Integrating Technology in the Classroom: Teacher Perspectives

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Abstract

The purpose of this study was, given the elimination of a Type I barrier, to investigate how teachers utilized the International Society for Technology in Education (ISTE) National Educational Technology Standards (NETS) and what barriers teachers perceive to be present that may inhibit technology are barriers technology integration in the classroom. This qualitative study was designed based on the naturalistic inquiry approach (Lincoln & Guba, 1985). Through purposeful sampling, this study took place in a suburban school division within the U.S. that has eliminated a Type I barrier, technology access to secondary teachers and students. The site was chosen due to the abundance of technology available to teachers and secondary students within the school division. Ten secondary teachers that participated were in various stages of their profession and years of service within the school division and represented various secondary schools within the division. The findings suggest that teachers fail to fully implement all of the ISTE NETS when it comes to integration in the classroom. Insufficient time to plan and prepare for activities that would integrate technology into the classroom was among the external factors most of the participants listed as to why their instruction did not always utilize technology. Although the division has eliminated a major barrier through its one-to-one laptop initiative, the findings indicated further external, Type I barriers existed. Results of this study suggest the key elements to the barriers that inhibit integration continue to be Type II barriers, teacher beliefs towards technology and teacher-centered pedagogy.

Dedication

The completion of this dissertation is not only a joyous occasion for me but I hope a lesson for my children as well. As a first-generation college graduate, I was always told not to allow anyone to tell me I could not accomplish something. While I conclude this terminal degree, I know that I could not have done so without the love, support and encouragement of my family. To my wife, Shandie, completion of this program and dissertation would not have come to fruition without your sacrifices, patience and understanding. I know you spent many hours feeling like a single parent helping with homework, shuttling back and forth to soccer practices alone. It was your love and encouragement that has helped make this accomplishment possible. For this, I am eternally grateful. To my children, the demands of this degree required me to focus my attention and time away from you at times, but your understanding was unwavering. It is my sincerest hope that you, too, will never allow anyone to tell you cannot accomplish something. If there is nothing else you have learned from my going to class, studying and writing this dissertation, please know that you should always challenge yourself, be persistent, and never stop questioning everything around you.

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I would be remiss to leave out my colleague and friend, Dr. Jodie Brinkmann, who was with me step for step throughout our classes and writing. Her sense of humor coupled with our dual competitiveness allowed me to push through times I may have procrastinated. For this, I am ever grateful.

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Chapter I

Background of the Study

Throughout the past decade, school divisions across the nation have been injecting funds, time, and professional development into technology integration in the classroom. In 2003, individual school divisions in the U.S. spent between $218,000 and $233 million on hardware and software (Fickes, 2004), and by 2005, nearly 100% of all U.S. public schools had Internet access (NCES, 2003). The Federal Government alone invested over eight billion dollars in educational technology between 1995-2000 (US DOE, 2000).

> On November 9, 2010, U.S. Department of Education Secretary Arne Duncan stated: Broadband today has become as important as telephone and electricity…The USDA, the Commerce Department, and the Federal Communications Commission used Recovery Act funds -- $7.2 billion – to expand broadband service to areas covering thousands of schools…By fully integrating technology into everything teachers do, we will make progress toward providing the digital learning experiences our children need to prepare them for future success (Duncan, 2010, November 9).

School divisions throughout the country are finding ways to make mobile computing devices available to students on a consistent basis. They seek to improve engagement, attendance, and attitude through the use of technology (Bethel, Bernard, Abrami, & Wade, 2007). In fact, in many schools, educators are expected to integrate technology in ways that extend and increase their effectiveness (Ertmer & Ottenbreit-Leftwich, 2010). As such, one would expect technology to be integrated into every classroom and used by every teacher to some degree throughout the school day. Unfortunately, this does not seem to be the case. Computers are found to be "oversold and underused" instead of facilitating, teaching and learning in a significant way

(Cuban, 2001; Cuban, Kirkpatrick, & Peck 2001). In fact, in a presentation to the ISTE Conference in Denver (2010), Project Red reported that among the 997 schools from all over the nation that completed their survey, 80% of the responding schools under-utilize technologies they have already purchased (Project Red, 2010).

Public school technology initiatives have evolved over the years beginning with stationary computer labs to computers in classrooms to mobile laptop carts to one-to-one laptop initiatives (Bonifaz & Zucker, 2004). Rather than being used as integral components of instruction within the classroom, technology advocates have repeatedly been disappointed to find new technology collecting dust (Cuban, 2001; Trotter, 2007). In response to Larry Cuban's findings, Mathews (2001) wrote, "We have wired up. We have gone online. We have partnered ourselves to Apple, Microsoft, Gateway and Pepsi-Cola. We have created and crossed over the digital divide. We are somewhere past dawn. Yet the fundamental problems remain. Why?" (p. 3E). The problem seems to be that the student is now approaching the teacher's level of technology proficiency (Knezek & Christensen, 2000).

According to the National Technology Education Plan (2005), students have mastered the Internet away from school and have outpaced their teachers in terms of the computer's potential use as an educational tool (Jaillet, 2004). A shift of knowledge has occurred when it comes to technology. Prensky (2001) suggests that teachers over the age of forty are "digital immigrants" while the students they teach are "digital natives." Rather than immigrants, Palfrey and Gasser (2008) define these individuals as "digital settlers", individuals who grew up in an analog world, but have been instrumental in creating the digital world. Regardless of immigrant or settler, these individuals tend to continue to use analog communication such as mailing bills rather than on-line payments. These individuals are teaching the digital generation, the ones who live by

texting, blogging, Facebooking, iPhones, iPods, and more recently iPads.

Is this digital disconnect merely an age difference between teachers and students? There has always been some sort of societal disconnect between the generations which may be visible within education. Lancaster and Stillman (2002) wrote about the differences between the Traditional (born Pre-1946), Baby Boomers (born 1946-1964), Generation X'ers (born 1965-1981) and the Millenials (born 1982-2000). They discussed how each of the generations not only grew up in separate historical times, but also hold different outlooks on work and life. Might this disconnect extend to technology?

Statement of the Problem

Recently, Prensky (2009) moved away from the digital native/immigrant distinctions as he argued that no matter your generation, now that we are further into the twenty-first century, technology has inevitably affected us all. He decided to focus discussion on what he terms, digital wisdom. A digitally wise individual, Prensky purported, is one that accepts technology and accesses the power of digital enhancements to complement innate abilities in order to facilitate wiser decision making (Prensky, 2009). Technology has enhanced decision making on many topics by eliminating our own limitations on the knowledge of the topic in question. Now, more than ever, we can debate and discuss issues where our knowledge base is limited by easily going to a search engine or other database on the Internet. We are limited to our perceptions and tend to go astray in our thinking when we are not open to digital enhancements.

Without technology integration one can argue that teachers that lack digital wisdom will tend to share the same pedagogy as was held when they were students. This lack of acceptance of digital enhancements not only limits the teacher's content knowledge but also does a disservice to the students within the classroom. In education, such a digital divide would equate

to a gap between students and their teachers (Underwood, 2007). Digitally wise teachers allow students to learn by new technologies, put themselves in the role of guide and context providers, thereby allowing students to go beyond, in some cases, the teacher's own knowledge of the content (Prensky, 2009).

Even with the increase of monies from the federal to state levels designed to increase technology use within schools, the efforts to increase teachers' computer skills must be improved (Johnson, Levine, Smith, & Stone, 2010). Teachers play an essential role in the effective implementation of one-to-one initiatives and the responsibility for implementation into the classroom often falls to the teacher. For example, Bebell and Kay (2010) concluded that it is "impossible to overstate the power of individual teachers in the success or failure of one-to-one computing" (p. 47) and that "teachers nearly always control how and when students access and use technology during the school day" (p. 47).

This study investigated teacher use of technology and their perspectives on any barriers they feel may inhibit technology integration into the classroom. Li (2007) stated that computer technology is now accessible in almost all schools in the U.S., but is not utilized by a majority of teachers for classroom instruction. In her research, Ertmer (1999) developed two types of barriers to technology integration, which continues to be used throughout current studies. The first barrier, Type I, includes extrinsic or external barriers that are beyond the teachers' control such as lack of access to technology, insufficient planning time and lack of administrative or technical support. Type II barriers include intrinsic or internal barriers such as the teachers' beliefs and established classroom practices (Ertmer, 1999).

The overall issue is that if a teacher integrates technology into the classroom, the playing field between student and teacher, when it comes to technology use, is leveled. Conversely, if a teacher does not integrate technology into the classroom, the generational gap remains.

Purpose of the Study

Today's students will become tomorrow's workforce and in order to be successful, must acquire technology literacy skills that require them to use, manage, understand, and evaluate technology as part of their 21st century education (Pierce, 2010; Partnership for 21st Century Skills, 2008; eSchool News, 2010; Association of American Colleges and Universities, 2007). Without this technology laden education, the future of the United States work force will not be able to compete in the technology driven global economy of tomorrow (Partnership for 21st Century Skills, 2008; eSchool News, 2010; NSBA, 2009).

As the need for clear and consistent implementation of technology in the classroom arose, the International Society for Technology in Education (ISTE) began the development of the National Educational Technology Standards (NETS) in 1998 (see Table 1). The basis of the ISTE NETS is to change the learning environment from teacher-centered to a student-centered environment in which teachers facilitate student learning, and provide opportunities for "digital age learning" (ISTE, 2008). The essential conditions described in the 2007 NETS for students, stress the need for equitable access to contemporary technologies and telecommunications (ISTE, 2008). In addition to establishing expectations for use, the NETS can be used to help establish a more concrete image of different ways to effectively integrate technology into the K-12 setting using twenty-first century skills.

Twenty-first century skills and their initiatives originated in the belief that the current century will demand a set of different skills and competencies from people in order for them to

Table 1

The ISTE NETS and Performance Indicators for Teachers (NETS•T)

1. Facilitate and Inspire Student Learning and Creativity Teachers use their knowledge of the subject content, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.
2. Design and Develop Digital-Age Learning Experiences and Assessments Teachers customize and personalize learning activities to address students' diverse learning styles using digital tools and recourses. Teachers design, develop, and evaluate authentic learning experiences and assessments incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the NETS•S.
3. Model Digital-Age Work and Learning Teachers exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society.
4. Promote and Model Digital Citizenship and Responsibility Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices.

Note. Adapted from "iste nets: Leading Digital-Age Education." Copyright 2008 by ISTE (International Society for Technology in Education). Used under Fair Use Guidelines, 2012.

effectively function at work (Dede, 2007; Kalantzis & Cope, 2008). These skills not only include core content but also critical thinking and collaboration while applying knowledge to new situations. The 21st century tools of information and communication technologies are utilized to engage students. Although there is no agreement on a specific set of such skills, a working definition of 21st Century skills is: those skills which young people will be required to have in order to be effective workers and citizens in the knowledge society of the 21st Century (Ananiadou & Claro, 2009).

A shift in how technology resources are provided to students to gain 21st century skills has emerged where technology resources are no longer shared. Thousands of teachers and students have been provided with their own laptop computers in school. In 2003–2004, it was

estimated that in the U.S., 4% of school divisions were implementing some form of one-to-one computing. In 2006, it was estimated that close to 25% of school divisions were implementing some form of a one-to-one laptop program (eSchool News, 2006). Due to the availability of laptops, school divisions around the world are investigating ubiquitous solutions to providing 21st century skills (Livingston, 2006). Currently, one-to-one laptop initiatives exist across the nation in a wide variety of settings. Large-scale initiatives can be found in South Dakota, Pennsylvania, New Hampshire, Texas, Georgia, Louisiana, California, Virginia, Florida, Kansas, Maine, Massachusetts, and Michigan (Holcomb, 2009).

Access to the hardware and software, a Type I barrier, is not an issue in school divisions with a one-to-one initiative. Teacher integration and the use of the technology provided are not well understood. Teaching a computer or technology skill by itself does not constitute technology integration into the educational process (International Society for Technology in Education, 2008). Even with the Type I barrier eliminated, Weston and Bain (2010) suggested that students' and teachers' effective use of technology is stymied by many obstacles. Mouza (2008) suggested that there is limited research in the area of how, when, and to what degree laptops are used. The purpose of this study is, given the elimination of a Type I barrier, to investigate how teachers are utilizing the ISTE NETS and what barriers teachers perceive to be present that may inhibit technology integration in the classroom.

At the Association of American Publishers Annual Meeting in March 2010, Education Secretary Arne Duncan commented "Nothing is more important than getting a great teacher into every classroom and supporting their growth and development. Technology can help us build the capacity of teachers and improve their effectiveness, by enabling more connected teaching." (Duncan, 2010, March 3).

Significance of the Study

Technology goes beyond the classroom. It is found in our everyday lives and is increasingly becoming a job requirement throughout the world. In order for the next generation to compete within this global stage, students will be required to know and use various digital enhancements. Children spend the vast majority of their day in a classroom. In order for the students to learn how to effectively utilize technology, teachers must first incorporate its use into content. Findings from this study will enable division leaders the opportunity to better understand the barriers teachers perceive to integrating technology. Through investigating these barriers and teachers' perceptions of technology, technology coordinators and administrative leaders will have the potential to discuss these barriers and determine appropriate ways to increase technology use in their schools.

Theoretical Framework

The theoretical framework for this study was developed through a review of literature that examined the theoretical basis of integrating technology into the classroom. This theoretical framework was based on not only the increase of educational monetary funds but also a national and local community influence.

Teachers' uses of technology are based on their value beliefs but these uses may not be considered best practices (Otenbreit-Leftwich, Glazewski, Newby , & Ertmer, 2010). Identifying the barriers to technology integration through teachers' beliefs provide opportunities for school and technology leaders to aid in the reduction of these barriers. Thus, the result could result in an increase in consistent technology integration within the classroom. Based upon this framework, this study examined 6-12 public school teacher perceptions and beliefs toward technology integration and identifiable barriers that interfere with technology integration in a

suburban school division that has eliminated the Type I barrier of teacher and student access to hardware and software.

The hypotheses guiding this study were that within a technologically saturated school division: 1) ISTE NETS are extensively used in the classroom and 2) teachers perceive barriers that interfere with consistent technology integration in the classroom and these barriers are identifiable. As a result of these barriers, technology is not integrated into the classroom on a consistent basis, which creates a technology gap between the teacher and students.

Research Questions

There are three basic research questions this study investigated:

1. How are activities that represent the ISTE NETS being used in the classroom?
2. What are the barriers teachers perceive to be in place that causes them not to integrate technology consistently into their teaching practices?
3. How are the teacher perceptions related to their gender, years of teaching experience, grade level or subject level?

Limitations

This study had some practical limitations. First, this suburban school division has technology rich resources that are not available in many schools divisions; thus, it is not a typical school division that can represent most schools divisions in the U.S. This limits the generalizability of the findings. However, as school divisions begin to consider one-to-one technology initiatives, this study identified barriers these divisions may avoid in the implementation of the initiative and training of teachers. Second, in this qualitative study, the analyses were based upon self-reported information. Therefore, it is possible that the

participants did not fully disclose all relevant information pertaining to this study. However, it was the focus of this study to investigate the teachers' perceptions toward technology integration and identify any barriers they felt might keep them from consistent integration. Third, the researcher's assumption that all participants have a view that technology is useful in the classroom setting may be limiting, as not all the participants may share the same view.

Delimitations

This qualitative study examined teachers' perceptions and beliefs toward technology integration and the barriers that exist. With this in mind, the delimitations of this study included purposeful sampling of the geographical location of the participants and the fact that the participants and their students had continuous access to technology within the classroom.

Definition of Terms

Consistent Technology Integration: For the purposes of this study: the utilization of technology in the classroom to enhance student learning three to five times per week.

Digital Divide: A gap between those that use technology and those that do not (Prensky, 2001).

Digital Immigrant: Not a native user of technology as the digital world did not exist when they were born; usually someone born prior to 1980 (Prensky, 2001).

Digital Native: Individuals born after 1980 into the digital world (Prensky, 2001).

Digital Settlers: Individuals that have grown up in an analog world but assisted in the creation of the digital world (Palfrey and Gasser, 2008).

Digital Wisdom: Acceptance of digital enhancements that aid in critical thinking and problem solving (Prensky, 2009).

Technology: For the purposes of this study: Digital media including but not limited to, computers, electronic whiteboards, LCD displays, digital cameras, and software.

Technology Integration: Within the classroom, students are able to select technology tools to help them obtain information, analyze and synthesize the information, and present it professionally (International Society for Technology in Education, 2008).

Type I Barriers: External barriers that are beyond the teachers' control (Ertmer, 1999).

Type II Barriers: Internal barriers such as teachers' beliefs and perceptions (Ertmer, 1999).

Web 2.0 tools: Include but are not limited to, blogging, wikis, podcasting, social networking, RSS feeds, as well as web applications (Moodle, Skype, Google Earth, Wordle).

Organization of the Study

This research study includes five chapters. Chapter I contains the background and introduction of the study, the statement of the problem, the significance and purpose of the study, the theoretical framework, the research questions, this study's limitations, and delimitations and definition of terms.

Chapter II presents an overview of literature as it relates to digital natives versus digital immigrants, technology integration and teacher beliefs.

Chapter III contains a description of the methodology used for this research study. It provides an introduction, the selection and setting of the interviews, data collection procedures and data analysis procedures.

The study's data, Chapter IV, include a profile of the participants, data analysis and results. Chapter V provides the study's results and findings. Also, any implications and recommendations for future research are provided.

Chapter II

Review of Literature

Within popular media, it is generally agreed upon that there is a positive effect on the educational experience when technology is integrated into the classroom by assisting teachers in their craft and engaging a broad spectrum of students (Chapman & DeBell, 2006; Bowerman, 2005). Parents, students, business members and communities have embraced technology within their own lives and, as such, continue to expect the same within the schoolhouse walls. According to the U.S. Department of Education (2003), "Technology is now considered by most educators and parents to be an integral part of a high-quality education" (p.3).

The purpose of this review of quantitative and qualitative research was to provide an overview of studies pertaining to teacher perceptions, beliefs and dispositions when it comes to technology integration. The central research questions that are addressed throughout this literature review include the following (1) How are activities that represent the ISTE NETS being used in the classroom? (2) What are the perceived barriers that cause teachers not to integrate technology consistently into their teaching practices? (3) Are the teacher perceptions related to their gender, years of teaching experience, grade level or subject level?

As the search began, key terms (e.g. digital immigrants; technology integration; teacher computer use) were searched using Ebscohost database, Education Complete, and Google Scholar. Glancing over the thousands of peer reviewed articles that have been published regarding technology integration into the classroom; there were areas that began to come to the surface. Research has begun to lessen when it comes to technology accessibility, as the country has been successful in providing computer access in virtually every classroom in America. If

accessibility is no longer an issue, then one must turn to the teacher. A narrowing search of key terms (teacher efficacy; teacher disposition; teacher technology beliefs) was used. This drew the number of peer review articles down to a few hundred. The list was further reduced as abstracts were reviewed. Qualitative and quantitative research articles that were published within the past seven years were reviewed. These articles investigated the potential predictors and/or potential barriers to technology integration into the classroom.

Teaching in the Digital Age

Significant learning occurs when capable teachers use technology effectively in the classroom (Johnson, Levine, Smith, & Stone, 2010; Association of American Colleges and Universities, 2007). The fluid evolution and continual introduction of technology sustain a fear of computers and technology, and some teachers are techno-phobic. While the teachers may believe that technology is important, the fear of using it in the classroom brings issues of confidence, anxiety, and lack of understanding (Li, 2007).

In the Speak Up 2009 survey (Project Tomorrow, 2010), a new student vision for American education emerged. The student responses to the survey reported using online learning, Web 2.0 tools, and mobile devices within their daily lives. They saw the use of these tools and applications within the classroom as merely an extension of the way they are currently living and learning outside of the classroom. For example, when it came to integrating mobile devices into the classroom, the majority of high school students that responded stated that the devices would be used to look up information on the Internet (70%) or to record lectures (56%). Similarly, 43% of parents that responded to the survey stated that they felt that the use of the mobile devices in the classroom would increase student engagement. Conversely, 76% of

responding teachers stated that one of their concerns regarding the mobile devices within the classroom is potential student distraction from content (Project Tomorrow, 2010).

National studies (CDW-G, 2006; NCES, 2009) indicate a positive move of classroom teachers' effort to use technology in the classroom. In fact, of the 1000 teachers who responded to the Teachers Talk Tech survey, 79% self-reported using computers "to teach students" (CDW-G). In the NCES (2009) survey 69% of teachers reported either they or their students use technology in the classroom. Unfortunately, when we take a closer look at teacher and student perceptions of what is being used within the classroom; there is a technology use perception gap. When asked, "To what extent is technology integrated into your classes?" 58% of teachers (n=302) stated they were almost fully integrated, whereas only 34% of students (n=400) reported the same (CDW-G, 2010).

Is this digital disconnect in the classroom due to the lack of comfort with technology among teachers? The students are using technology at home, on the bus to school, on the way home and even when banned within the school. Even teachers are using technology just as much as students and in similar manners as their students when outside the classroom (CDW-G, 2010). Larry Cuban (2001) discussed how, even in Silicon Valley schools situated in communities immersed in technology, traditional teaching and learning practices persisted. Professional development or some sort of technology training is offered to teachers continuously throughout the school year. One might wonder why professional development is offered when it does not seem to be making a difference. Holcomb (2009) suggested that it is critical for schools to understand how teachers choose to use laptops, as simply providing each student with a laptop is not enough.

Digital Native vs. Digital Immigrant

Comfort level with technology appears to increase as age decreases. Students today were born into an era of home computers and Internet, while most established educators have had to acquire this knowledge as adults. As newer generations of computer software and hardware become increasingly user-friendly, students are learning technology skills based on social demands and through user intuitiveness (Baker, 2006). Prensky (2001) and Jukes (2008) suggested that teachers, who are defined as Digital Immigrants, speak digital as a second language and therefore have an accent that creates a barrier between them and their Digital Native students. Palfrey and Gasser (2008) concurred with Prensky and Jukes, stating that teachers often cut themselves off from their students because of language and cultural barriers. The theory of many policy makers is with abundant access to new technology, teachers will increase its use within the classroom, which will, in turn, lead to better teaching and learning. Based upon the vastly different backgrounds and comfort levels with technology between the two generations, this may not be the case.

In order to evaluate whether or not teachers who have grown up with technology will use educational technology more often than veteran teachers, Russell, O'Dwyer, Bebell and Tao (2007), surveyed 2,864 Massachusetts teachers representing twenty-two school divisions. Forty-six percent of the sampled population had taught more than fifteen years while twenty-six percent were relatively new to the profession having taught five or fewer years. In addition to the number of years the teachers had taught, Russell et al. were interested in the number of years the teachers had been at their current school.

Rather than use the somewhat generic term of "technology use," the survey was constructed using five distinct categories of teacher technology use. The categories included

teachers' use of technology for preparation, teachers' use of technology for delivering instruction, teacher-directed student use of technology during class time, teacher-directed student use of technology for creating products, and teachers' use of electronic mail (e-mail) for professional purposes (Russell et al., 2007).

Overall, teachers who had been teaching for longer periods of time reported less frequent use of technology (Russell et al., 2007). Those who had taught for more than ten years had students create products using technology less frequently than teachers with less than ten years teaching experience. Also, teachers who had taught more than fifteen years reported less frequent use of technology to prepare for lessons and use e-mail. Teachers with three to five years of teaching experience reported that they more frequently had students create products using technology than teachers with six or more years of experience throughout their careers. Likewise, teachers with three to ten years of teaching experience reported the most use of technology for preparation. Although the amount of time teachers had taught at their school yielded differing patterns of technology use depending on the category in question, it was interesting to note that teachers new to a school generally used technology less often than teachers who had been at the same school for three to ten years. Russell et al. attributed this negative effect, in part, from teachers who are new to a school requiring adjustment time to a new curriculum, school culture, and instructional materials.

The findings within the Russell et al. (2007) study, based on teacher self-reporting data, revealed the relative importance of examining specific, discrete uses of technology rather than considering technology use as a generic construct. Without the separation of the categories of technology usage, the patterns reported within this study would not be possible. Although, newer teachers appeared to be more comfortable using technology outside of the classroom for

communication and preparation, Russell et al. (2007) indicated the need for efforts to be made to help increase the use of technology during instruction. Changing school assignments also seemed to have a negative effect on teacher technology use. Even though teachers entering the profession are more comfortable with technology than previous generations, these teachers need to develop skills to use technology in a wide variety of ways.

Robinson (2003) provided similar findings in regards to teachers' age having an indirect effect on technology use within the classroom. Studies (Robinson, 2003; Snoeyink & Ertmer, 2002) have suggested that veteran teachers may have less computer proficiency and confidence to integrate technology and thus limiting opportunities for changing their daily teaching practices. The current path analysis supports this hypothesis by indicating that as a teacher ages and their years of teaching experience increase, their computer proficiency decreases (Inan & Lowther, 2010). As would be suspected, the analysis indicated that computer availability indirectly and directly influenced technology integration.

Occasional to rare users

The lack of proper technology integration in the classroom will not prepare students to be able to compete in a global, technology-driven world if technology skills are not learned (eSchool News, 2010; Association of American Colleges and Universities, 2007). Providing a 21st century education is the number one challenge facing public education today (National School Boards Association [NSBA], 2009).

Utilization of technology has been a longstanding issue despite external efforts to integrate it into the classroom. As a benchmark in teacher technology use in educational research, Larry Cuban continues to be referenced due to the location of the research and continued relevance. At the time of publication, Cuban, Kirkpatrick, and Peck (2001) indicated

that even after two decades of intense promotion of technology by policy makers and parents, most teachers and students had access to technology but were only occasional to rare users within the classroom. This led to the research questions: (1) With abundant access to information technologies, did the national patterns of infrequent and limited teacher usage of computers emerge in the selected two high schools? If so, why is this so? (2) Did the teachers within these selected schools who used computers in the classroom for instruction typically maintain existing practices? If so, why? (Cuban et al., 2001)

Cuban et al. spent seven months during the 1998-1999 school year interviewing twenty-one teachers and twenty-six students in two schools located in Northern California's Silicon Valley. Students reported that there was some computer use in English and social studies, which mostly involved report writing and Internet searches. Little to no use of computers in math, science and foreign language was reported. Shadowing the teachers resulted in observations that even in computer based classrooms teacher-centered instruction was commonly seen. Very little evidence of student-centered instruction was observed. Most of the teachers in the two high schools adapted technology to fit familiar practices of teacher-centered instruction.

Reasons for the infrequent use of the technology in classrooms were reported as lack of time teachers have to find and evaluate software, computer and software training was seldom offered at convenient times and the generic training that was available was considered irrelevant to the specific needs of the teacher (Cuban et al., 2001). There was little difference in the use of computers between veteran and novice teachers. Gender and age of the teacher were not factors of increased technology use within the classroom.

The uneven usage of technology within the two schools could be explained historically in two ways according to Cuban et al. The first is called "slow revolution" where small changes

accumulating over time create a slow-motion transformation. Such was the case with the commercial application of electricity, according to economist Paul David (1990), which existed in the 1880's but it was not until the 1920's that companies harnessed electrical power for manufacturing, distribution and production or products. This idea considers a gradualist view of change, which implies that limited technology use within the classroom will dissolve. The second explanation emphasized the authors' beliefs that comprehensive high schools continue to follow decades old curricula structure and usage of time. Cuban et al. argued that teachers are not given enough time to prepare appropriate lessons using technology and teachers eventually leave education for other professions where more time is available for technology use.

Despite the identified benefits of utilizing technology in classrooms to support learning, many teachers rarely use technology in an effective manner (Johnson, Levine, Smith, & Stone, 2010; Association of American Colleges and Universities, 2007; Rakes, Fields, & Cox, 2006). It has been reported that 80% of the teachers use technology less than half of the time (Bauer and Kenton, 2005). Bauer and Kenton (2005) stated that most teachers do not use technology to teach and also fail to integrate technology into their curriculum (p. 519). In fact, the Florida Innovates school survey results for 2007-2008 indicated that in a typical Florida school most teachers (56%) did not integrate technology to deliver curriculum content. Only 24% of the teachers surveyed expected students to go beyond the use of productivity software such as word processing, designing presentations, and spreadsheets. The findings showed that teachers use technology 55% of the time as a method for delivery of instruction, 54% as a tool for providing instruction, and only 46% as a tool embedded in daily instruction for all curricular areas (Ritzhaupt, Hohfeld, & Barron, 2008). Although the technology had increased in its availability and usefulness over the years, this further corroborated the Cuban et al. study showing teachers

rarely integrate it in daily instruction.

Barriers to Technology Integration

To clearly identify perceived obstacles to incorporating technology into every day lesson plans, Ertmer (1999) classified two types of barriers to technology integration. The first barrier, Type I, includes extrinsic or external barriers that are beyond the teachers' control such as lack of access to technology, insufficient planning time and lack of administrative or technical support. Type II barriers include intrinsic or internal barriers such as the teachers' beliefs and established classroom practices (Ertmer, 1999).

Through observation and interviewing elementary teachers, Ertmer, Lane and Woods (1999), designed a study in order to examine the relationship between these barriers and technology integration. The teachers who participated in the study had many reasons to use technology in the classroom. They included motivating students, technology preparation, creating more interesting lessons, and reaching students with learning problems. However, these reasons did not mean that the teachers actually integrated technology into the classroom. The teachers that used technology as a supplement to their pedagogy, reported concerns regarding technology's relevance, which is a Type II barrier. Teachers also commented that they faced a lack of time to add technology on to the curriculum, a Type I barrier.

Teachers must perceive technology as necessary and valuable if they are to embrace and change their way of teaching. Otherwise, teachers who feel no need to integrate technology will find a barrier to support their beliefs. "Teacher beliefs interact with first-order barriers to facilitate or limit teachers' technology use" (Ertmer et al., 1999, p.67). Brinkerhoff (2006) reported similar findings where teachers frequently fail to build on the technology potential due

to several barriers including administrative support, attitudinal or personality factors, training and experience.

In response to Ertmer's (1999) types of barriers, Lowther, Strahl, Inan and Ross (2008) questioned whether or not technology integration would be evident when the barriers were removed. Lowther et al. (2008) investigated a state technology program whose purpose was to "integrate the use of technology as a tool into curriculum and instruction to prepare students to meet state academic standards" (p.3). The Type I and Type II barriers the program addressed were "computer availability, curriculum materials availability, teacher beliefs, demographic characteristics of teachers, teachers' proficiency, and support from administration, technicians, and peers" (p.5).

The results indicated that the students in the state program outperformed the control group when the teachers were provided time to change, the barriers were removed and replaced with student-centered environments. The results of the study indicated more "intensive and meaningful student use of technology in student-centered environments" (Lowther et al., 2008, p.24). The teachers also had more positive attitudes toward technology integration and confidence in integrating than the control teachers.

Rather than focus on negativity associated with barriers, Drent and Meelissen (2008) conducted a large-scale national study in the Netherlands, which focused on positive factors that allowed the barriers to be overcome. There were four factors that emerged from the analysis, student oriented pedagogical approach, positive attitude, computer experience, and personal entrepreneurship of the teacher (Drent & Meelissen, 2008, p.195). Teachers with higher order thinking skills were able to be more innovative with technology even if they were less than proficient with technology. The largest impact was the factor of personal entrepreneurship that

Drent and Meelissen defined as "the amount of contacts an educator keeps (both inside and outside the school) for his own professional development in the use of information and communication technologies" (p. 195).

An indirect effect of computer experience and attitude on pedagogical approach was seen with the teachers surveyed. This indicated that experience with information and computer technology (ICT) support the development of a student-oriented pedagogical approach. The teachers who are most likely to integrate technology into the classroom are those that see the advantages of technology use in the classroom and are student-centered in their way of teaching (Drent & Meelissen, 2008). Similarly, Redmann & Kotrlik (2008) identified three aspects that are responsible for a significant part of integration of technology: technology availability, barriers that prevent integration and years of teaching experience (p. 77).

Teacher dispositions

If student-centered teachers are more likely to incorporate technology into their lesson plans, then what specific traits are found in these types of individuals that make them amenable to this new style of teaching? Vannatta and Fordham (2004) sought to investigate teacher dispositions that predict technology integration in the classroom among K-12 teachers. The survey measured the relationship of non-technology-specific attributes such as teacher self efficacy, philosophy, openness to change, amount of professional development, and the amount of technology use in the classroom rather than use a measurement that examined technology specific areas such as teacher attitudes towards computers.

The Teacher Attribute Survey (TAS) also included items that assessed the amount of professional development and technology training, years of teaching, willingness to take a graduate course without an incentive, the number of hours worked beyond the contractual

workweek and openness to change. The authors examined the professional development and technology training as separate variables, as not all professional development sessions include technology. To create a construct of commitment to teacher improvement, the authors used the willingness to take a graduate course without an incentive and the number of hours worked beyond the contractual workweek. A construct of openness to change was included to measure teacher comfort and excitement to try new methods of instruction and teacher willingness to take risks and make mistakes.

The findings of the TAS survey showed classroom technology use was fairly low among teachers and students. In fact, teachers mainly used technology within the classroom for the Internet, word processing and email. When combining student and teacher use of technology within the classroom, the authors found a normal distribution curve. The teacher attribute data revealed that the sample population was fairly open to change, leaned slightly toward student-centered and constructivist environment, and had slightly above average self-efficacy. The sample indicated that within the past two years they averaged 44 actual hours of professional development and 19 hours of technology training (Vannatta & Fordham, 2004). The results also indicated that the teachers spend between 6-15 hours beyond the contractual workweek preparing for class and had been teaching for approximately 16 years on average. The model produced from the data analysis indicated three variables that best predict overall technology use within the classroom: number of hours of technology training, number of hours worked beyond the contractual workweek, and openness to change (Vannatta & Fordham, 2004).

The findings suggested that the teacher attribute of time commitment to the profession and openness to change combined with the amount of technology training to best predict technology use in the classroom. A teacher that approached professional development with an

attitude of willingness to try new techniques and take risks and is committed to spending time outside of the contractual work-week to practice these new techniques may be more likely to integrate technology into the classroom. Even though technology is accessible at some level within classrooms and schools, teachers and their dispositions may be the ultimate reason technology is not integrated more often within the classroom.

Teacher attitudes, beliefs and perceptions

For decades, a positive teacher attitude toward technology has been recognized as a necessary condition of the effective integration of technology into the classroom (Woodrow, 1992). The teacher is the most crucial factor as to whether or not technology integration into the classroom is successful. Teachers make choices on how they will utilize the technology they are given based on many factors, including their beliefs on pedagogy, and will tend to use the technology within their existing practice (Mouza, 2008). Under this premise, Chen (2008) studied the relationship between teachers' beliefs and teachers' practices through the use of qualitative research methods of twelve Taiwanese high school teachers.

Purposeful sampling of the population was used as the teachers were from a public high school in Taipei. Chen (2008) anticipated that within the country, this city would have teachers that would be more apt to undertake technology integration. In addition, the school chosen had a reputation for technology integration and academic achievement of the students was above average in comparison with other Taipei high schools. Twelve participants whose teaching experience ranged from two to twenty-eight years agreed to be interviewed.

The participants all reported that they used technology for personal purposes, for lesson planning, and for administrative work. Not all, however, viewed technology as a means to achieve instructional goals other than covering curricular content, preparing students for

assessments, and highlighting important content (Chen, 2008). Insufficient time to plan and prepare for activities that would integrate technology into the classroom as well as inadequate technical and administrative support were among the external factors all the participants listed as to why their instruction did not always utilize technology. Also, the participants reported that the inflexible school organization and assessment system discouraged teachers from using technology to conduct creative but time-consuming activities. The participants reported that they were unwilling or hesitant to allow students to spend much needed classroom time to work on technology related projects as they all stated that they were under pressure to cover all content prior to assessments. Some of the teachers recognized the negative effect of heavy lecturing and repetitive test-taking practices but considered these to be best for achieving the primary goal of the school. The teachers also reported concern regarding classroom management and as such, utilized PowerPoint presentations that allowed listing of important material while also allowing them to attend to student behavior.

Although the participants reported agreement on constructivist concepts during the interview process, they admitted to remaining teacher centered and lecture based while their technology use was restricted to areas that supported such instruction. Chen's opinion as to the differences among the teachers' beliefs and their practices came down to school culture. According to Chen, a system that focuses on high-stakes assessments as well as student competition can strongly discourage teachers from undertaking innovative initiatives such as technology integration.

In order to gain teachers' thoughts on technology within the classroom, Al-Bataineh, Anderson, Toledo, and Wellinski (2008) surveyed teachers in grades six through 12 in a Midwestern school division. Forty-nine teachers voluntarily responded to the survey and

identified several obstacles to classroom technology integration. Teachers reported the lack of time to implement technology, full classrooms, and the pressure to raise test scores. Another issue for their traditional classroom was technology access. Without a one-to-one scenario, the schools were limited to computer lab availability. Educators conveyed frustrations with the lack of availability of computer labs when the curricular content could have been supplemented by technology (Al-Bataineh et al., 2008). Also, teachers reported discomfort with the ever-changing scope of the technology landscape. Among those surveyed, the highest usage rates were on productivity and management (email, word processing, and electronic grade book). Al-Bataineh et al. (2008) found the least frequent way to use technology (2.7%) was as an instructional device. The teachers recommended making technology more available to students. They suggested more professional development training on using the tools in order to provide effective teaching and learning. Sharing digital content in a collaborative environment with content specific information seemed to indicate the future of how technology and education should be related (Al-Bataineh et al., 2008).

As teachers continually report concern about access to technology, a Type I barrier (Ertmer, 1999), Garthwait and Weller (2005) performed a qualitative study using two seventh grade teachers involved in the Maine Laptop Technology Initiative. The teachers' level of adoption seemed to be directly proportional to their core beliefs about how students learn. Network connectivity and Internet availability did not seem readily available in the first year of the Maine Learning Technology Initiative (Garthwait & Weller, 2005). Due to one teacher's, "Susan", frustration with technical glitches, her implementation level did not match that of the other, "Rick." Susan believed the purpose of the laptop project had nothing to do with changing the face of education but rather to help students become more efficient in their schoolwork. On

the other hand, Rick, reported a pedagogy shift and change in his classroom culture. Within his technology-facilitated classroom, students became independent learners (Garthwait & Weller, 2005). Parents, though, have strong feelings about creating an educational environment that is laden with technology. Acting upon the parents' suggestions, students in seventh and eighth grade in Maine public schools as well as their teachers have a laptop paid for by state taxpayers, at an annual cost of $11 million (Washuk, 2011).

The technology landscape continually updates and shifts over the years. Based on this fact, Shi and Bichelmeyer (2007) compared two ethnographic case studies that were conducted in 1991 and 2004 to answer the question, "How have teachers' experiences with computers changed?" (p.182). While the 1991 study used the naturalistic inquiry (Lincoln & Guba, 1985) method, the 2004 study followed the critical inquiry (Carspecken, 1996) method. Both studies were performed using purposeful sampling of teachers in a Midwestern state. Six themes emerged from these studies using the constant comparative method. The themes included accessibility, the need for technical support, teacher perceptions about computer usefulness, appropriate programs, factors facilitating computer use, and factors inhibiting computer use.

Although the 2004 study indicated an increase of computer use by teachers due to easier access and administrative mandates of email, attendance and grading software use, the study corroborated Cuban et al. (2001) beliefs that teachers used computers the same way even after 13 years (Shi & Bichelmeyer, 2007). The teachers in the 2004 study continued to have similar issues as those in the 1991 study. Even though computers had been in use more by 2004, teachers continued to hold skeptical views of the potential benefit computers may have in education as their 1991 colleagues.

The results of the comparison showed the need for technology training and the lack of collegiality as these issues were mentioned by both groups of teachers (Shi & Bichelmeyer, 2007). Little improvement in the teachers' professional development experiences in the thirteen years was indicated through the comparison of the two case studies. Shi and Bichelmeyer concluded that there was a need for technology and administrative leaders to identify the true problems of technology integration into the classroom.

Examining the direct and indirect effects of teachers' individual characteristics and perceptions of factors that influence their integration of technology into the classroom was the focus of Inan and Lowther (2010). Technology integration research has identified many critical variables thought to be important in achieving effective technology integration. Many of these variables have been examined in isolation from one another or from the school setting in which the integration was to occur. The purpose of Inan and Lowther's (2010) study was to provide a framework and holistic view approach through the use of path analysis.

Path analysis is a statistical technique for examining dependent and independent variables to reveal the relative effects of each variable upon the other variables in the model (Inan & Lowther, 2010). This analysis provides a pictorial representation of relationships among the variables where arrows indicate hypothesized paths and direction of influence. The data collection instrument that was utilized was the Teacher Technology Questionnaire (TTQ) which was validated (Lowther & Ross, 2000) and is commonly used in research (Lowther, Inan, Strahl, & Ross, 2008). The largest portion of the participants (40.7%) had been teaching more than fifteen years. Almost all, 93.7%, owned a home computer and most teachers rated their computer ability as either "moderate" (38.7%) or "good" (41.8%) (Inan & Lowther, 2010).

Key findings from the TTQ that were later entered into the path analysis indicated that teachers' demographics, their years of teaching, had a direct negative impact on computer proficiency and had a significant total impact on technology integration. Teachers' age indirectly affected technology use. Teachers' beliefs and readiness positively influenced their technology integration. This finding supported the hypothesis that teacher belief is one of the essential factors that explains technology use (Ertmer, 2005; Vannatta & Fordham, 2004). The availability of computers and technical support positively influenced teachers' beliefs and readiness.

The lack of research at the time on teacher beliefs about technology and its use in the classroom prompted Wozney, Venkatesh and Abrami (2006) to examine teachers' perceptions and technology use in the classroom. Their study examined the relationship between instructional, motivational, school culture and teachers' personal factors that impact the frequency and overall nature of the integration of computer technology into the classroom.

Wozney et al. (2006) used the expectancy-value model to predict teacher use and integration of technology in the classroom. The expectancy-value theory model was found to be an accurate predictor of productivity largely applied to the industrial and occupational settings (Vroom, 1964). They used three different constructs within the model, expectancy, value and cost. The expectancy items dealt with teacher perceptions of technology via self-efficacy. The value items assessed the teachers' perception of the innovation and the degree they saw it associating with positive outcomes. Cost items of the model assessed the perceived physical and psychological demands of technology such as preparation time and effort to integrate technology into the classroom.

Among the teachers who responded to the Technology Implementation Questionnaire (TIQ), 39% reported that computer technologies were "rarely" or "not at all" integrated into their classroom activities. Teachers that preferred student-centered pedagogy were more likely to report using computers in their classrooms more frequently, rate themselves as more proficient in using the computer and place themselves at a higher stage in technology integration. Male teachers reported using the computers more for communicative and analytic purposes than the female respondents. Conversely, female teachers reported instructional use of the computer significantly more than male respondents (Wozney et al., 2006).

Wozney et al. (2006) found that teachers use technology more for informative and expressive purposes such as word processing, the World Wide Web and online journals. Fewer than half of the teachers in this study reported using technology for tutorials, remediation, and drills. Teachers' personal use of computers outside the classroom was the strongest predictor of technology integration into the classroom.

The teachers' expectancy of success was the most predictive variable of computer use. The teachers who believed they have the skills and who value the outcomes are more likely to use technology within the classroom. Time preparation to use technology, cost, was not a predominate predictor of technology use (Wozney et al., 2006).

The attitude the teacher held toward technology may determine the amount and specific use within the classroom. Teachers that used technology more outside of the classroom seemed to use technology more within the classroom. This was an interesting note that may have a relationship with the researchers' findings that cost, the time to prepare a lesson using technology, was not a reliable predictor of technology use. Teachers did not appear to mind

taking the time to construct high technology integration lessons if they already had personal experience using technology.

Educators have primary contact with students the majority of the day throughout the year. As students continue to "plug in" to technology in their personal lives, it is important for researchers to study the reasons, or variables, why some teachers fully integrate technology into the classroom and why some educators fail to do so. The purpose of the Mueller, Wood, Willoughby, Cross and Specht (2008) study was to study elementary and secondary in-serviced teachers who did or did not integrate technology into the classroom. They expected to be able to determine the variables that best discriminated between the integrators and non-integrators within the sample population.

The population of teachers chosen for the quantitative study was sampled from a complete list of teachers in a midsized Canadian city school division with the majority of teachers in the sample being female (67%), with an average of 14.8 years of experience (Mueller et al., 2008). The survey that was utilized was developed based on responses from educators in an earlier focus group study with elementary and secondary teachers from Wood et al. (2005).

According to the Mueller et al. (2008) study, experience with computer technology and attitudes toward technology in the classroom are important predictor variables for teachers that integrated technology and those that did not no matter whether the teacher was elementary or secondary. The predictive strength of attitudes toward computers as an instructional tool was found to be consistent with the value-expectancy theory introduced by Wozney et al. (2006). Mueller et al. expected that teacher efficacy would have an impact on technology integration, but found it not to be significant. They discussed the possibility that teacher efficacy needs to be directly related to computer usage and not teaching in general as was presented in the

measurement. The authors also indicated that the high and low integration groups did not differ in terms of years of experience or gender. Interestingly, there was no significant impact on the number of years of teaching experience in any of the analyses. The authors proposed that although one might expect younger teachers to have more computer experience, they may be more focused on surviving the first few years of the profession than technology integration.

Summary

This chapter provided a literature review pertinent to digital immigrants vs. digital natives, the barriers to technology integration, and teacher beliefs, perceptions, and attitudes toward technology. Even with the advantage of the development of newer technologies over time, it has been shown that teachers fail to integrate technology any more now than before the turn of the century (Cuban et al., 2001; Shi & Bichelmeyer, 2007).

The classroom teacher faces both internal and external barriers to technology integration (Ertmer, 1999; Brinkerhoff, 2006). Even though a teacher may hold a positive attitude toward technology in the classroom, it does not mean that integration is occurring in a meaningful way (Drent & Meelissen, 2008; Chen, 2008; Johnson, Levine, Smith, & Stone, 2010; Association of American Colleges and Universities, 2007; Rakes, Fields, & Cox, 2006; Bauer & Kenton, 2005). As can be expected, if a teacher cannot access technology on a regular basis, this limits its use within the classroom. Teachers also commented that they face a lack of time to incorporate technology into the curriculum (Ertmer et al., 1999; Chen, 2008). In a student-centered environment, when teachers are provided time to incorporate technology and access to technology is readily available, students have been shown to outperform their counterparts (Lowther et al., 2004). The teachers with higher order thinking skills were able to be more

innovative with technology even if they are less than proficient with technology (Drent & Meelissen, 2008).

Studies have shown that teachers' age and years of experience have a direct and indirect negative impact on technology use within the classroom (Inan & Lowther, 2010; Robinson, 2003; Snoeyink & Ertmer, 2002). Teachers who had been teaching for longer periods of time showed less frequent use of technology (Russell et al., 2007).

This literature review indicated that teachers' beliefs and perceptions, when it comes to technology, were an important measure of technology integration into the classroom (Vannatta & Fordham, 2004; Ertmer, 2005; Wozney et al., 2006; Mueller et al., 2008; Inan & Lowther, 2010). Literature documenting these barriers and teacher beliefs were emphasized, as this literature was relevant to this study. In Chapter III, the methodology is proposed for investigating teacher perceptions of technology and technology integration in a purposeful sample.

Chapter III

Methodology

The purpose of this study was, given the elimination of a Type I barrier, to investigate how teachers are utilizing the ISTE NETS and what barriers teachers perceive to be present that may inhibit technology integration in the classroom. The research questions guiding this study were as follows: (1) How are activities that represent the ISTE NETS being used in the classroom? (2) What are the perceived barriers that cause teachers not to integrate technology consistently into their teaching practices? (3) Are the teacher perceptions related to their gender, teaching experience, grade level or subject level? This chapter describes the design of the study, selection of participants, the data collection procedures, and a description of the qualitative analysis procedures that were employed to analyze the data.

Design of the Study

This study was designed based on the naturalistic inquiry approach (Lincoln & Guba, 1985). The qualitative methodology was selected as it provides the best fit to understanding the teacher perspectives of technology integration in the classroom. Qualitative research uses an approach that seeks to understand phenomena in context specific settings (Hoepfl, 1997).

Cronbach (1975) stated that statistical research is not able to make a full account of interaction effects that take place in social settings. Qualitative data have the ability to more fully describe a phenomenon and will enable the researcher to report data rich with detail and insights into the participants' experiences (Lincoln & Guba, 1985; Stake, 1978; McMillan & Wergin, 2002).

The framework for this study was based on grounded theory. Through focusing on teachers' experiences and perceptions, the researcher conducted in depth interviews of the participants. Participants were able to describe what they feel is significant while the researcher observed and interpreted meanings in context (Patton, 2002). Many researchers refer to this concept as grounded theory (Creswell, 1998; Lincoln & Guba, 1985; Patton, 2002; Strauss & Corbin, 1990).

Researcher's Role

In this study, the researcher served as the moderator, listener, observer, and analyst. As the instrument of analysis for the study, the researcher constructed understanding through the questions asked; context studied, and personal biography (Rossman & Rallis, 2003). The data were evaluated through the lens of the researcher; therefore the background of the researcher plays a role in the investigation.

The researcher is currently in the third year of a three-year doctoral program in Educational Leadership and Policy Studies at Virginia Tech. Throughout his various experiences, the researcher has participated and presented many professional development sessions regarding technology use and technology integration not only as secondary teacher but also as an administrator. These experiences allowed the researcher to be a qualified critic in regards to technology and its integration into the classroom. While this may create a bias on the part of the researcher, the researcher used a formal interview format and an interview protocol to limit any bias he may have had on the topic. The roles that the researcher have held and experienced have created an excellent background for conducting this study.

Site Selection

This study was conducted in an east coast suburban school division that eliminated a Type I barrier through a one-to-one initiative. Within this school division, technology was abundantly available to teachers and secondary students as each is provided a laptop.

Selection of Participants

In qualitative inquiry, the dominant sampling strategy is purposeful sampling. Purposeful sampling seeks cases that can be studied in depth (Patton, 1990). The interview participants selected for this study were employed secondary teachers of the selected school division at the time of the study. Through this purposeful sampling, the participants were in various stages of their profession and years of service within the school division. The middle and high school teachers who indicated a willingness to participate were assigned a number and randomly selected using a table of uniform random numbers. Each participant was allowed to withdraw at any time. Selected participants were assured participant and individual school confidentiality in order to avoid identification.

Douglas (1985) stated that a point in a qualitative study at which the interviewer begins to hear the same information and therefore learns nothing new has reached saturation. The final sample size of this study was determined once the emergence of regularities, or saturation of information, was evident (Guba, 1978; Lincoln & Guba, 1985; Weiss, 1994; Rubin & Rubin, 1995).

Data Collection

The source of data collection utilized in this study included recorded interviews. This study utilized open-ended interview questions that allow for individual variations. An interview protocol was developed and tested via a pilot study (Appendix A). The pilot study was used to

ensure the interview protocol would elicit information pertinent to the research questions. Participants of the pilot study were asked to evaluate and provide suggestions to the protocol. At the conclusion of the pilot study, the feedback and interviews were synthesized and transcribed. The participants in the pilot study were teachers with various levels of teaching experience and one experienced professor associated with the doctoral program in which the researcher is enrolled.

Prior to the interviews, the researcher obtained approval from the school division selected to perform the study and obtained approval from the Virginia Polytechnic and State University's Institutional Review Board. The study's potential participants were contacted and notified of the study's purpose. In order to protect participant confidentiality, each teacher was assigned a pseudonym. The researcher was the only holder of any identifiable information. All information was stored on the qualitative software, NVivo, which utilizes its own password security in addition to the researcher's own password protected computer. Also, all recorded interviews and field notes were destroyed at the end of the study to further ensure participant anonymity.

The recorded interviews were conducted at a location and time that was convenient for the participants. Each participant was informed of their confidentiality and was asked to sign an informed consent form that adheres to the Virginia Polytechnic and State University's Institutional Review Board requirements (Appendix B).

Data Analysis

Bogdan and Biklen (1982) defined qualitative data analysis as "working with data, organizing it, breaking it into manageable units, synthesizing it, searching for patterns, and discovering what is important and what is to be learned" (p. 145). The researcher analyzed the participants' answers using Erickson's (1986) interpretive method of data analysis. Based on

Erickson (1986), the researcher created categories for the data as it was extracted. Category validity was substantiated by continually seeking to confirm or disconfirm evidence from the data corpus (Erickson, 1986).

Analysis began with the identification of themes that emerged from the raw data, called coding (Strauss and Corbin, 1990). As these themes emerged, the researcher began linking the themes to establish key categories as stated by Erickson (1986). Through continuous interviews, additional themes arose and any revisions or links to the categories were conducted. The final categories were then tested against the data corpus to ensure confirmation or disconfirmation of the evidence collected. A qualitative software program, NVivo, was utilized in the data analysis.

Credibility

Credibility in qualitative inquiry depends less on sample size than on the richness of the information gathered and on the analytical abilities of the researcher (Patton, 1990). In order to enhance credibility, Patton (2002) explained that a qualitative researcher "returns to the data over and over again to see if the constructs, categories, explanations, and interpretations make sense, if they reflect the nature of the phenomenon" (p. 570). The researcher kept a reflexive journal of the details regarding the research design and implementation, as well as the process of gathering, analyzing, and interpreting the data. The study procedures were designed to be systematic and rigorous, as the formal interviews were held in a structured interview environment.

This study utilized three techniques to establish credibility: triangulation, peer debriefing, and member checking. Triangulation enhances the credibility and rigor of a qualitative study (Rossman & Rallis, 2003). Triangulation of this study's data occurred through the analysis of the interview transcripts, researcher checking division's website, member checks, and the use of peer debriefing. Member checking and peer debriefing were used to hold the integrity of the data and

interpretation of the data.

The peer debriefer, a third year doctoral student, reviewed the interview protocol, interview transcripts, reflexive journal and provided feedback. Member checking was accomplished through sending each participant a copy of the interview transcript to verify accuracy.

Transferability

The reader may decide on whether or not the results can be applied to their situation by examining the setting selection, participation selection, procedures, and analysis strategies. The purpose of this study is, given the elimination of Type I barriers, to investigate how secondary public school teachers are utilizing the ISTE NETS and what barriers teachers perceive to be present that may inhibit technology integration in the classroom.

Dependability

Dependability refers to the appropriateness of the study's methodology, data analysis and data collection. Lincoln and Guba (1985) stated that dependability of a qualitative study is enhanced by the use of dependability audits. The dissertation chair and committee were the dependability auditors as they reviewed and approved the methodology of this study.

Summary

The purpose of this study was, given the elimination of Type I barriers, to investigate how teachers are utilizing the ISTE NETS and what barriers teachers perceive to be present that may inhibit technology integration in the classroom. The participants were purposefully sampled from a Virginia school division that currently has a one-to-one student laptop initiative.

The methodology utilized in this study included the qualitative naturalistic inquiry

approach. Through a pilot study, the interview protocol was revised and refined. Recorded interviews were conducted at a location and time convenient to the participants.

Key categories that emerged from the interview transcripts, field notes and reflexive journal are discussed in the following chapter. The findings of this study may help policy makers, school administrators, and the participants make more informative decisions regarding classroom technology integration.

Chapter IV

Results of the study

The purpose of this chapter is to present the research results and the analyses of data collected in this study. Data were gathered by interviews of participants and analyzed through qualitative procedures. The design of this study utilized the naturalistic inquiry strategy to gather the perceptions of 10 secondary teachers within a suburban county that has implemented a one-to-one laptop initiative in Virginia.

This chapter begins with a description of the selected school division's demographic information followed by participants' profiles. Interview data and an overall summary of the data analyses are also shared.

School Division Demographic Information

This study was conducted in a suburban public school division located in the Commonwealth of Virginia. This division has a total secondary student enrollment of approximately 30,000. The school division was selected for the purpose of this study as it began a one-to-one laptop initiative for its secondary teachers and students over 10 years ago (Table 2). Through this initiative, the school division eliminated a Type I barrier to the use of technology within the classroom (Ertmer, 1999). Also, the mission of the school division is to prepare students for success in the 21st century through the use of 21st century skills and the National Educational Technology Standards (NETS) (School Division Technology Website).

Table 2

School division technology infrastructure

High Schools	Middle Schools
• Staff: 1,700 Dell Latitude E6400	• Staff: 1,170 Dell Latitude E5400
• Students: 14,840 Dell Latitude E6400	• Students: 11,120 Dell Latitude E5400
• Labs: Dell desktops allocated to 58 labs across all high schools	• Labs: 350 iMac desktops allocated across 31 labs in all middle schools

Note. Adapted from selected division's website

Data Collection Procedures

A total of 75 secondary teachers were emailed the researcher's participation letter by the division's department of research and planning (Appendix B). The department utilized the Statistical Package for the Social Sciences (SPSS) software to run a random sample of secondary participants. In order to ensure saturation of data and participant home school randomness, the researcher requested the department to run the algorithm for 25 potential participants for high school and middle school teachers, respectively. The algorithm was run three separate times due to limited response from teachers. Each run of the algorithm contained new potential participants and did not include those from previous samples. Saturation of data was obtained after conducting five high school and five middle school teacher interviews.

The participants were directed to contact the researcher via email; interview locations and times were set at the participants' convenience. Prior to the beginning of the interview, the participants were asked to sign an informed participant consent form (Appendix C). The interviews were digitally recorded and transcribed; reliability was confirmed through member checking. Data from the interviews are presented by interview question and a summary of the

data is shared following each interview question. Table 3 lists the teachers' perceptions of technology integration in the classroom and indicates the frequencies with which they discussed various components included in each of the interview questions.

Profile of the Participants

Douglas (1985) stated that a point in a qualitative study at which the interviewer begins to hear the same information and therefore learns nothing new has reached saturation. In this study, data saturation was obtained after interviewing five high school and five middle school teachers. A code was developed throughout the findings of this study so that quotes could be attributed to the corresponding participant. Each participant is identified as a high school or middle school representation and by the sequence of interview. For example, H1 indicates high school interview one, while M2 indicates middle school interview two.

Interview Question 1.

Interview question one sought to gather demographic data from the participants. As shown in Table 4, there were a higher proportion of female respondents (60%, n=6) compared to male respondents (40%, n=4) who participated in this research study. The percentage of male and female teachers participating in this study may at first glance appear disproportional; however, the 2010 U.S. Bureau of Labor Statistics shows that among secondary teachers, 43% were males (MenTeach.org). Within the Commonwealth of Virginia, in 2010, 80% of teachers were female and 20% male (Virginia Department of Education, 2011). All participants were from different schools within the division with teaching experience ranging from four to 13 years and represented the core subjects (Table 4).

Table 3

Relative Frequencies of Teachers' Perceptions of Technology

Teacher Perceptions (Interview Questions)	Relative Frequencies
Types of instructional technology used	
Promethean Board™	7/10
Projection Capabilities	5/10
ActivInspire™	4/10
LCD Projector	3/10
Technology Use	
Daily	6/10
75% of the time	4/10
Projecting notes	5/10
Drill/practice	5/10
Foster Learning and Creativity	
Use projects	7/10
Student Communication	3/10
Activities for diverse learning styles	
Use self-paced software	6/10
Use "fill-in-the-blank" note-taking	6/10
Allow students to help others	3/10
Model digital-age work and learning	
Demonstrate via note presentation	10/10
Use Google to answer questions	3/10
Ask students to help others	3/10
Modeling and teaching safe and ethical use	
Cite sources in class notes/presentations	6/10
None; Depend on division training modules	4/10
Teach credible sources	3/10
Barriers to integrating more technology	
Time	8/10
Lack of power outlets	7/10
Students	4/10
Delivery of student laptops	4/10
Hardware/Software problems	5/10

Table 4

Profile of Participants

Code	Gender	Years of teaching experience	Subject taught
H1	Female	12	Math
H2	Female	6	English
H3	Female	5	Science
H4	Male	4	History
H5	Male	10	History
M1	Male	5	History
M2	Female	13	Science
M3	Female	8	English
M4	Male	8	Math
M5	Female	7	Science

Interview Question 2.

This question was developed to ensure the participants were working within an environment that contained not only the laptops provided but also other technology tools that could be used within the classroom. When asked what types of instructional technology they used in the classroom, all participants stated that they used the website created by the school division that resembles Blackboard™ . This website offers students and parents a variety of information including homework assignments and teachers' uploaded class notes and presentations. The site also offers the ability for discussion boards for students and teachers to communicate outside of school.

All of the participants indicated that the classrooms either contained a Promethean Board™ (N=7) or a LCD projector (N=3) that they used to display notes or activities. Of the teachers with a Promethean Board™ , a majority (N=5) stated that they use it primarily for its projection capability. The high school math teacher commented, "With the Promethean Board™ in my classroom, they [students] can come up and draw on the board, but that is just another way of displaying" (H1, p.1). The English teacher at the high school stated, "I am lucky enough to have a Promethean Board™ in my classroom so I can display my notes and PowerPoint™ presentations" (H2, p.1). The high school science teacher further supported the use of projection, "I am blessed that all of these rooms have a Promethean Board™ . I use that on a daily basis for projection" (H3, p.1). A high school history teacher said, "I actually use the Promethean Board™ as an old school projector. It is reliable" (H4, p.1). One of the middle school science teachers shared, "I have a Promethean Board™ in my classroom, so I use that to project my notes" (M5, p.1).

The Promethean Boards™ also have been installed with software, ActivInspire™ , which allows the teachers and students to manipulate images and use wireless hand-held devices to vote or answer questions. One participant stated, "…we just did an activity where they [students] can come up to the board and draw" (H1, p.1). When speaking about the types of technology used in the classroom, another teacher stated, "When I first came here, I was like all this technology scares me. Now, the more I am trained in it, the more I try to use it" (H3, p.1). At the middle school level, teachers worked with the students on basic computer skills using Microsoft Office™ , especially PowerPoint™ . "One of the first projects we did this year was how to make a PowerPoint™ presentation," stated one middle school teacher (M2, p.1).

Interview Question 3.

This question sought to investigate how often teachers used technology in the classroom (Table 5). A math teacher at the middle school shared his view on technology in the classroom early in the interview:

> I use the laptops as more of a resource a lot of times since I teach math rather than a tool. What I tend to do is print out what I want and have the kids do paper and pencil in class and have the website as a resource for them. Just because I feel like they need to have the paper pencil. They need to just do it. On the computer is not the same as writing and showing your work. It would just take forever to do that on a computer (M4, p. 2).

Table 5

Teacher Technology Use in the Classroom

	H1	H2	H3	H4	H5	M1	M2	M3	M4	M5	Total responses
Interview Question 3											
Use Technology Daily		x		x			x	x	x	x	6
Use Technology 75% of the time	x		x		x	x					4
Main use for projection		x		x		x		x		x	5
Main use for drill/practice	x		x		x		x		x		5

While this was not entirely a shared viewpoint amongst all of the participants, half of teachers interviewed stated that they use technology more as a resource than as a tool in the classroom. This use was seen more at the high school level than the middle school. The high school math teacher stated, "The laptop is more about them having access to a website more than

anything, but I do use them a lot" (H1, p.1). A high school history teacher commented, "We go on the web a lot to show different things because something might come up in the course of discussion" (H4, p.1). At the middle school, a science teacher said, "Most of my use is Internet - based and just random resources I have found" (M5, p.1).

Even though the participants stated that they use technology in the classroom anywhere from daily (N=6) to 75% of the time (N=4), they either used the technology for projecting notes (N=5) or for drill/practice instruction (N=5). High school responses ranged from, "We only do snippets of technology" (H1, p.3) to "if it fits in the lab, I will use technology. There are a lot of gizmos and such, but I think there is more benefit to a hands-on lab" (H3, p.3). The middle school teachers statements ranged from, "every day we have a warm up activity in Blackboard™ that they download and then we look at it on the Promethean Board™ " (M5, p.3) to "everything is on the website, class is set up kind of like an online college course would be" (M2, p.4).

In an effort to seek whether teachers were utilizing the ISTE NETS, the following interview questions were created that mirrored the ISTE NETS as seen in Table 1.

Interview Question 4.

The fourth interview question asked what instructional activities the teachers used that facilitates student learning and creativity in both face-to-face and virtual environments (Table 6). Teaching the curriculum and the State's content assessment was a major focus of both the high school and middle school math teachers. "As far as creativity, the SOLs [Standards of Learning] shoot creativity down" (H1, p.2). She continued to share, "Creativity is probably my lowest strength, so I probably don't do a good job of teaching it or incorporating it [into the classroom]. Yeah, I don't use technology for creativity in my class" (H1, p.2). Although she perceives that she does not use technology for creativity, she stated, "…with the regular stats class, which does

not have an SOL, I encourage them to be creative about how they set up a spreadsheet" (H1, p.2). The middle school math teacher was concerned about the time students spend on the computers, "What I found is that these sites are great, but they [students] really don't get the math basics because all of the time they spend on the computer" (M4, p.3). While he stated that integrating technology into the math classroom should be important he stated that teaching the content is most important, "I still found that every minute that they are not practicing is a minute we have lost on teaching the math skills that we cannot get back" (M4, p.3).

Table 6

Foster Learning and Creativity

	H1	H2	H3	H4	H5	M1	M2	M3	M4	M5	Total responses
Interview Question 4											
Use for projects	x	x	x		x	x		x	x		7
Use for student communication				x			x			x	3

The English teachers take a different view regarding creativity and teaching content. At the high school, H2 commented, "I always try to have some kind of little piece of creativity. They make digital movies, which certainly allows for creativity" (H2, p.2). The middle school English teacher uses creativity to increase student interest in the subject. When talking about teaching pronouns, conjunctions, interjections and prepositions, she stated, "I know that sounds really boring, but I make it come alive for them and more interactive because I take the book work and put in into the interactive website I've designed" (M3, p.2). In addition to that unit, she also shared that students, "will be talking about advertising techniques and they will be using MovieMaker™ to actually script and create their own movie of a controversial commercial"

(M3, p.2).

The high school science teacher is more apprehensive in her comment, "I have not done the interacting with each other. I am kind of afraid with freshmen, allowing them free range to do it. That has been a little bit outside my comfort level so far" (H3, p.3). She did state that even though she does not use technology for interaction among students, "…have a project every nine-week marking period, and I do usually incorporate technology into that in some way" (H3, p.3). A middle school science teacher also shares the high school view on creativity and technology stating; "The collaboration and creativity is not a strength on my part, but it is something I am cognizant of and working to improve and develop what I already do in the classroom" (M5, p.2). One middle school science teacher covers creativity through projects. She states, "I actually taught them how to make PowerPoints™ . They love the animations and the transitions" (M2, p.3).

Using the Promethean Board™ , one high school history teacher increases communication sharing, "Face-to-face, I use it [technology] to facilitate conversations" (H4, p.1). He poses a question on the Promethean Board™ and asks students to talk about the topic. This teacher understands that this is a limited use of technology indicating, "I tend to stick with the things the kids have had previous experience with. I am not a trailblazer" (H4, p.1). Another high school history teacher views the laptops as a potential distraction in the classroom by commenting, "Low-achieving students and students that struggle in school have behavior problems and you cannot give them a lot of freedom because they do not know what to do with it" (H5, p.2). His view of the classroom is more structured for classroom management purposes, "If you don't keep the class super structured, the ones on the outskirts are now gone" (H5, p.2). A middle school history teacher shared a differing viewpoint on teaching creativity, stating, "I try to have a

project at the end of every unit and usually that that requires some sort of technology or has a technology component to it" (M1, p.2). This teacher gave an example of how he, "…had the students create a virtual diary of a factory worker and the students used a lot of digital technology" (M1, p.2). Afterwards, the students presented their work to the class.
Within this area of the NETS the teachers talked about being structured in class and showed nervousness when it came to allowing students the freedom to utilize technology, especially when it came to technology in which the teachers were not experienced. Teachers utilized projects as a major component of teaching creativity using technology within the classroom. A middle school science teacher gave examples of projects she uses to teach creativity, "…they do a biomes project…a zoo builder" (M2, p.3).

Interview Question 5.

The fifth interview question pertained to students' diverse learning styles. The question asked teachers to describe some activities they have used that customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources (Table 7). The high school math teacher shared, "I give them [students] notes sheets that they fill in. It isn't really using technology, but I can then put the sheet on the Promethean Board™" (H1, p.3). In the high school English class, the teacher utilizes software to aid in addressing students' diverse learning styles, "Definitely self-paced stuff in ActivInspire™. Two of my classes are collaborative, so I have other teachers helping me in there. Sometimes we group them according to the ability level, but very rarely" (H2, p.2). The high school science teacher shared a similar comment regarding the use of software, "What I am working on learning is the ActivEngage already on the computers has a self-paced piece where kids can go at their own rate" (H3, p.3). One high school history teacher uses technology

in projects to address differentiation. He commented, "Anything they have to create allows me to kind of tailor to the individual. If the kid is excelling, then we enrich with the project. If the kid is struggling, we are going to reinforce" (H4, p.2). Similar to the math teacher, the other high school history teacher commented, "The notes are in fillable format. They take the notes sheet and fill in the missing words or sentence from what I show up on the board. This way, the kids can work at their level by adding more notes or just writing what I have" (H5, p.2).

Table 7

Activities for diverse learning styles

	H1	H2	H3	H4	H5	M1	M2	M3	M4	M5	Total responses
Interview Question 5											
Self-paced software		x	x			x	x	x	x		6
Fill-in-the-blank notes	x			x	x			x	x	x	6
Students help each other						x	x			x	3

The middle school history teacher uses one tool for differentiation as he stated, "In terms of differentiation, webquests are a great tool" (M1, p.3). One middle school teacher views differentiating as an opportunity for students to aid others as she shared, "Some kids are much faster than others. The kids that already kind of know it or are very fast at it; they go around and help me. They are my helpers, and I say, "Great. Go" (M2, p.2). Focusing on students whose language is not English, the middle school English teacher commented, "I am using Google Translate to take my notes that they would normally have in English. This way they can have it both ways, in their native language and also in English to help them with the ESL [English as a

Second Language] process" (M3, p.3). The middle school math teacher combines technology with a hands-on approach to differentiate as he stated:

> We have personal whiteboards or ActivEngage, I try to mix it up. With the white boards it is great because they can hold up their answers for me to see at the front of the room, so I don't even have to move away from the board if I am working with someone. (M4, p.4)

He stated that although the software that is installed on the laptops is useful, "The ActivEngage is not quite so individualized, but I can still look at the overall percentage that got it right so I know whether I need to stop or I can keep moving" (M4, p.4). Just as the other middle school teacher stated earlier, another middle school science teacher uses students as aides. She stated:

> Trying to keep them [students] active and also allowing them to become facilitators to help classmates that may not have the technological experience. Some of my more advanced students in this class become my facilitators, my go to kids, who can help those kids without bring attention to those weaknesses that they have. (M5, p.3)

As H1 stated, "I have really tried to customize based on learning style[s] this year," Teachers were very aware of the fact that students learn in different ways and the need to them to vary their teaching styles. However, the varying styles of differentiation are limited in scope. Providing notes in a form where students fill in missing information was a common activity shared by a majority of the teachers (N=6). Allowing students the ability to walk around the room helping others was mentioned by the middle school teachers (N=3). Using software that was included on the laptops to help the students pace their learning was the only true use of technology incorporated in order to aid students with diverse learning styles. Five other teachers shared similar views of software as H3, who stated "I am working on the Active Engage [that is] already on the computers [that] has a self-paced piece where kids can go at their own rate" (H3,

p.3).

Interview question 6.

This question sought to gain the teachers' perceptions of how they model digital-age work and learning (Table 8). The high school math teacher stated, "I think that you demonstrate it when you are teaching them. When I am showing them how to use Excel, they see me using it and building it" (H1, p.3). The high school English teacher shared a similar comment; "I am showing them how I use the technology and then requiring them to use it, which is teaching them without them really knowing it" (H2, p.2). The high school science teacher commented, "I think that they see me do presentations and stuff like that, the review of the notes and stuff. I think they realized how tough it can be in doing their own presentations last week" (H3, p.3). She stated that as the students presented, some of them had difficulty, "When they came up and did their presentations, I said, "See? It is not as easy as it looks!" (H3, p.3). One high school history teacher said, "I am always trying to use PowerPoint, the web, showing them examples, modeling the project, modeling how to log into a program and use it" (H4, p.2). Another high school history teacher stated, "I demonstrate how to use the technology when I am teaching. They see me using it and can then use it appropriately" (H5, p.2). The middle school history teacher shared, "I'm very, organized. Everything goes in folders and there are folders upon folders upon folders so that there's easy to follow pathway online to get to certain items and that's something the kids really, struggle with is digital organization" (M1, p.3). When asked, one middle school teacher was short and to the point, "Through modeling and daily use" (M2, p.4). The middle school English teacher added, "I hope by modeling that, they are also learning the beauty of trial and error and exploring the technology. I wish more adults were like this and not so hesitant" (M3, p.3). The middle school math teacher commented, "One of the things that has been really

in my head is that the more I use the technology, the more the kids will know that we are serious about it" (M4, p.5). Another middle school science teacher shared, "I model it in class on a daily basis. I provide them with different opportunities, not just from one website or resource, but from a variety of resources. I can give them some tech support, but they are usually better at the tech support than I am" (M5, p.3).

The teachers all stated that through modeling technology use, they feel that they are exhibiting their technology knowledge and skills. Even when it comes to the students knowing how to use some form of technology when the teacher does not, the participants felt that this increased collaboration with the class.

Table 8

Model digital-age work and learning

	H1	H2	H3	H4	H5	M1	M2	M3	M4	M5	Total responses
Interview Question 6											
Demonstrate through use	x	x	x	x	x	x	x	x	x	x	10
Have students use Google	x			x	x						3
Ask students for help								x	x	x	3

Interview Question 7.

Advocating, modeling and teaching safe and ethical use of digital information were the scope of the seventh interview question. The question asked teachers if and how they dealt with safe and ethical use of technology in their classrooms (Table 9). The high school math teacher was quick to comment, "I don't… at all. Because I don't do anything with actual writing, I have

never talked about the rules of using it. I have never talked about what is legal and illegal" (H1, p.4). The high school English teacher stated, "I make sure that when I take things off of Flicker, or images, I make sure that it is noted on the PowerPoint" (H2, p.3). She continued to comment, "If I borrow a flipchart off of someone's Promethean Planet.com, I always leave that person's page on the chart so they know I am giving credit to the person who made it" (H2, p.3).

Table 9

Modeling and teaching safe and ethical use

	H1	H2	H3	H4	H5	M1	M2	M3	M4	M5	Total responses
Interview Question 7											
Use citations when giving notes		x	x		x	x	x			x	6
None	x				x		x		x		4
Teach various reliable sources				x		x		x			3

In the high school science classroom, "When they are citing information, they have to show the URL. I showed them how you could find the URL, how to search Google and look for shareable images" (H3, p.3). One high school history teacher commented on credible websites, "I always tell them first to make sure that they are going to websites that are credible. I talk about what that would look like- maybe an .edu at the end or a museum website" (H4, p.3). He stated that within his notes he will, "cite the website or location that it came from unless it is teacher created" (H4, p.3). The middle school history teacher also shared concern regarding teaching students to seek credible websites, "We learn the difference between .gov, .edu, .com, .net, and what those mean in terms of the information on those sites" (M1, p.3). He also spoke of how

technology allowed for easier ways of cheating, "At the start of the year we talk about plagiarism. You talk about that with the code of conduct, but some of the activities, we talk about the dangers of researching on the Internet" (M1, p.3).

Another high school history teacher leaves this portion of technology education to the division. He stated that, "Truly, I don't do much of that. The students have to go through some training modules when they get the laptops. The modules talk about this stuff" (H5, p.3). One middle school science teacher said, "When they [students] get their computers, have training modules. If it is something I pulled, I note that the information is not mine" (M2, p.5). The middle school English teacher commented, "We talk about this a lot. We start talking about sources and reliable sources early on. I start with print first, and then work up. I model it for them by leading them through a research process" (M3, p.4). The middle school math teacher stated, "There is a website the county has that includes a series of self-study modules that the kids do. If I see my kids on sites that they aren't supposed to be on, then they lose their computer for the rest of the day" (M4, p.5). Another middle school science teacher shared, "I teach them about Internet behavior, what is appropriate and where. Whenever we use resources, I try to cite them on my worksheet or slides" (M5, p.3).

The teachers depend on the modules that the students are required to work through regarding the safe and ethical use of the Internet and technology. The vast majority used their modeling of citing sources used for notes and presentations as the primary way of teaching this tenet of the ISTE NETS.

Interview Question 8.

What the participants perceived as barriers to integrating more technology into their classroom was the focus of the final interview question (Table 10). Time, in general, was the

largest barrier that was mentioned among the teachers (N=8). All of the high school teachers spoke about time being a limiting factor (N=5). The math teacher at the high school commented, "If I had more planning time, I would want to take a few topics and put a lot of technology into them. I think we are asked to do so much. I can't be asked to do something else" (H1, p.4). She was also concerned with the division's technology mandates in regards to time, stating, "the hardest thing with the county is that every month there is something new" (H1, p.4).

Table 10

Barriers to integrating more technology

	H1	H2	H3	H4	H5	M1	M2	M3	M4	M5	Total responses
Interview Question 8											
Time	x	x	x	x	x			x	x	x	8
Lack of power outlets		x	x			x	x	x	x	x	7
Students		x	x			x			x		4
Late delivery of laptops		x			x	x		x			4
Harware/software issues	x		x	x			x	x			5

The high school English teacher spoke about time and professional development, "The time is a huge barrier, because I think that though the professional development days are well intentioned to show us the new technology, there is not time later to practice and play" (H2, p.5). The science teacher at the high school commented on time in regards to division technology mandate, stating, "The county is trying to be more of a showcase. Sometimes adding technology is not necessarily better for students. It takes time for us to learn this new stuff" (H3, p.5). Time, as a

barrier is not limited to high school. As the middle school English teacher stated she is so interested in technology that, "I will spend hours playing and figuring something new out. So, I would say that I spend a significant piece of my time on instructional technology in just learning how to bring it in to my classroom" (M3, p.5). However, she stated that, "There isn't a lot of time in a teacher's life. Just thinking about the other teachers in my building, there is already the apprehension about bringing the technology in to the classroom" (M3, p.5). She too commented on the professional development offered by the division, "There are already the time constraints- not enough time to spare, and then we have staff development days that aren't really used for staff development" (M3, p.5).

A majority of the teachers (N=7) stated that even though the county has had a one-to-one laptop initiative for years, there is a barrier of lacking power outlets within the classroom. Teachers in older buildings have limited outlets along the walls of the classroom. One middle school science teacher commented, "Our school was built 50 years ago, so the number of outlets available and the basic battery life on a computer when it is used throughout the day [is a barrier]" (M5, p.3). The classroom has limited outlets and, "Finding places for them to plug in when I only have plugs on one wall… just the logistics of that is hard" (M5, p.3). When talking about barriers, the high school English teacher shared that there are, "Not enough outlets. We have old buildings with a lot of cinderblock walls. It falls to the teachers to buy power strips" (H2, p.4). Thus far, she stated that she has, "spent $100 on power strips and then stretches them to the middle of the classroom so that everyone can reach them with their chargers" (H2, p.4). Even in newer buildings, power to recharge the laptops is an issue. When asked about barriers, the high school science teacher teaching in a newer school stated, "Power cords! I don't know why they didn't put them in the floor. The ceiling is nice, but you have to stand on a chair to get

them to come down" (H3, p5). She compared her current classroom to one she had last year, "It is obvious that these classrooms were designed with computers in mind. In my old class, we lost outlets during the renovation of the older school. That doesn't make sense when you are planning to incorporate technology" (H3, p.5). The middle school math teacher shared his views on outlets being a barrier, "This year I am in a room with outlets everywhere. There is no barrier at all. It really depends on the room you are in" (M4, p.7). He continued to state his perception of this barrier and technology integration, "There again, I would be less inclined to use the computers if I knew the first five minutes or more would be wasted as everyone was fighting to find an outlet" (M4, p.7). In his view, the lack of outlets "would make me less inclined to use the laptops" (M4, p.7).

Students were seen as a barrier to more technology use within the classroom. One middle school history teacher mentioned students not taking care of the laptops and also whether or not they even bring it to class. He said, "Whether or not they [students] charge their computers, whether or not they bring their computers, whether or not they take care of their computers, they treat them like trash sometimes" (M1, p.4). He gave an example of the lack of care some students have for their laptops, "You'll see kids walking from [neighboring high school] right up the road here and they are holding on to, they've got their computer open so they can listen to music and are holding on to just the screen" (M1, p.4). Students, as a barrier was continued in several of the teachers' comments (N=4). When it comes to students not bringing the laptops to class, the high school English teacher made a comment that was shared by several other teachers (N=4):

> The school that I teach at is supposed to be a one-to-one laptop initiative, but yesterday we took the [division benchmark] test all online and I have classes of 30-33 kids, and in

each class only 13 to 15 kids brought a laptop. (H2, p.3)

The science teacher at the high school was concerned about the amount of time it takes students to take out their laptops. "Sometimes it just takes such a long time for them to get the laptops out, log in, and get going" (H3, p.6). The problems with students did not end there in this classroom, "the end of whatever project you are doing, they [students] don't know how to save files properly. The beginning and end [of a project] waste so much time" (H3, p.6).

An unforeseen temporary barrier in this school division that has been a large barrier to technology use within the classroom has been a delay in issuing student laptops at the beginning of the school year. Once the student has signed the acceptable use policy and paid the laptop usage fee of $50, in the past, the division would quickly issue a laptop to the student. This year, however, there seemed to be a lack of power chargers. The middle school history teacher commented, "The 6th graders here, half of them still don't have their computers. They weren't given them yet because they don't have enough chargers and so I don't know when they are supposed to get them" (M1, p.5). The middle school English teacher spoke in frustration, "We are in a one-to-one county initiative, but this is week five of school, and about 25% of the eighth grade class do not have their own computers yet. That is significant, especially because we are supposed to use technology in our classes on a regular basis" (M3, p.4). She shared her concern about this barrier and some other teachers in her school, "a person who is already a little nervous about it or apprehensive [about technology]… this becomes almost an excuse. Well, the computers aren't here so I am just going to keep going with worksheets" (M3, p.4). This temporary barrier is focused at the middle school as the students are issued their laptops in sixth grade and are just re-issued the same ones throughout the rest of their schooling.

Technology will have its software and hardware problems. Half of the participants

commented on this being a barrier to using technology more in the classroom. The high school math teacher shared, "Now when I first started, I gave up on it [technology]. Every time we got started with something on the computer there were problems- the machines would shut down, the Internet signals would drop due to too much use" (H1, p.3). She did indicate that these issues have decreased over the years, "I will say these issues have gotten better. Those things happen a lot less frequently" (H1, p.3). One high school history teacher said about software problems, "There is nothing more frustrating. I brought in the carts, logged in- or tried to but couldn't because they didn't have user names. And then the Internet didn't work" (H4, p.7). He continued to state that this barrier made it, "the first and only time we have tried to do a WebQuest. I am not going to risk that again" (H4, p.7). The middle school English teacher spoke of, "Little things like the power going out. That happens every now and then. When you have this very elaborate lesson plan on the computer and the power goes out, and especially if you are being observed at the time, it is a problem" (M3, p.5). One added task the teacher must do is, "You always have to have back up plans- like a boy scout I guess. It is physical stuff like that that makes things difficult sometimes" (M3, p.5).

Although the division is well into its one-to-one laptop initiative, teachers perceive there are remaining barriers to an increased use in the classroom. It should be noted that during this study, the researcher noticed that the division posted a message on its website stating that it was working on a solution to a weeks long issue with its Blackboard-like site. Therefore, for several weeks, students and teachers had been unable to log in to upload notes, assessments or homework assignments. This issue was noted after the data were collected for this study and was not part of the interview questioning.

The third research question posed whether there was a relationship to teachers'

perceptions on technology use and their years of teaching experience or grade/subject level taught. The data show that there is equity of use and ideals regarding technology in the classroom among the teachers' gender and years of teaching experience. The difference in teacher perceptions can be seen in the level but the subject being taught.

Both math teachers share similar viewpoints on the teaching of ethics and safe use of technology, they both feel that it is not their position to teach this area of the ISTE NETS. The high school math teacher stated, "I don't, at all." (H1, p.4) when asked about how she models and teaches ethical and safe use of technology. Similarly, the middle school math teacher spoke about the division modules for the students and then stated, "If I see my kids on sites that they aren't supposed to be on, then they lose their computer for the rest of the day" (M4, p.7).

English teachers use technology not only for word processing but also creatively. The middle school English teacher creates a MovieMaker project that requires students not only to write a script but they will also be, "recording, doing voiceovers, and they will have to be looking at sources as well." (M3, p.2). In addition to creating digital movies, the high school English teacher has created a medieval webquest that will allow students to "build their own catapult" (H2, p.2).

The science teachers are more inclined to use technology when they see a fit for it within the curriculum as one teacher at the high school stated:

> There were some technology issues last year. And if something doesn't work in the first five minutes, I move on to maintain classroom management. If it fits in with the lab, I will use technology. There are a lot of gizmos and such, but I think there is more benefit in a hands-on lab. (H3, p.2)

Other than projecting notes and working on specific projects, the history teachers all spoke of

technology as a resource rather than an everyday tool. As one high school history teacher put it, "Students use the laptops once every 2-3 weeks. We use them a fair amount, but it is usually for enrichment or project-based" (H4, p.1).

Summary

It is clear through analyzing the data that no matter the home school of the teacher, the gender, or the number of years teaching experience, teachers within this one-to-one laptop initiative have varying perceptions of technology in the classroom. It is also noted through the data analyses that there was similarity among the teachers that teach similar subjects rather than levels of students taught.

All of the participants indicated having access to either a Promethean Board™ or LCD projector. Using technology within the classroom is primarily for drill/practice instruction or projecting notes to the class. Teachers who were nervous or were not experienced with technology tended not to use it to increase creativity within the classroom. Technology was mostly utilized as a tool for students to show creativity through projects.

Software that is available within the classroom was used to customize the content for students' diverse learning styles. The majority of teachers used notes in a format where students fill in missing information to aid their learning style.

All of the participants stated that through modeling technology use, they feel that they are exhibiting their technology knowledge and skills. There was a mix of responses in regards to advocating, modeling and teaching safe and ethical use of digital information. Teachers discuss this area of the ISTE NETS with their students, mainly regarding appropriate Internet sites and citing sources. Students must complete modules on the division's website at the beginning of the year.

The data indicated that there were several barriers that impeded increased use of technology in the classroom even when the division had removed a Type I barrier. The most discussed barrier was time. Teachers spoke about planning time, time to learn the technology and the lack of time they perceived they had following professional development. Although the division was in its tenth year of its laptop initiative, teachers discussed technology infrastructure as a barrier to technology use, specifically the lack of electrical outlets. Older schools were being renovated; however, one teacher stated that the renovation left fewer outlets within the classroom. A newer school also had electrical power concerns as expressed by one teacher who discussed having to figure out how to use the power cords that were installed in the ceiling. Students were also seen as a barrier to integrating technology. Mainly, students failed to bring the laptops to class and teachers perceived the lack of care students showed toward the laptops. One unforeseen barrier was the division's failure to order an appropriate number of chargers for some newly ordered middle school laptops. This caused some middle school students to be without a laptop into the fifth week of school. Software and hardware problems were also mentioned as a barrier to technology integration. Loss of power and loss of Internet connectivity caused teachers to have to create additional plans where the laptops would not be needed.

Chapter 5 describes the principal findings of this study and how this study reflects the literature on integrating technology in the classroom. The researcher's findings, conclusions, implications, and recommendations for further research are also presented in Chapter V.

Chapter V

Summary and Conclusions

The purpose of this study was, given the elimination of a Type I barrier, to investigate how teachers are utilizing the ISTE NETS and what barriers teachers perceive to be present that may inhibit technology integration in the classroom. It also investigated the Type II barriers teachers perceived to be present that may inhibit technology integration in the classroom. As Weston and Bain (2010) suggested, even in a one-to-one setting, computers should be integrated into the teaching processes of the school. This study provides a voice from practitioners whose responsibility it is to integrate technology into the classroom. This voice is silent in the current research base as Mouza (2008) suggested that there is limited research in the area of how, when, and to what degree laptops are used.

Summary of Findings

The purpose of this study was, given the elimination of a Type I barrier, to investigate how teachers are utilizing the ISTE NETS and what barriers teachers perceive to be present that may inhibit technology integration in the classroom. Three research questions were developed to guide this study. They are as follows:

1. How are activities that represent the ISTE NETS being used in the classroom?
2. What barriers do teachers perceive to be in place that causes them not to integrate technology consistently into their teaching practices?
3. How are the teacher perceptions related to their gender, years of teaching experience, grade level or subject level?

The qualitative methodology of naturalistic inquiry approach (Lincoln & Guba, 1985) was selected to gain teacher perspectives of technology integration in the classroom.

Finding One. Although teachers indicated that they use technology regularly, there is a discrepancy between their perceptions of use and level of integration into the classroom.

The school division provided the teachers a tool to project images through either the use of a Promethean Board™ (N=7) or a LCD projector (N=3). Most of the participants stated that they use technology on a daily basis, yet most of that use is for projecting topic notes or for student drill and practice. A high school science teacher commented, "I am blessed that all of these rooms have a Promethean Board™ . I use that on a daily basis for projection" (H3, p.1). Even with the functionality of the Promethean Board™ , the majority of those that had access to the tool used it primarily for its projection capability (N=5). A high school history teacher shared, "I actually use the Promethean Board™ as an old school projector. It is reliable" (H4, p.1). Therefore, teachers were not utilizing the more expensive Promethean Board™ with its increased interactive capabilities any more than those having a LCD projector or overhead projector at their disposal. Even though some of the participants (N=4) discussed using the installed interactive software ActivInspire™ and ActivEngage™ with the Promethean Board™ when it comes to differentiating their teaching for students' diverse learning styles, this usage was mainly related to tutorials or topic practice. The middle school math teacher added, "The ActivEngage is not quite so individualized, but I can still look at the overall percentage that got it right so I know whether I need to stop or I can keep moving" (M4, p.4).

Similar to what Muniandy, Mohammad, & Fong (2007) noted in their study of four Elementary school teachers in Oregon, this study's data noted that technology use was mainly utilized for PowerPoint™ presentations and projecting content information to students. The

findings from my research support the literature that stated most technology is under-used and limited to tutorials, remediation, and drills (Li, 2007; Project Red, 2010; Wozney et al., 2006).

Finding Two. The most common technology related activities that teachers used to facilitate student learning and creativity were projects.

The high school and middle school math teachers saw teaching the curriculum and the State's content assessment as more of a focus than this facet of the ISTE NETS. The high school math teacher shared, "As far as creativity, the SOLs [Standards of Learning] shoot creativity down" (H1, p.2). The science teachers commented that this area is a weakness for them; however they stated that they incorporate technology through the use of projects. Sharing her thoughts on this question, the high school science teacher noted that the students would, "…have a project every nine-week marking period, and I do usually incorporate technology into that in some way" (H3, p.3). The use of projects was further discussed by the middle school history teacher who incorporates technology into a project at the end of every unit that includes student creativity and presentation. The English teachers all stated that they used technology as a tool for students to show they understood the content through creating creative projects. Through creating movies to visiting interactive sites on the Internet, the English teachers all stated that they attempt to provide some creativity use with technology in every unit.

Finding Three. Teachers view their students as a barrier that inhibits technology integration into the classroom.

The students that were to be gaining 21st Century skills through the use of technology were seen as being a barrier to such lessons. Teachers commented on students' lack of computer care to failing to bring the laptops to class as a deterrent to using technology. A middle school history teacher commented on students as a barrier, stating, "Whether or not they [students]

charge their computers, whether or not they bring their computers, whether or not they take care of their computers, they treat them like trash sometimes" (M1, p.4). A participant made one specific comment:

> The school that I teach at is supposed to be a one-to-one laptop initiative, but yesterday we took the [division benchmark] test all online and I have classes of 30-33 kids, and in each class only 13 to 15 kids brought a laptop. (H2, p.3)

Dunlavey and Heinecke (2007) and Zucker and McGhee (2005) reported similar findings regarding students failing to bring technology with them. Middle school teachers stated that students would fail to bring the laptops to class, which would impede on the technology-based lesson (Zucker & McGhee, 2005). One study found that putting laptops on carts or distributing laptops, as classroom sets appeared to provide more consistent student access to laptops than allowing students to take them home (Shapley et al., 2010).

Teachers viewed the student laptops as a potential distraction in the classroom. When discussing using the laptops for creative uses, he stated that, "Low-achieving students and students that struggle in school have behavior problems and you cannot give them a lot of freedom because they do not know what to do with it" (H5, p.2). This finding corroborates what has been found in previous studies (Dunleavy, Dexter, & Heinecke, 2007; Lowther et al., 2008) that reported teachers see laptops as a potential classroom distraction.

Finding four. The lessons used by teachers to address different learning styles were limited in scope and were at lower levels.

The majority of discussion (N=6) was regarding how teachers presented notes to the class. Through the "fill-in-the-blank" note-taking method where the teacher projects notes on the board leaving out important information was a common use of technology. One high school

history teacher commented that, "The notes are in fillable format. They take the notes sheet and fill in the missing words or sentence from what I show up on the board. This way, the kids can work at their level by adding more notes or just writing what I have" (H5, p.2).

Allowing students the opportunity to walk around the classroom aiding other students was seen as an activity used to address various learning styles within the classroom (N=3). One middle school science teacher stated that she has, "Some of my more advanced students in this class become my facilitators, my go to kids, who can help those kids without bring attention to those weaknesses that they have" (M5, p.3).

Finding Five. The teachers used software that was included with the laptops to aid students with diverse learning styles.

Using the software that was included on the laptops to help the students pace their learning was the only true use of technology incorporated in order to aid students with diverse learning styles. Five teachers shared similar views of software as the high school science teacher, who stated, "I am working on the Active Engage [that is] already on the computers [that] has a self-paced piece where kids can go at their own rate" (H3, p.3).

Teachers perceived their modeling of class notes and/or PowerPoint™ presentations demonstrated their fluency of technology when it comes to digital-age work and learning. All of the participants felt that illustrating the use of their laptop while presenting the content successfully demonstrated their fluency of technology. The high school English teacher shared, "I am showing them how I use the technology and then requiring them to use it, which is teaching them without them really knowing it" (H2, p.2).

Finding Six. Teachers have a limited understanding of the ways to use technology available to them.

When some of the teachers stated that students might have technology questions of their own, the teachers commented that they would ask the class for help or instruct students to search via Google™ . A middle school science teacher stated, "I can give them some tech support, but they are usually better at the tech support than I am" (M5, p.3). This indicates that teachers are also aware of the potential digital-divide between them and their students (Knezek & Christensen, 2000; Prensky, 2001; Underwood, 2007). However, teaching a computer or technology skill by itself does not constitute technology integration into the educational process (International Society for Technology in Education, 2008).

Finding Seven. Teachers model ethical use of technology rather than discuss the topic in class.

The school division requires students to complete a series of training modules online at the beginning of the school year. Some of these modules discuss safe and ethical use of technology. As such, some of the participants (N=4) did not feel it was necessary to discuss such topics in class. When discussing teaching ethical use of technology, a high school history teacher commented, "Truly, I don't do much of that. The students have to go through some training modules when they get the laptops. The modules talk about this stuff" (H5, p.3). The middle school math teacher commented further, "There is a website the county has that includes a series of self-study modules that the kids do. If I see my kids on sites that they aren't supposed to be on, then they lose their computer for the rest of the day" (M4, p.5). The majority of the teachers (N=6) stated that they model ethical use of technology through citing sources on the class notes or slide presentations. The high school English teacher shared, "I make sure that when I take things off of Flicker, or images, I make sure that it is noted on the PowerPoint" (H2, p.3). A few (N=3) shared that within their curriculum, they teach students where to obtain credible sources for research.

The findings in this research study are consistent with the literature by suggesting that teachers are ill prepared in preparing students with technology skills. Studies have found that in order for teachers to prepare students for the 21st Century, teachers must be able to successfully integrate technology into the classroom (Bellanca & Brandt, 2010; Richardson, 2008). The NCES (2009) findings indicate that teachers integrate technology into the classroom at very low numbers. Nationwide, teachers described their use of social networking websites at 7%, using blogs or wikis at 9%, using testing software at 44%, and using drill/practice tutorial programs at 50% (NCES, 2009).

Finding Eight. Teachers are not using the ISTE NETS as a framework to support the integration of technology into the classroom.

The ISTE standards require teachers to demonstrate and implement meaningful technology use in their teaching. However, the data from this study suggest that teachers do not describe high levels of competence with the ISTE NETS. There was sparse evidence in educational literature that shows the existence of innovative, individualized, problem-based instruction using technology (Weston & Bain, 2010).

The research showed the most common uses for laptops within the classrooms were: writing papers, browsing the Internet, creating presentations, and taking assessments. These findings support recent studies that indicate that students most often use laptops in the classroom to conduct Internet research, create presentations and word process (Suhr, Grimes & Warschauer, 2010; Shapely et al., 2009).

The findings of this study are supported by the literature, which indicates that many teachers do not routinely use technology in the classroom (Bellanca & Brandt, 2010). As with the Bellanca & Brandt (2010) study, the participants in this study did show awareness of the

advantages of using technology in the classroom, but have not turned that knowledge into practice.

Finding Nine. The uses described by these participants centered on technology as a tool for a traditional form of instruction.

A high school history teacher said, "I actually use the Promethean Board™ as an old school projector. It is reliable" (H4, p.1). Similarly, a math teacher at the middle school shared his view on technology, "What I tend to do is print out what I want and have the kids do paper and pencil in class and have the website as a resource for them" (M4, p. 2).

This finding was consistent with research indicating that teachers use technology as a supplement to their pedagogy rather than utilizing technology as a reform agent to their current pedagogy (Ertmer et al., 1999; Chen, 2008; Mouza, 2008; Otenbreit-Leftwich et al., 2010). Larry Cuban (2001) discussed how, even in Silicon Valley schools situated in communities immersed in technology, traditional teaching and learning practices persisted.

Finding Ten. The teachers in this study indicated time as a barrier to technology integration.

The teachers discussed this barrier in regards to planning, learning new technology and also students taking too much time using technology. The science teacher at the high school commented on time in regards to division technology mandate, stating, "The county is trying to be more of a showcase. Sometimes adding technology is not necessarily better for students. It takes time for us to learn this new stuff" (H3, p.5). The math teachers felt pressure to ensure content mastery; therefore, they do not utilize the laptop as a tool within their natural content delivery. They have a fear of running out of time to cover the content as one middle school teacher stated, "I still found that every minute that they are not practicing is a minute we have lost on teaching the math skills that we cannot get back" (M4, p.3).

This finding is consistent with the literature which has indicated that one of the factors teachers report that results in low integration of technology is time (Cuban et al., 2001; Vannatta & Fordham, 2004; Chen, 2008; Al-Bataineh et al., 2008).

Finding Eleven. School infrastructure is an important factor when integrating technology.

Although the school division is in its tenth year of the laptop initiative, a majority of the participants (70%) commented on another Type I barrier, the lack of power outlets. The high school English teacher shared that there are, "Not enough outlets. We have old buildings with a lot of cinderblock walls. It falls to the teachers to buy power strips" (H2, p.4). This barrier was a concern not only for the teachers at older schools but also for those in newly built buildings. Even though the division is in the process of renovating some aging schools, one teacher mentioned that she lost outlets after the renovation. Teachers spent their own money on extension cords for students to have the ability to charge their laptops. The English teacher at the high school commented that she has, "…spent $100 on power strips and then stretches them to the middle of the classroom so that everyone can reach them with their chargers" (H2, p.4). Within the newer buildings, power outlets are perceived as a problem as they have been installed in the ceilings of the classrooms utilizing retractable extension cables. Teachers shared that the problem with these cables is that they continuously need to be pulled down and are out of reach. Technology infrastructure is a barrier seen in the literature that supports this finding (Schoepp, 2005; Snoeyink & Ertmer, 2002). This division is not alone when it comes to outlet issues, as Dunlavey and Heinecke (2007) indicate in their findings.

Within a one-to-one environment, there are software/hardware problems. The main issues that were discussed by the teachers were focused on connectivity with the Internet and sudden loss of power. The middle school English teacher spoke of, "Little things like the power

going out. That happens every now and then. When you have this very elaborate lesson plan on the computer and the power goes out, and especially if you are being observed at the time, it is a problem" (M3, p.5). While discussing barriers they perceive that inhibit integration of technology, one high school history teacher said, "There is nothing more frustrating. I brought in the carts, logged in- or tried to but couldn't because they didn't have user names. And then the Internet didn't work" (H4, p.7). He continued to state that this barrier made it, "the first and only time we have tried to do a WebQuest. I am not going to risk that again" (H4, p.7). The high school math teacher shared, "Now when I first started, I gave up on it [technology]. Every time we got started with something on the computer there were problems- the machines would shut down, the Internet signals would drop due to too much use" (H1, p.3). She did indicate that these issues have decreased over the years, "I will say these issues have gotten better. Those things happen a lot less frequently" (H1, p.3). Another example of a software problem came about a few weeks after data collection. The division posted a message on its website stating that it was working on a solution to a weeks long issue with its Blackboard-like site. Therefore, for several weeks, students and teachers had been unable to log in to upload notes, assessments or homework assignments.

Finding Twelve. Lack of inventory of power chargers at the middle schools was a barrier to technology use in a one-to-one environment.

An unforeseen Type I barrier was the school division's failure to order an appropriate number of chargers for some newly ordered middle school laptops. This caused some middle school students to be without a laptop into the fifth week of school. The middle school history teacher commented, "The 6th graders here, half of them still don't have their computers. They weren't given them yet because they don't have enough chargers and so I don't know when they

are supposed to get them" (M1, p.5). In addition to the history teacher, the middle school English teacher spoke in frustration:

> We are in a one-to-one county initiative, but this is week five of school, and about 25% of the eighth grade class does not have their own computers yet. That is significant, especially because we are supposed to use technology in our classes on a regular basis (M3, p.4).

Her concern was not solely with the students but also with teachers that may be apprehensive when it comes to technology in the classroom, "a person who is already a little nervous about it or apprehensive [about technology]… this becomes almost an excuse. Well, the computers aren't here so I am just going to keep going with worksheets" (M3, p.4). The literature supports the finding that without access to the technology, teachers are less likely to use technology in the classroom (Ertmer, 1999; Al-Batineh et al., 2008; Garthwait & Weller, 2005). If students are not able to obtain laptops, teachers are forced to make alternate plans that will not require students to access the Internet or require the teacher to print out the notes rather than utilize the division's website.

The final research question investigated how the teacher perceptions related to their gender, years of teaching experience, grade level or subject level. Literature indicated that teachers who had been teaching for longer periods of time reported less frequent use of technology (Russell et al., 2007) while other studies (Robinson, 2003; Snoeyink & Ertmer, 2002) suggested that veteran teachers may have less computer proficiency and confidence to integrate technology and thus limiting opportunities for changing their daily teaching practices.

Finding Thirteen. The subject taught is an indicator of teacher perceptions of technology rather than their years of experience or grade level.

The study showed that the data do not indicate a difference in teacher perception of technology based on years of experience or grade level taught. Rather, there is a relationship among teachers' subject level. The math teachers felt pressure to ensure content mastery and do not utilize the laptop as a tool within their natural content delivery for fear of running out of time to cover the content. While the middle school math teacher stated that integrating technology into the classroom should be important, he stated that teaching the content is most important, "I still found that every minute that they are not practicing is a minute we have lost on teaching the math skills that we cannot get back" (M4, p.3). He continued to state that; "I use the laptops as more of a resource a lot of times since I teach math rather than a tool (M4, p.2). The math teachers did use the laptops as a resource for students as a tutorial or drill/practice tool. The high school math teacher shared, "The laptop is more about them having access to a website more than anything, but I do use them a lot" (H1, p.1). The history teachers were much the same. They reported that technology is used more as a resource. The projection of images and notes were stated as the main use of technology even for differentiation.

The research showed the English teachers shared common viewpoints on technology. These teachers spoke of creative uses when it came to technology. They went beyond having students write papers by having them create movies and similar activities. At the high school, the English teacher commented, "I always try to have some kind of little piece of creativity. They make digital movies, which certainly allows for creativity" (H2, p.2). When talking about teaching pronouns, conjunctions, interjections and prepositions, the middle school English teacher stated, "I know that sounds really boring, but I make it come alive for them and more interactive because I take the book work and put in into the interactive website I've designed" (M3, p.2). She also shared that students, "will be talking about advertising techniques and they

will be using MovieMaker™ to actually script and create their own movie of a controversial commercial" (M3, p.2).

The study showed the science teachers were apprehensive when it came to technology. They were more inclined to use technology when they see a fit for it within the curriculum as one teacher at the high school stated:

> There were some technology issues last year. And if something doesn't work in the first five minutes, I move on to maintain classroom management. If it fits in with the lab, I will use technology. There are a lot of gizmos and such, but I think there is more benefit in a hands-on lab. (H3, p.2)

A middle school science teacher also shared the high school view on creativity and technology stating; "The collaboration and creativity is not a strength on my part (M5, p.2). She continued to state, "Most of my use is Internet based and just random resources I have found" (M5, p.1). Zucker & McGhee (2005) indicated in their study that science teachers used technology highly as a way to remain knowledgeable of recent scientific developments. In my study, however, the findings with the science teachers that participated show a contradiction to Zucker & McGhee (2005).

Discussion of Findings

Studies indicated that computer access is necessary but not sufficient for technology integration in the classrooms (Holcomb, 2009; Lowther et al., 2008; Mueller et al., 2008). The data from this study corroborated the findings in the literature. Although the division that was studied implemented a one-to-one laptop initiative over 10 years ago, teachers continue to perceive various Type I barriers that inhibit technology integration.

It was striking to find one major barrier at the middle schools, the lack of student access to laptops. This was due to the ordering of an insufficient number of chargers for new laptops. As a result, the teachers reported that the computers were not delivered to the students until the arrival of the chargers. At the time of the study, the fifth week of school, several of the middle school teachers commented that the students had yet to receive their laptops. This posed an obstacle for teachers of these students, as they were required to plan alternative activities for these students or print a copy of everything that was uploaded to the teachers' websites. At the time of the study, another external barrier outside of teachers' control was noted. The division's Blackboard-like website, according to the division's notice, had been inoperable for weeks. Therefore, students and teachers had been unable to log in to upload notes, assessments or homework assignments. The teachers all mentioned the division's focus on this particular website and its directive that all teachers use it for communication with students and parents.

Insufficient time to plan and prepare for activities that would integrate technology into the classroom was among the external factors most of the participants listed as to why their instruction did not always utilize technology. The participants reported that they were hesitant in allowing students to spend classroom time to work with technology or saw the barrier of students failing to bring their laptop to class. These findings support literature that posed similar results (Chen, 2008; Al-Bataineh et al., 2008).

The findings also suggested that teachers fail to fully implement all of the ISTE NETS when it comes to integration in the classroom. The reasoning of this failure may be a Type II barrier, the teachers' beliefs and/or the teachers' established pedagogy. One of the intentions of the ISTE NETS is to change the learning environment from teacher-centered to a student-centered environment (ISTE, 2008). However, the teachers' only student-centered activities

were unit projects. They were hesitant to go beyond using technology as a note taking, or drill and practice resource. This was consistent with research indicating that teachers use technology only as a supplement to their current pedagogy (Ertmer et al., 1999; Chen, 2008; Mouza, 2008; Otenbreit-Leftwich et al., 2010). This continued to support indications from researchers that a gap in the amount, frequency, and quality of technology integration into the classroom remains (Underwood, 2007; Prensky, 2009).

Implications

Implication One. School leaders should provide teacher training on pedagogy reform.

Palfrey and Gasser (2008) stated that, "…very few schools of any sort take the simple first step of giving teachers adequate training or any training at all, to help them teach using technologies in a way that supports their specific pedagogical mode." Educators must first understand the need for pedagogy reform in order to move with the pace of technology and students of the 21st century. Schools need to continue to provide opportunities for teachers to understand how their teaching should evolve (Jukes, 2008).

The findings of my study add supporting evidence for the critical importance of providing teacher training on pedagogy reform. This not only would include a shift toward student-centered teaching but also providing training on how technology can be used in reference to differentiated learning styles. Similar to what Cuban et al. (2001) observed, this study shows very little evidence of student-centered instruction. The teachers have adapted technology to fit familiar practices of teacher-centered instruction. Student-centered pedagogy training should be increased at the higher education as well as the school division level.

Implication Two. School leaders should create more planning time for teachers to integrate technology into their classrooms.

Teachers perceived that there are always new technologies and mandates to utilize them yet they have little time to do so. Therefore, administration should ensure that teachers are comfortable with the technology that is already in place prior to mandating any new technology be integrated into the classroom.

Implication Three. Administration should provide training to illustrate how technology can be used to accomplish the school improvement goals rather than allow technology to be a barrier.

This study showed that assessment mandates, either from the State or the division, are a major focus and concern for the teachers. According to Chen (2008), a system that focuses on high-stakes assessments as well as student competition can strongly discourage teachers from undertaking innovative initiatives such as technology integration.

Results of this study confirm the need for effective training of the ISTE NETS. Teachers should be able to indicate what facet of the ISTE NETS they are using in the lesson and effectively demonstrate their understanding. Teacher preparatory coursework should contain ISTE NETS education in regards to the content area.

This research indicated that students were seen as a barrier to teachers integrating technology into the classroom. One such concern was the lack of laptops being brought to the class by the students. As the high school teacher commented,

> The school that I teach at is supposed to be a one-to-one laptop initiative, but yesterday we took the [division benchmark] test all online and I have classes of 30-33 kids, and in each class only 13 to 15 kids brought a laptop. (H2, p.3)

Schools may provide classroom sets or carts of laptops rather than allowing students to take the laptops home. Although this may eliminate the barrier of students not having a laptop in class, it may create an economic divide outside of the classroom.

In this study, teachers commented on the lack of technology infrastructure when it came to power outlets for the laptops. As school divisions renovate aging buildings, leaders need to require additional electrical outlets be installed throughout the classroom. In the mean time, administrators should either budget for the purchase of additional laptop batteries for each classroom, or purchase power chords for teacher that will allow their students the ability to charge the computers while in the classroom.

Implication Four. Administration should train teachers within their content area.

The data from this study indicates that content teachers hold similar beliefs and perceptions toward technology by the subject being taught. To utilize this finding, professional development opportunities should be grouped by subject rather than in vague and generalized format.

Implication Five. Teachers should fully integrate computer use on a daily basis, thus encouraging student responsibility.

Teachers within this study stated they saw students as a barrier to integrating more technology into the classroom. However, the data show that although the teachers perceived that they used technology on a daily basis, the use was limited and rarely involved students using the laptops. As teachers increase the expectation of student use of the laptops in the classroom on a daily basis, this should reduce the students failing to bring the laptops to class as well as potentially increase student care of the laptops.

Implication Six. Administration should increase teacher accountability in regards to effective technology integration.

Just as in implication five, the same holds true for teachers. The administration should increase teacher accountability in requiring the effective use of the technology that is provided as well as increase student use.

Implication Seven. Administration should create a plan or consequence for student failure to bring laptops to school.

Increased teacher expectations of students bringing the laptops to class on a daily basis will increase the amount of students doing so but will not solve the entire lack of laptops issue. Therefore, the administration should create either a plan for students that fail to bring their necessary laptops to school on a daily basis, or create consequences that will encourage the students to begin to bring the laptops on a consistent basis.

Implication Eight. The school division should review its current infrastructure and create a plan to address technology integration issues.

Even in a division that initiated a one-to-one laptop environment 10 years ago, there are structural issues, mainly power outlet issues that must be answered prior to mandating full technology integration. As was seen in this study, older classrooms that were renovated lost power outlets while new buildings had a plethora of outlets but built into the ceiling, which created awkward access. Any division planning on implementing a similar environment should study a similar division, which has the technology in place in order to see how they are handling the power issue for laptops.

Implication Nine. School divisions should review purchasing and inventory protocols prior to mandating technology integration.

This study indicated an issue with middle school students not having the laptops available to them due to a purchasing error of power cords for the laptops. Therefore, during the fifth

week of school, these students could not access their teachers' website or resources covered in class. This issue also created an excuse for teachers that were uncomfortable with technology in the beginning. These teachers were less likely to begin creating lessons that utilized the student laptops once the laptops were finally delivered to the students.

Recommendations for Further Research

The research questions from this study focused strictly on how secondary core subject teachers utilized the ISTE NETS and what barriers they perceived that inhibited them from integrating technology into the classroom. This research also purposefully selected a school division that had over 10 years experience implementing a one-to-one laptop initiative for its secondary teachers and students. According to the selected division's 2015 technology plan, the division plans on moving to tablets in the next two years and digital textbooks in the 2012-13 school year (School Division's 2015 Technology Plan). The next step in the research process would be to consider other divisions that have implemented a one-to-one initiative, which have eliminated other Type I barriers or have attempted to reform teacher pedagogy toward student-centered activities.

An extension of this study would be to investigate a technology professional development program based on specific teacher subjects. The results could be correlated with specific content areas to inform the school district leaders to what extent the training increased teacher technology integration in the classroom. The study could be technology activity specific as opposed to total laptop usage.

Selecting a division within a state that has adopted the Common Core State Standards would create more generalizable results that could be utilized by other divisions adopting the common standards.

Examining other variables such as comparing divisions with and without one-to-one technology initiatives, students' achievement scores on the common assessments in these differing divisions and teacher preparation with the ISTE NETS.

Further research is needed to investigate the administrator's understanding, training and competence with technology and the ISTE NETS.

It would be informative to see how administrators evaluate technology use within their schools based on their knowledge of the 21st Century technology skills.

Research into this assumption and to what, if any, level technology plays should be a focus as we continue to push 21st Century skills.

Findings of this study add to the previous research indicating that teachers perceive external barriers to integrating technology regardless of eliminating one of the Type I barriers, access to technology. Results of this study suggest the key elements to the barriers that inhibit integration continue to be Type II barriers, teacher beliefs towards technology and teacher-centered pedagogy.

Reflections

This qualitative study requested secondary teachers within the selected division to be interviewed on their use of the ISTE NETS and perceptions of barriers to further technology integration into the classroom. The researcher was unable to receive enough responses to his request to participant until 75 high school and middle school teachers were contacted. A limitation to this methodology was the potential participants were invited via email which would assume only the teachers responding to the email were minimally technology savvy. Another limitation would be the teachers that participated in the study selected themselves into the study. A concern the researcher had among those that self-selected to be interviewed was any potential

bias on the part of the division, otherwise known as the "company line." The results were mixed enough that the researcher feels that he received a good mix of answers to assume there was no bias on any participants' part of the study.

The interview questions were set to assume teachers may or may not know the facets of the ISTE NETS. This served the interviewer well as the participants did not need any clarification of the interview questions. Also, the researcher sent the interview protocol to the participants when they responded to indicate interest to participate. It was noted by the researcher that this allowed some of the teachers to make notes on the interview questions prior to the interview. There were several teachers that indicated interest in the study and were sent the interview protocol but failed to set an interview appointment with the researcher. This may be due to the interview questions themselves as the teachers may have been hesitant to participate due to lack of knowledge of the interview topics or hesitation in concern over anonymity or lack of time to participate.

The literature and findings from this study indicated that technology implementation has yet to reach meaningful levels of integration into the classroom (Project Tomorrow, 2010; Jukes, 2008; NCES, 2009). There are many variables that continue to be barriers to teachers utilizing technology within the classroom. Even within a division that has long ago initiated a one-to-one laptop program, there are still external, Type I barriers to overcome, some of which are temporary. However, the Type II barriers, those of teachers' beliefs towards technology and teacher-centered pedagogy are areas that should be the focus of training and professional development. The lack of proper technology integration in the classroom will not prepare students to be able to compete in a global, technology-driven world if technology skills are not learned (eSchool News, 2010; Association of American Colleges and Universities, 2007).

Providing a 21st century education is the number one challenge facing public education today (National School Boards Association [NSBA], 2009).

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Appendix A

Interview Protocol

1) Tell me about yourself
    a. What subject do you teach, at what level, and how long have you taught?

2) What types of instructional technology do you use in your classroom?

3) How often do you use instructional technology in the classroom?

4) Using technology, what instructional activities have you used that facilitate student learning and creativity in both face-to-face and virtual environments?

5) Describe some activities you have used that customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources.

6) What are some ways you demonstrate fluency in technology?

7) How do you advocate, model, and teach safe, legal, and ethical use of digital information and technology?

8) What are some barriers that have prevented you from using technology on a daily basis in your classroom?

Appendix B

Participant Letter

Potential Participant:

You are invited to take part in a doctoral dissertation study that will engage core secondary school teachers in your county. This study aims to document your perspectives on integration of technology in your classroom and any barriers you perceive that limit its use.

As a high school assistant principal and former science teacher, I want to learn more about the integration of technology in a county that has initiated a one-to-one program. This study is solely for the purpose of my dissertation and is not being conducted by your school division. However, any findings of this study will be shared to the division leadership. All participants, schools and the school division will remain anonymous in all reports and presentations resulting from the study.

I believe that educators, parents, and policy makers can benefit from hearing the voices of secondary school teachers. This qualitative study will consist of an interview process. You will be asked a few questions which should last approximately 60 minutes. During the interviews, all participants will be asked to discuss experiences regarding the integration of technology in the classroom. The Virginia Tech IRB as well as your division's Department of Research and Planning have approved this study.

The interviews will not impact your instructional time. The session will be audio-recorded, transcribed, and reviewed for accuracy by each participant. After the audio recording is transcribed, the transcripts will be sent to you to review for accuracy. Only my advisor, a transcriber and I will have access to the audio recordings and the transcripts of the interview. The transcriber will be required to sign a confidentiality agreement.

I do not believe that you will encounter any identified risks during or upon completion of this study. Participation is voluntary and you are free to withdraw at any time.

If you are interested in aiding in my dissertation study, please contact me via email crobert8@vt.edu so that we may set a time and location at your convenience. I hope to conduct the interviews beginning as soon as possible and finish my data gathering by Thanksgiving break. Thank you for your assistance.

Sincerely,

R. Matthew Covington, Ed.S.
Doctoral Candidate

Appendix C

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Informed Consent for Participants
in Research Projects Involving Human Subjects

Title of Project: Integrating Technology in the Classroom: Teacher Perspectives

Investigator(s): R. Matthew Covington

I. Purpose of this Research/Project

The purpose of this project is to fulfill a dissertation requirement while soliciting your perceptions of technology integration into the classroom. Specifically, this study seeks your views on your use of the International Society for Technology in Education National Education Technology Standards (ISTE NETS) as well as any barriers to technology integration you perceive that keep you from integrating technology into the classroom. Your school division is not conducting this study. Findings from this study will enable readers of the study the opportunity to better understand the barriers teachers perceive to integrating technology. Through investigating these barriers and teachers' perceptions of technology, technology coordinators and administrative leaders will have the potential to discuss these barriers and determine appropriate ways to increase technology use in their schools.

II. Procedures

You will spend approximately 45-60 minutes participating in an interview that will be conducted at a site and time convenient to you that will not interfere with instructional time. You will be provided the interview protocol prior to the interview so that you may prepare and reflect on your experiences. The session will be audio-recorded, transcribed, and reviewed for accuracy by you. After the audio recording is transcribed, the transcripts will be sent to you to review for accuracy should you agree to share your contact information. Only my advisor, a transcriber and I will have access to the audio recordings and the transcripts of the interview. The transcriber will be required to sign a confidentiality agreement.

_____(Initials) I hereby consent to allow my interview to be audiotaped.

III. Risks

There are no anticipated risks with this study.

IV. Benefits

Although there are no direct benefits to participating in this study, it may afford you some time for reflection and better understanding of your use of technology in the classroom. However, the findings from this dissertation study will provide readers participants' perceptions of technology integration as well as any barriers to technology integration participants perceive when teaching in a division that has eliminated a Type I barrier, access to laptops. The findings will provide individuals a better understanding of

anything that may stand in the way of teachers utilizing technology more in the classroom which will allow leaders the opportunity to create plans that reduce these identified barriers.

V. Extent of Anonymity and Confidentiality

The information you share will be handled confidentially. Your information, your school as well as your school division will be assigned a pseudonym to preserve anonymity. The list connecting your name to the pseudonym will be kept in a secure file. At the conclusion of the study, all information pertaining to the interviews, including field notes and any listing of your identification, will be destroyed. The transcriber will be required to sign a confidentiality agreement. It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subjects involved in research. The Virginia Tech IRB and HCPS Department of Research and Planning have approved this study.

VI. Compensation

You will not be compensated for your participation in this study.

VII. Freedom to Withdraw

You have the right to withdraw from participating in this study at any time as well as declining to answer all questions. Your audiotape and any field notes will be destroyed at the time of your withdrawal. Should you decide to withdraw, please inform the investigator as soon as possible.

VIII. Subject's Responsibilities

Other than sharing your thoughts on the subject and providing any transcript corrections, you do not have any responsibilities. You will be provided a copy of the consent form for your records.

IX. Subject's Permission

I have read the Consent Form and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent:

Chair, Virginia Tech Institutional Review
Board for the Protection of Human Subjects
Office of Research Compliance
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, VA 24060

_____ Date_____
Subject signature

Should I have any pertinent questions about this research or its conduct, and research subjects'

rights, and whom to contact in the event of a research-related injury to the subject, I may contact:

R. Matthew Covington (804) 569.0544
Investigator(s) Telephone/e-mail

Travis Twiford, EdD. ttwiford@vt.edu
Faculty Advisor Telephone/e-mail

Departmental Reviewer/Department Head Telephone/e-mail
David M. Moore 540-231-4991/moored@vt.edu

Appendix D

IRB Approval

VirginiaTech

Office of Research Compliance
Institutional Review Board
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, Virginia 24060
540/231-4606 Fax 540/231-0959
e-mail irb@vt.edu
Website: www.irb.vt.edu

MEMORANDUM

DATE: July 11, 2011

TO: Travis W. Twiford, Robert Matthew Covington

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires May 31, 2014)

PROTOCOL TITLE: Integrating Technology in the Classroom: Teacher Perspectives

IRB NUMBER: 11-614

Effective July 11, 2011, the Virginia Tech IRB Administrator, Carmen T. Green, approved the new protocol for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at http://www.irb.vt.edu/pages/responsibilities.htm (please review before the commencement of your research).

PROTOCOL INFORMATION:
Approved as: **Expedited, under 45 CFR 46.110 category(ies) 6, 7**
Protocol Approval Date: **7/11/2011**
Protocol Expiration Date: **7/10/2012**
Continuing Review Due Date*: **6/26/2012**
*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:
Per federally regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals / work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.