resources available in technology rich and technology poor schools in this research study indicated that both groups of schools were similar in the total amounts of resources available. The consistent use and utilization of these building technology resources was a factor that differentiated technology rich schools from technology poor schools in this study.

Conclusion ten. In this research study it was found that the school s that were identified as technology rich schools had both the highest and lowest computer to student ratios, which directly challenges earlier research by Smith (1996). Principals of technology rich schools in my research study identified the consistent use of computers, SMARTboards and wireless laptops in building programs. Technology rich school principals also identified continuous technology professional development as resource available through district membership in an out-of-district technology support program. Six out of the eight technology rich school principals also identified the presence of a paid technology staff person as the primary technology facilitator for building technology development. These findings support the real definition of technology rich schools as being those schools that have a paid technology facilitator, continuous technology professional development, consistently use their building technology resources and have technology support through district membership to an out-of-district technology support program.

Recommendations for Future Research

In completing this research study, the following recommendations are suggested for future research:

1. Research participants mentioned in this study that there was a lack of technology resources available to staff. An area of future research could examine the question: Is there a correlation between the availability of building technology resources and student performance data?
2. All research participants mentioned the benefit of technology resources in supporting increased student engagement in lessons. A future research study could explore the following question: What is the influence of increased student engagement through the use of technology on student achievement?
3. This research study primarily focused on the principals' leadership role in integrating and development of technology in schools. To better understand principals' leadership roles, an area of future research could examine the question: What are the teachers' perceptions of principal technology leadership in developing highly functional building technology programs?
4. This research study compared and contrasted school districts participating versus not participating in the Regional Information Centers' Model Schools Program. A future research study could further explore this area by examining the question: In what ways does school district participation in technology programs support increases in student achievement?
5. Most research participants in this study suggested they had limited direct involvement in district level technology related decisions. A future study could more closely

explore the following question: In what ways would principal technology leadership benefit from local autonomy and direct control of technology related decisions as they relate to building budget, professional development and technology expenditures?

Concluding Statement

The evolution of technology has led to the potential for the evolution of the use of technology in schools. We are currently in a time period when the United States public educational system is being intensely evaluated by the federal government for failures in meeting expected levels of academic achievement for all students. State Education Departments are being provided federal funding, in the form of Race to the Top Funding, if they demonstrate the ability to establish criteria for high academic standards for local school districts to address concerns with student achievement. State Education Departments' outline for planning for support of student development in the areas of Science, Technology, Engineering and Math (STEM) is one of six priority areas evaluated by the Federal Government for consideration of receiving these funds. With New York State being a recent recipient of this federal awarding of funds, there is an even greater importance for school principals to fully utilize practices and processes to support the development and use of 21st century technology skills in elementary and secondary schools in school districts across the state.

In conducting this research study, the strategy of phenomenological inquiry was selected as the research design that would best support school principals in sharing their professional experiences in utilizing and developing 21st century technology programs in their school buildings and further assist the researcher in analyzing relationships and patterns in data.

Information collected from research participants indicates the following: Principal behaviors and practices of using, implementing and developing technology in school buildings

need to extend beyond the general practices associated with daily principal duties; Being the technology leader of the school building should be more of a priority for school principals; School district leaders should provide more autonomy to principals in utilizing building funds for technology resource expenditures; Teacher resistance to change, as it relates to the use of technology, is a factor that principals should plan for and address through well developed strategies; School building technology resources can be effective supports for increasing student engagement and participation in the learning process; School principals are not consistently or continuously supported by district level administrators with sufficient technology resources or technology training; There is a great need for higher educational institutions to provide technology leadership and development coursework for school principals as part of the certification process to better support principals in their role of building technology leader.

Recommendations for future research indicate that additional investigation of the following areas relating to principal utilization and development of technology should be explored: the relationship between the availability of building technology resources and student performance data; the influence of increased student engagement through the use of technology on student achievement; teachers' perceptions of principal technology leadership in developing highly functional building technology programs; school district participation in technology programs and increases in student achievement; principal autonomy and direct control of technology related decisions as they relate to building budget and technology expenditures.

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Appendix A
Cover Letter

February 1, 2010

Dear Colleague:

My name is Tracy L. Ford and I am a doctoral candidate in the educational leadership program at Sage Graduate School in Albany, New York. I am conducting research on the topic of K-12 principals' use of technology in school districts in New York State.

The purpose of this study is to gain insight on the leadership practices of K- 12 school principals regarding the implementation and use of 21st century technology in school districts across New York State. I will be analyzing the differences in principals' practices and experiences in implementing technology and the impact of available district resources on those practices. A qualitative analysis will be conducted focusing on the principal behaviors, available technological resources and the district's technology plan. Methods of inquiry will include interviews of elementary and secondary building principals in the selected and consenting districts and observations of the school building technology resources. The data collected will be used to support school principals in effectively implementing 21st century technology and establishing necessary supports to allow this goal to be sustained.

As a result of your experiences with implementing technology in your district, I would like to invite you to participate in this research study. At your convenience, I would like to schedule a personal interview, which will last approximately 45 minutes. This study is confidential and real names will not be used in recording or reporting the data. Confidentiality will be maintained, with only the researcher having access to the information via password protected computer through the duration of the study. All materials and information will be destroyed at the conclusion of the work in October 2010. Sharing your knowledge of school leadership as it pertains to information technology will be a very valuable contribution to the field of educational leadership that could serve as a model for future efforts in improving leadership capacity in implementing and sustaining the use of technology.

Please review the attached document regarding informed consent. If you have any questions regarding the nature or range of this study as well as your participation, please feel free to contact me at 518-428-6240 cell, 518-328-5210 work or fordt@troy.k12.ny.us

I look forward to meeting with you and gaining insight on your technology program. Thank you in advance for your consideration.

Sincerely,

Tracy L. Ford

Appendix B
Informed Consent Form

To: _____

You are being asked to participate in a research project entitled**:** *Principals' Use of Technology in Technology Rich and Technology Poor Schools in New York State : A Qualitative Study of Administrative Practices.*

This research is being conducted by **: Tracy L. Ford***, Doctoral Candidate in the Educational Leadership Program at Sage Graduate School, Albany, New York.*

The purpose of this study will be to explore the leadership practices of K-12 school principals associated with the implementation and use of 21st century technology. A qualitative analysis will be conducted focusing on the availability and use of these resources from the leadership perspective. Bridges' three phases of transitions will be utilized to evaluate the degree of success obtained by school leaders toward the change effort of incorporating and sustaining the use of technology. Methods of inquiry will include interviews of school principals in the selected districts. A document review of the district technology plan will be conducted and visual observations of building technology resources will be recorded. The data collected will be helpful in determining the availability of resources in contrasting schools, the perspectives and practices of principals that support successful implementation of technology, the degree to which these practices support student achievement, and resources utilized to support the professional growth of principals.

This study will be conducted confidentially. Participants will be interviewed and audio taped for accuracy of transcription. Participants may elect not to answer any questions and may terminate the interview at any time. The names of the participants as well as the districts selected for study will be maintained confidentially. Pseudonyms will be developed for both the participants as well as the districts and used when reporting the results. The participants as well as the selected districts will be known only to the student researcher. All interviews will be transcribed and maintained on a password protected computer. Once the transcribed interviews will be verified for accuracy by the participants, the audio tapes will be maintained until the research has been concluded and then destroyed. Upon conclusion of the study, results will be disseminated to each participating school district.

The potential risks involved in this study may be inherent in any controversy associated with the topic of investigation. Any controversial information that involves the participants could pose a potential risk if made public. However, in order to minimize these potential risks, the confidentiality of all participants will be maintained with the utmost care.

The interview protocol for this research study will be in person. If for some reason the participant is uncomfortable with this format, the researcher is open to conducting telephone interviews as well as having the participant answer the interview questions in written format either by mail or email.

In the event that I am harmed by participation in this study, I understand that compensation and/or medical treatment is not available from The Sage Colleges. However, compensation and/or medical costs might be recovered by legal action.

I understand that I may at any time during the course of this study revoke my consent and withdraw from the study without any penalty.

I have been given an opportunity to read and keep a copy of this Agreement and to ask questions concerning the study. Any such questions have been answered to my full and complete satisfaction.

I, _____, having full capacity to consent, do hereby volunteer to participate in this research study.

Signed: _____ (Research Participant)

This research has received the approval of The Sage Colleges Institutional Review Board, which functions to insure the protection of the rights of human subjects. If you, as a participant, have any complaints about this study, please contact:

Dr. Samuel Hill
Chair of the Institutional Review Board
Sage Colleges IRB
Sage Graduate School
45 Ferry Street
Troy, New York 12180
(518) 383-3258
hills@sage.edu

Appendix C
Building Principal Interview Protocol

A Qualitative Study of Principals' Use of Technology in K-12 Schools

Date: _____
Time: _____
Location: _____
Interviewer: _____
Interviewee: _____
Questions:

Part I: Principal Leadership Practices

1. How would you define technology leadership and 21st century technology?

2. How would you describe your role as the technology leader of your school?

3. What are the important attributes and behaviors needed to be an effective building leader in implementing 21st century technology?

4. What are some specific ways in which you support the implementation of 21st century technology in your building?

5. How much time per week do you allocate toward supporting staff in implementing 21st century technology?

6. How are teachers and support staff supported in integrating and utilizing 21st century technology to support instruction?

7. Does your school have a standing committee that oversees the implementation of technology?

8. How much of your building budget is allocated to the purchasing and implementation of technology?

9. Does your school have a school improvement plan or technology plan that details the implementation of technology?

    a. What does is the main focus of the plan?

    b. How is the plan communicated and reinforced with school stakeholders?

    c. How often is the plan reviewed and revised?

Part II: Challenges to Leadership

10. What are some specific challenges you face when caring out practices that support the implementation of 21st century technology in your building?

11. What are some ways in which you address these challenges?

12. How are you supported district administrators in addressing these challenges?

13. What are some specific challenges faced by teachers and staff in integrating 21st century technology to support instruction?

14. How do you support your teachers and staff in addressing these challenges?

Part III: Supports for Student Achievement

15. In what ways do you feel that the implementation of 21st century technology has been an effective support for student achievement?

16. What are some specific examples where you can directly link implemented technology with efforts to improve student achievement?

17. What are some ways in which you support students in utilizing technology?

18. In what ways do you feel implemented technology has supported teacher instruction?

Part IV: Preparation and Professional Development

19. In serving in the role of technology leader, do you feel adequately prepared through your educational experiences in serving as a facilitator in the implementation of 21st century technology?

20. Have you been provided professional development opportunities by district level administrators to support you in the role of technology leader in your building?

21. Have you been fully engaged in the development, review and revision of the district technology plan?
    a. How often do you engage in this practice?

22. What recommendations would you provide to higher educational institutions and district administrators to better support you in implementing 21st century technology?

Appendix D
Technology Inventory Checklist

Building Observation Data

Location: _____

1. **Number of Classroom Computers _____**
2. **Number of Office Computers _____**
3. **Number of Wireless Laptops/Carts _____**
4. **Number of Computer Labs _____**
5. **Number of Printers _____**
6. **Number of Smart Boards _____**
7. **Number of LCD Projectors _____**
8. **Number of LCD Message Boards _____**
9. **Number of Televisions _____**
10. **Palm Pilots _____**
11. **Distance Learning Room _____**
12. **Video Conferencing Equipment _____**
13. **Web Cams _____**
14. **Digital Cameras _____**
15. **Software Program for Attendance/Grades/Discipline/Scheduling _____**
16. **Internet Access _____**
17. **Wireless Capability _____**
18. **Number of Security Cameras _____**
19. **Alarm System/Alarm _____**
20. **Building Access System _____**