5-2019

Teachers' Perceptions of 1:1 Technology Integration in Select Minnesota Secondary Schools

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Teachers' Perceptions of 1:1 Technology Integration in Select Minnesota Secondary Schools

by

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A Dissertation

Submitted to the Graduate Faculty of

St. Cloud State University

in Partial Fulfillment of the Requirements

for the Degree

Doctor of Education in

Educational Administration and Leadership

May, 2019

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Abstract

Statement of the Problem

While understanding and implementing technology integration in the education setting has significantly improved in the past few decades, little has been done to formulate a research-based best practice model that will follow a set of standards maintained by ISTE. Integration can be most successfully achieved through following a set of standards established by The International Society for Technology in Education – Standards for Educators. According to Ertmer (2015), teachers are expected to enrich teaching and learning despite a number of barriers that impede them such as lack of training, staff support, and hardware and software access. These continue to be issues for many teachers. Moreover, a teacher's belief in technology and their past experiences play a pivotal role in integrating technology into lessons, Ertmer (2015).
An examination of technology research in Minnesota displayed that one of the problems encountered by secondary school classroom teachers is the integration of technology into their teaching. Because school districts continue to experience barriers to technology integration, understanding those barriers and being able to develop a plan to address them will provide teachers with the support required to become more effective in their use of technology.

Study Purpose and Overview

The purpose of the study, in a select sample of Minnesota school districts, was to examine the relationship between teachers' self-reported technology competency, their ratings of the frequency, and quality of technology usage, in supporting their teaching, and the quality of the technology professional development they received. Furthermore, study respondents were requested to identify types of professional development that would increase their usage of technology in the teaching process and the barriers to technology integration in their schools and school districts. The following research questions were designed to support these aims:

1. How did select Minnesota teachers rate their level of technology competency based on ISTE standards?
2. How did select Minnesota teachers rate the frequency of their use of technology in supporting their teaching?
3. How did select Minnesota teachers rate the quality of their use of technology in supporting their teaching?
4. What did select Minnesota teachers rate as their level of need for further/additional technology professional development?
5. What did select Minnesota teachers identify as the types of professional development that would increase their usage of technology in the teaching process?
6. What did select Minnesota teachers identify as barriers to the integration of technology in their schools and school districts?

Key Findings

Prior to the leaders of school districts and individual schools considering adopting 1:1 technology programs, it would be advisable that a number of issues be weighed before adoption, including current staff knowledge and usage of technology, professional development needs, and potential barriers that may affect successful adoption.

Acknowledgment

Without question, completing a doctoral degree is the most worthwhile experience I have had as a professional. I would like to thank all members of Cohort V. The friendships I have developed were an unexpected bonus of my experience. They have provided me with great support and continual professional advancement. The phone calls, emails, and text messages of support will not be forgotten. The relationships I developed was the real win. A special thank you to my two roommates, Nate and James. You two opened the door to a total stranger and made me feel like we had been friends forever.

I would like to sincerely thank my dissertation committee members, Dr. Roger Worner, chairperson, Dr. Kay Worner, Dr. James Johnson, and Dr. David Lund. Professional, supportive, and caring are three qualities they have shown me. It didn't go unnoticed. A special message to Dr. Worner, who motivated me and showed a belief in my abilities. I owe you big time, pal.

To my mom and dad who have always shared their positive encouragement. You were the ones who put me on this path. I recognize the journey that you took which laid the foundation of my own way. I love you. To my brother, sisters, and nephew who have hearts of gold have been supportive and proud of my professional experiences–thank you and I love you.

To my extended family, friends, and colleagues, thank you for providing words of encouragement and support through this journey. Especially, the staff at Franklin Middle School, Bob, Scott, and Shane who have helped me become better as a person and a professional.

Finally, I would like to acknowledge the sacrifices that were made by my wife and daughters. Not only in this journey, but in everyday life. As an administrator, coach, or doctoral student, you've filled the gaps wonderfully. We have a great family and look forward to our future together. "Family is not an important thing, it's everything."~Michael J. Fox.

Dedication

It starts and ends with my family. I'm inspired each and every day by my wife, Karlene. An amazing wife, mother, and friend. Simply put–the best. I have wanted nothing more than to be a good dad to my three beautiful daughters. Bailey, Paige, and Piper, I hope I made you proud and inspired you to do great things in your life. Dream big, anything is possible.

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Chapter 1: Introduction

According to the National Education Technology Plan (U.S. Department of Education, 2010), delivering effective teaching can be accomplished through preparing teachers with the tools necessary to improve their competencies and expertise for the duration of their tenure. With technology being a part of everything teachers do, supporting student learning, increasing engagement, and building capacity are essential to transforming education. Ingersoll and Smith (2003) stated that over 50% of teachers leave the profession within the first 5 years of employment, and part of that number can be attributed to a lack of technology skills and support by unprepared practitioners (Kay, 2006). “The literature suggests that if we are going to change teachers’ technology practices, we also need to change the underlying beliefs that support and facilitate that practice” (Ertmer, 2015, p. 2).

A disconnect between teaching with technology and student ability was recognized in a statute enacted in 2001 under the No Child Left Behind (NCLB) Act. “NCLB bill requires each student to be technological literate by eighth grade through meeting technology literacy standards” (Learning Point Associates, 2007, p. 4). The International Society for Technology in Education (ISTE) joined the United States Department of Education in establishing a set of standards (ISTE Standards) that resulted in the creation of individual standards for teachers, students, administrators, coaches, and computer science educators (Learning Point Associates, 2007).

The ISTE standards provided guidelines for teachers to assess their level of technology aptitude. Most importantly, the ISTE*T (Teacher) standards provided a benchmark for determining disparities in school district staff development and training programs. Once identified, goals can be established to address those disparities. Chizmar and Williams (2001)

stated that regardless of the present level of technology competencies, teachers are seeking additional training by exchanging experiences involving usage and adoption; collaboration with staff members is the backbone to staff development opportunities.

Conceptual Framework

As schools continue to advance, teacher technology competency or teacher technology efficacy will continue to be at the forefront of technology integration. ISTE Standard for Educators (formerly known as ISTE*T) established guidelines allowed teachers to identify and meet their own standards and performance indicators (ISTE, 2017). Stager (2007) stated the changing demographics of students, the development of digital learning, and the schools urge to be innovative pushed the change in student technology standards (ISTE*S). Stager (2007) stated the change to student standards involved a modification to the teacher standards to ensure student success. Smith (2017) stated the focus used to be on supporting learning with technology. According to Smith (2017), the evolution from supporting the students to empowering them to a student-centered learning is ideal and the seven Educator Standards address the teacher's ability to adapt the curriculum with technology.

Statement of the Problem

While understanding and implementing technology integration in the education setting has significantly improved in the past few decades, little has been done to formulate a research-based best practice model that will follow a set of standards maintained by ISTE. Integration can be most successfully achieved through following a set of standards established by The International Society for Technology in Education–Standards for Educators. According to Ertmer (2015), teachers are expected to enrich teaching and learning despite a number of barriers that impede them such as lack of training, staff support, and hardware and software access. These

continue to be issues for many teachers. Moreover, a teacher's belief in technology and their past experiences play a pivotal role in integrating technology into lessons (Ertmer, 2015).

The National Education Technology Plan (U.S. Department of Education, 2010) stated that teaching is practiced in isolation and recognized that,

> These conditions exist because our education system and the institutions that prepare educators often fail to give educators the tools to do their job well. Our education system holds educators responsible for student achievement but doesn't support them with the latest technology the way professionals in other fields are supported. As a result, the technology of everyday life has moved well beyond what educators are taught and regularly use to support student learning. (p. 39)

Knowing the 1:1 technology available to each of the Minnesota secondary schools, the study intends to examine the link between teachers' self-reported technology competency and the frequency, quality, and value of technology usage by teachers in the technology process. As a result, the study endeavors to furnish the participating schools with insights that may be of value in planning professional development. It is anticipated that the findings of the study may provide an understanding of the types of professional development and training that may be required by school districts to embolden teacher use of technology at the classroom level.

An examination of technology research in Minnesota displayed that one of the problems encountered by secondary school classroom teachers is the integration of technology into their teaching. Because school districts continue to experience barriers to technology integration, understanding those barriers and being able to develop a plan to address them will provide teachers with the support required to become more effective in their use of technology.

The Purpose of the Study

The purpose of the study, in a select sample of Minnesota school districts, was to examine the relationship between teachers' self-reported technology competency, their ratings of the frequency, and quality of technology usage, in supporting their teaching, and the quality of the technology professional development they received. Furthermore, study respondents were requested to identify types of professional development that would increase their usage of technology in the teaching process and the barriers to technology integration in their schools and school districts. In this respect, the National Education Technology Plan (U.S. Department of Education, 2010) found that,

> The technology that enables connected teaching is available now, but not all the conditions necessary to leverage are. Many of our existing educators do not have the same understanding of and ease with using technology that is part of the daily lives of professionals in other sectors with this generation of students. The same could be said of many of the education leaders and policymakers in schools, districts, and states of the higher education institutions that prepare new educators for the field. (p. 48)

Demographic data were collected and analyzed to ascertain whether or not study respondents' ratings of technology competency and the frequency, quality, and value of technology usage varied on the bases of their years of teaching experience, school level, and hours of technology staff development.

Research Questions

Ritchie, Lewis and McNaughton-Nicholls, Ormston (2014) stated that a study's research questions–in conjunction with the method employed–result in the acquisition of purposeful data to guide the findings of the research.

The study intended to examine the perceptions of a select sample of Minnesota teachers on their technology competency and the support technology provided them in the teaching process. Furthermore, the study proposed to ascertain those barriers to technology integration that respondents encountered and the need for and types of professional development they identified as most valuable to them in the teaching process.

It was anticipated that the findings of the study would establish whether or not a relationship existed between teachers' self-assessments of their technology competencies, the quality of technology professional development they received and, further, the technology integration barriers they had encountered.

The study focused on an examination of the following six questions. It was intended that the results of the study would provide an understanding of professional development and training that might embolden teachers in their use of technology at the classroom level.

The research questions were as follows:

7. How did select Minnesota teachers rate their level of technology competency based on ISTE standards?
8. How did select Minnesota teachers rate the frequency of their use of technology in supporting their teaching?
9. How did select Minnesota teachers rate the quality of their use of technology in supporting their teaching?
10. What did select Minnesota teachers rate as their level of need for further/additional technology professional development?
11. What did select Minnesota teachers identify as the types of professional development that would increase their usage of technology in the teaching process?

12. What did select Minnesota teachers identify as barriers to the integration of technology in their schools and school districts?

Assumptions of the Study

The study focused on a select group of Minnesota secondary school teachers. The assumptions of the study were as follows:

- The participants in the study were assumed to be interested in technology integration as they teach in a 1:1 learning environment in their school districts.
- The participants in the study were assumed to have answered survey questions honestly and accurately.
- The definition of technology and technology integration were assumed to be inferred for the study.
- The participants in the study assumed the research method and instrument used to collect data were valid for their intended uses.

Delimitations

The parameter of the study, or delimitations, defines the boundaries and limits the scope of the study (Simon & Goes, 2013). The delimitations for the study were as follows:

- The study surveyed a select sample of secondary school teachers located in central and northwestern Minnesota school districts.
- The study was limited to middle school and high school teachers who taught grades 6-12 students.
- The study excluded teachers whose teaching experience was less than one year due to their probable inexperience causing them not to integrate technology in their classrooms.

- The quantitative method of inquiry utilized a questionnaire. By incorporating a questionnaire, the threat of internal validity was a concern.
- The researcher's experience with technology may have created a sense of bias.

Definition of Terms

Digital immigrant–Adults born before 1980 who have not always been exposed to web 2.0 resources (Palfrey & Gasser, 2008).

Digital Native–All students and some adults born after 1980 who have been exposed to ongoing technologies of the 21st century and web 2.0 applications (Palfrey & Gasser, 2008).

Self- Efficacy–Level of confidence a person has toward a task. A higher sense of efficacy commonly leads to higher levels of effort, motivation, and resilience with regards to the task (Bandura, 1982).

Technology Integration–Curriculum integration with the use of technology involves the infusion of technology as a tool to enhance the learning in a content area or multidisciplinary setting...Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally. The technology should become an integral part of how the classroom functions–as accessible as all other classroom tools. The focus in each lesson or unit is the curriculum outcome, not the technology. (Chapter 7: Technology Integration, U.S. Department of Education. National Center for Education Statistics (NCES), December 9, 2008)

Web 2.0–Gould (2010) defined Web 2.0 as "The social use of Web which allows individuals to collaborate, encouraging them to become active participants and/or producers in knowledge creation and to sharing information online" (p. 3).

Wiki's–allow users to create and edit Web page content using any browser (Cunningham, 2002).

Blogging–a web-based communication tool that engages people collaboratively by reflecting, sharing, and debating. Many blogs have large and dedicated readerships (Williams & Jacobs, 2004).

Social networking–web-based services that allow individuals to construct a profile within a bounded system, articulate a list of other users with whom they share a connection, and view and traverse their list of connections and those made by others within the system (Boyd & Ellison, 2007).

TPACK–Mirsha and Koehler (2007) defines TPACK as:

> the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones. (p. 66)

Mobile Learning–learning that takes place via handheld electronic device such as tablet computers or iPads and sometimes referred as e-learning (Joan, 2013).

Teacher Beliefs–have multiple definitions that are broad and complex. Kagan, (1992), who described teacher beliefs as "tacit, often unconsciously held assumptions about students, classrooms, and the academic material to be taught" (p. 65).

One-to-one (1:1) Learning Environment–every student having and utilizing a laptop or tablet, or other Internet-connected computing device in a K-12 setting (Lagarde & Johnson, 2014).

Organization of the Study

The study is presented in five chapters. Chapter I contains the introduction to the study, statement of the problem, purpose of the study, research questions, assumptions of the study, delimitations, definition of terms, summary, and conceptual framework. Chapter II presents a review of the related literature as it pertains to the historical context and benefits and barriers of technology integration experienced by select secondary school teachers. Chapter III presents the methodology employed in the study, including an introduction, the purpose of the study, research questions, replication of the study, participants, human subject approval, data collection procedures, data analysis, research design, procedures and timelines, and summary. Chapter IV details the findings of the study. Chapter V furnishes the summary of the data, conclusions, discussion, recommendations, and suggestions for further research.

Chapter 2: Teachers' Perceptions of 1:1 Technology Integration in Select Minnesota Secondary Schools

Literature Review

It is a current perception that technology is becoming an integral part of everyday life in a school (Department of Education, 2010). It is the challenge of the American educational system to leverage the learning sciences and modern technology to create engaging, relevant, and personalized learning experiences for all learners that mirror students' daily lives and the reality of their future (U.S. Department of Education, 2010).

The literature review consists of two sections focusing on research regarding technology integration in schools. The first section is a historical context of technology integration in schools in the last four decades. The second section features barriers to successful technology integration in schools.

Historical Context of Technology Integration

The history of technology integration spans only four decades, but over the past 40 years, unprecedented advances have been observed in computing and communication that have provided powerful technology resources and tools for learning (U.S. Department of Education, 2010).

In order for technology integration to occur in schools, educators must first understand the term (Earle, 2002). Researchers agree that technology integration is not about technology, rather it is about effective content delivery and practices (Earle, 2002; Hamilton 2007).

The integration of desktop computers into K-12 classrooms in the 1980s focused on teaching students the use of the Beginner's All-purpose Symbolic Instruction Code (BASIC) or Logo, an abbreviation for logotype (Ertmer, 2015). Ertmer (2015) stated that programming

languages were created to make the computer perform simple tasks, and over time educators gradually shifted their emphases from assisting students to learn about or from technology to helping them learn with technology.

After failure to produce satisfactory outcomes, numerous researchers commented on teachers' inability to incorporate the innovation into their teaching (Cuban, 1986; Hannafin & Savenye, 1993).

The 1980s and 1990s emphasized an increased need for programs to improve student learning. The response to this need was reflected by expanded implementation of computer technology into the curriculum (Cherian, 2009). Cherian found that across the country, pilot programs sought to improve student achievement by investing in programs aimed to enhance education beyond the traditional classroom.

Apple Classrooms of Tomorrow (ACOT)

The Apple Classrooms of Tomorrow (ACOT) project began in 1985, and it involved collaboration among universities, research agencies, Apple computer representatives, and a cross-section of K-12 schools (Sandholtz, Ringstaff, & Dwyer, 1997). Teachers received intensive training, and students were granted constant access to technology to write, analyze data, develop presentations, and conduct research. In a 10-year study of the effects of the project on student achievement, students involved in the study routinely used higher order thinking skills far beyond that which was expected for their grade level, demonstrating increased initiative to complete tasks (Barnett, 2003). Ringstaff, Yocam, and Marsh (2009) found, "Apple Classrooms of Tomorrow's research has demonstrated that the introduction of technology to classrooms can significantly increase the potential for learning, especially when it is used to support

collaboration, information access and the expression and representation of students' thoughts and ideas." (p. 1)

In addition, the aim of the teacher's environment was to establish a conventional and original way for students to utilize computers in a structured format (Bitter & Pierson, 2002). The intent was to create a model, technology-rich learning environment in which teachers and students could use computers on a routine, authentic basis (Bitter & Pierson, 2002).

Ertmer (2015) cited that in the early 1990s, computers were typically used to provide remedial, supplemental, or enrichment instruction for individual or small groups of students. In the mid-to-late 1990s, technology integration emphasized increasing students' productivity skills through the use of standard software programs such as word processing and spreadsheet applications. Educators gradually shifted their emphases from helping students learn about or from technology to helping them learn with technology (Ertmer, 2015).

Statham and Torell (1996) reviewed ten meta-analyses on the effectiveness of technology and its impact on student learning. They found that computer technology, when implemented properly, could profoundly impact student learning. They reported the following findings:

1. Student performance on tests: When properly implemented, the use of computer technology in education has a significant positive effect on student achievement as measured by test scores across subject areas and with all levels of students.
2. Impact on classroom instruction: When used appropriately, computer technology in classrooms stimulates increased teacher/student interaction and encourages cooperative learning, collaboration, problem-solving, and student inquiries.
3. Impact on student behavior: Students from computer-rich classrooms show better behavior, lower school absentee rates, lower drop-out rates, earn more college

scholarships and attend college in greater numbers than do students from non-computer classrooms.

4. Impact of computer use on subgroups: Computer-based teaching is especially useful among populations of at-risk students (Statham & Torell, 1996).

Nearly 10 years later, European researchers reported that technology, computers, in particular, do not increase student learning (Buckingham, 2007).

Similarly, Roschelle, Pea, Hoadley, Gordin, and Means (2000) reported from a study in 2000 that a team from Stanford Research Institute (SRI) International, an independent, non-profit corporation identified four technology enhancements that could aid children in learning: by active engagement; opportunities to participate in groups; frequent interaction and feedback; connections to real-world contexts.

Additionally, the results of Bransford, Brown, and Cocking (2000) reinforced Stathan and Torell's (1996) findings that the use of technology causes the real world to be brought to the forefront, allowing for curricula to provide layered enrichment by self-assessment, evaluation, and modifications. Teaching practices continue to expand by learning communities involving students, teachers, and parents.

Web 2.0. The term Web 2.0, conceived in 1999 by Darcy DiNucci, describes the "new" World Wide Web that permits users to interact and collaborate with each other with information flowing two ways–owner to user and user to owner.

Tucker (2014) and Gould (2010, p. 3) defined Web 2.0 as "The social use of Web which allows individuals to collaborate, encouraging them to become active participants and/or producers in knowledge creation and to sharing information online."

WEB 2.0 applications emerged in the mid-2000s, allowing both teachers and students to create and share information through, what is now considered to be, a participatory web (Ertmer, 2015). Singel (2005) suggested, “WEB 1.0 was commerce, WEB 2.0 is people, and WEB 2.0 is the catch-all descriptor for what is essentially much more dynamic Internet computing” (p. 6).

According to O’Reilly (2005), there are four primary levels of WEB 2.0 applications. O’Reilly defined level three applications as those that only exist on the Internet where a network connection is required such as eBay, Wikipedia, and Skype. Level two applications do not need to be online, as in the use of Flickr, which allows the sharing of photos on a database. Google Docs, spreadsheets, or iTunes are examples of level one applications that can be employed offline, but gain features “like” by being online. Level zero applications like Google Maps or MapQuest are largely utilized online.

Levy (2009) noted that WEB 2.0 has several modern applications including Wiki’s, Blogs, and Social networking. All or parts of these applications could be a part of a successful technology integration; however, this depends on teachers’ abilities to create socially active learning environments that encourage cooperative interaction, collaborative learning, and group work (Nelson, Christopher, & Mims, 2009).

Technology standards. It was not until the 1990s that The International Society for Technology in Education or ISTE, emphasized the integration of technology into the existing school curriculum (Bull, 2009).

ISTE developed ISTE Standards for Students (ISTE*S), Teachers (ISTE *T), Administrators (ISTE *A), Coaches (ISTE *C), and Computer Science Educators (ISTE *CSE). The ISTE standards are the benchmarks for learning, teaching and leading in the digital age and are widely recognized and are being adopted worldwide (ISTE, 2017).

Although the ISTE standards are being adopted worldwide, according to Bielefeldt (2012), assessing ISTE has been a concern since the standards were first published in 1998 and revised in 2007. For the purpose of assessment, instruction, or professional development, "ISTE-aligned" has been the term designated (Bielefeldt, 2012).

The concerns were centered on how educators quantify progress on technology standards, as stated by Martin (2015). Kyei-Blankson, Keengwe, and Blankson (2009) stated, "Monitoring and examining students' expectations and evaluation of faculty use of technology instruction is necessary to provide valuable feedback to educators and administrators regarding effective technology integration in teaching and learning" (p. 211).

In conjunction, The Partnership for 21st Century Skills (P21), a national organization that advocates 21st-century readiness for every student, was formed by a number of large businesses, educators, and government leaders. P21 presents a framework of an holistic view of 21st-century teaching and learning, and its members provide tools and resources to assist the U.S. education system by infusing content with the 4Cs–critical thinking and problem solving, communication, collaboration, and creativity and innovation (P21, n.d.).

Framework for teachers. Shulman (1986) recognized the need for a more coherent theoretical framework concerning that which teachers should know and be able to perform, including the content knowledge they needed to possess and how that content knowledge was related to good teaching practices (Archambault & Barnett, 2010). Shulman introduced the concept of pedagogical content knowledge (PCK) and defined it as extending beyond content or subject matter knowledge to include how to teach particular content (Archambault & Crippen, 2009).

Shulman (1986) stated that PCK contained, "The most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations–in a word, the ways of representing and formulating the subject that make it comprehensible to others" (p. 9).

Koehler and Mishra (2005) maintained that merely introducing technology to the educational process was not enough to ensure technology integration since technology alone does not lead to change. Rather, it is the way in which teachers use technology that provides the potential to change education (Carr, Jonassen, Marra, & Litzinger, 1998).

Koehler and Mishra expanded the definition of PCK adding technology as an essential component of the framework, creating technological pedagogical content knowledge (TPACK) (Archambault & Barnett, 2010). TPACK is a framework that introduces the relationship and the complexities of all three primary components of knowledge: technology, pedagogy, and content (Mishra & Koehler, 2006). Mishra and Koehler (2006) found that,

> Good teaching is not simply adding technology to the existing teaching and content domain. Rather, the introduction of technology causes the representation of new concepts and requires developing sensitivity to the dynamic, transactional relationship between all three components suggested by the TPACK framework. (p. 134)

The Three main components (see Figure 1) included in the TPACK framework are defined as:

1. Content Knowledge (CK)–"Teachers' knowledge about the subject matter to be learned or taught. The content to be covered in the middle school science or history is different from the content to be covered in an undergraduate course on art appreciation or a graduate seminar on astrophysics…As Shulman (1986) noted, this

knowledge would include knowledge of concepts, theories, ideas, organizational frameworks, knowledge of evidence and proof, as well as establish practices and approaches toward developing such knowledge" (Koehler & Mishra, 2009, p. 63).

2. Pedagogical Knowledge (PK)–"Teachers' broad knowledge about the processes and practices or methods of teaching and learning. They encompass, among other things, overall educational purposes, values, and aims. This generic form of knowledge applies to understanding how students learn, general classroom management skills, lesson planning, and student assessment" (Koehler & Mishra, 2009, p. 64).
3. Technology Knowledge (TK)–"Knowledge about certain ways of thinking about, and working with technology, tools, and resources. This includes understanding information technology broadly enough to apply it productively at work and in everyday life, being able to recognize when information technology can assist or impede the achievement of a goal, and being able to continually adapt to changes in information technology" (Koehler & Mishra, 2009, p. 64).

Pedagogical Content Knowledge (PCK), Technology Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK) complete the framework that associates one of the main three components with the other sub components comprising the overall theory of TPACK. Koehler & Mishra (2009) define TPACK as follows:

> TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the

problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones. (p. 63)

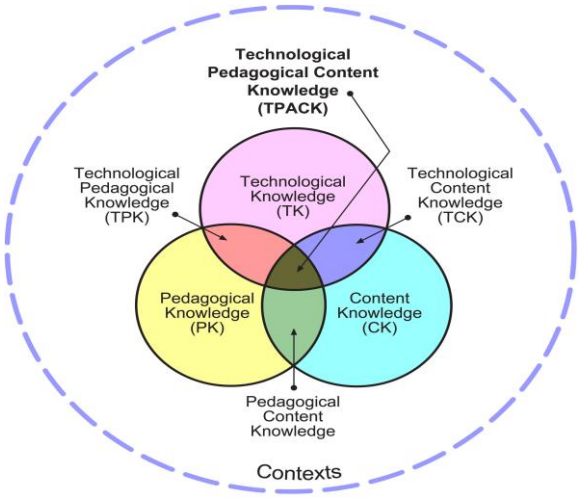

Figure 1. Three main components in the TPACK framework.

Mishra and Koehler (2006) suggested their model of technology integration in teaching and learning requires that developing content incorporates a thoughtful interweaving of all three key sources of knowledge: technology, pedagogy, and content.

Current Trends

The Pew Internet and American Life Project from 2008 predicted that the "mobile device will be the primary connection tool to the Internet for most people in the world in 2020" (Anderson & Rainie, 2008, p. 3). Using technology tools in a meaningful and engaging way enhances the education beyond the classroom. Providing technology standards and a teacher technology framework allows for progress in the continuously changing world of education.

In a Kaiser Family Foundation Study by Rideout, Victoria, Foehr, and Roberts (2010) on Media in the Lives of Eight to Eighteen Year-Olds, it was found that today's 8 to 18 year olds spend an average of an hour and a half daily using the computer outside of their school work.

This represents almost a half an hour more when compared to such usage 5 years ago. In the same study, it was found that home Internet access had expanded from 74% to 84% over the same time period.

Students once progressed from full-time cyber school learners to users of online courses as a supplement to involvement with schools, which participated in consortia that arranged options using a cooperative model (Wicks, 2010). It was reported that this was an option for only 5% of the students nationwide as lawmakers in each state established policies and laws that disallowed the practice.

The latest National Educational Technology Plan, "Transforming American Education: Learning Powered by Technology," outlined a vision to leverage the learning sciences and modern technology to create engaging, relevant, and personalized learning experiences for all learners that mirror students' daily lives and the reality of their futures (U.S. Department of Education, 2010).

An example of mobile learning in 2008 included a rural school in Ohio in which 49 teachers delivered instruction to 800 students in grades three through seven. Devices such as cell phones, tablets, or laptops were used at school and home over half of the school days and demonstrated dramatic increases in engagement and motivation by students. During the 2009-2010 school year, a second example of mobile learning took place at Cimarron Elementary School in Katy, Texas. Fifth-grade students were equipped with mobile devices for their use at school and home. Educators found significant student gains in mathematics and science compared to the previous year (Wicks, 2010).

Not all attempts at technology integration have been successful. The Los Angeles Unified School District (LAUSD) attempted a one-to-one iPad initiative for every student in the second

largest district in the country. The $30 million investment was short-lived when students "hacked" the district's security settings allowing students to access information on a non-secure device, thus, causing the LAUSD to cancel their contract with Apple (Chambers, 2014).

The technology culture has significantly changed over the past 40 years. Having adequate hardware and software is one of many obstacles to integrating technology successfully.

Barriers to Technology Integration

Despite the fact that technologies have achieved a substantial presence in schools (Education Development Center, EDC, 1996), there continues to be a number of issues that prevent teachers from effectively integrating technology in the teaching and learning process. In a review of past empirical studies, Hew and Brush (2007) identified over 123 different barriers to technology integration. Ertmer (1999) classified these barriers into two categories: extrinsic (first-order barriers) or intrinsic (second-order barriers). Typically, the first-order barriers that affect teachers are described as resources such as hardware, software, time, adequate training professional development, and support by administration and peers. The second-order barriers that affect teachers include personal beliefs, self-efficacy, and previous success.

Extrinsic or First Order Barriers

First-order barriers to technology integration are those obstacles that are extrinsic to teachers (Ertmer, Addison, Lane, Ross, & Woods, 1999). Means and Olson (1997) described such barriers as equipment, professional development, and support that are either missing or inadequately provided in teachers' implementation environments. Ertmer (2015) stated,

> Historically, school districts' efforts focused, almost exclusively, on eliminating first-order barriers, with the majority of efforts directed toward increasing access, support, and training. Consequently, schools have reported remarkable gains: student-

> computer ratios have been dramatically reduced while infrastructure, training, and support have been substantially increased to facilitate teachers' efforts. (p. 6)

Ertmer et al. (1999) acknowledged having to deal with numerous first-order barriers simultaneously might frustrate teachers who feel pressured to overcome every barrier before beginning the integration process. However, Donnelly, McGarr, and O'Reilly (2011) concluded that first-order barriers are easily removed once money is provided and, hence, are generally the barriers concentrated on first in reform efforts.

Although there are numerous extrinsic impediments to technology integration, the most common barriers that are advanced and addressed include hardware and software, training, and administrative and peer support.

Hardware/software access. The interpretation of access to technology may vary, but classroom teachers need access to hardware, the computer lab, and other technologies during the school day (Loehr, 1996; Schrum, 1995; Shelton & Jones, 1996; Sudzina, 1993). Failure to provide equality of access to technology is a barrier that will prevent integration (Eshetu, 2015, Gahala, 2001; Ritchie, 1996).

In the early days of the introduction of computers to classrooms, adopters focused on the innovation- computers, and software (Dwyer, 1991). As of 2009, The National Center for Education Statistics revealed that 97% of United States schools have computers with Internet access with a student to computer ratio of 1:7 (Gray, Thomas, & Lewis, 2010). Accessibility to resources does not guarantee successful technology integration implementation in teaching, but other barriers exist such as lack of high-quality hardware, suitable educational software, and access to resources (Balanskat, Blamire, & Kelfala, 2006).

Wager (1992) stated, “The educational technology that can make the biggest difference to schools and students is not the hardware, but the process of designing effective instruction” (p. 454). Viadero (1997) had a similar view on the secondary importance of equipment and software to pedagogy:

> Placing computers and software in classrooms is not enough. Discovering whether technology “works” is not the point. The real issue is when and under what circumstances. Like any other tool, teachers have to come up with a strategy or pedagogy to make it work. (p. 16)

Newhouse (2002) asserted that poor choices of hardware and software and a lack of consideration of their suitability for classroom teaching are problems facing many teachers. Every effort must be made to ensure that a “digital divide” does not separate students along gender, socioeconomic and ethnocultural lines (Flanagan & Jacobsen (2003). According to Bebell and O’Dwyer, (2010),

> Over the past decade, the belief was that increased access to and use of computers (and digital technology tools) would lead to improved teaching and learning, greater efficiency, and the development of critical skills in students motivated educational leaders and policy makers to make substantial investments in educational technologies. (p. 5)

Time for learning and professional development. In multiple studies, time consistently appeared at, or near, the pinnacle of any list of critical factors in trying to integrate technology (Leggett & Persichitte, 1998). The National Center for Education Statistics (2000) reported time as being the greatest barrier to the use of technology in instruction. The study examined two types of limitations: the lack of released time for teachers to learn, practice, or plan ways to use

computers or the Internet for instruction, and the lack of time in the schedule for students to use computers and the Internet in class.

Jones (2004) of the British Educational Communications and Technology Agency survey (2004) revealed,

> The problem of lack of time exists for teachers in many aspects of their work as it affects their ability to complete tasks, with some of the participant teachers specifically stating which aspects of ICT require more time including locating Internet advice, preparing lessons, exploring and practicing, and dealing with technical problems. (p. 15)

Leggett and Persichitte (1998) have been in situations and observed other teachers who had the expertise, the access, and the resources but were not allowed time to participate. The result was that technology implementation did not occur.

An overall, encompassing feature of adequate training includes professional development. As early as 1986, Guskey described staff development as "a purposeful endeavor. It is a deliberate activity generally undertaken with specific purposes or goals in mind" (p. 6). Staff development or teacher professional development, as a body of systematic activities designed to prepare teachers to do their job at several stages in their professional life, has become a major issue within educational research (Darling-Hammond, 1999; Darling-Hammond & Bransford, 2005). The preparation of quality teachers is considered the most important factor affecting student performance (Rivkin, Hanushek, & Kain, 2005).

An increasing number of researchers have asserted that formal training of teachers should be embedded in their daily practice, in particular when referring to the integration of technology into teaching (Lawless & Pellegrino, 2007). Although the number of professional development

opportunities for teachers has increased, an understanding of what constitutes quality professional development, what teachers gain from it, or its impact on student outcomes have not substantially increased (Fishman, Marx, Best, & Tal, 2003; Wilson & Berne, 1999).

Desimone (2009) suggested that in order for teachers to be prepared to use technologies in support of generative pedagogical development, the structure of teacher professional development programs is critical. A significant body of the research on teacher education has suggested that effective models of professional development include active learning, collective participation, and focus on content. According to Kubitskey, Barry, and Marx (2003):

> A design-based approach affords teachers the opportunity to learn how to use specific technologies situated in the context of their curricular needs. As a result, teachers take more ownership of the resources, have higher confidence in integrating the unit as a teaching tool, and are more likely to believe that the curriculum resources will have a positive impact on student achievement. (p. 594)

Borko, Jacobs, Eiteljorg, and Pittman (2008) highlighted several features that professional development programs should contain, including being situated in practice; focused on student learning; model instructional strategies; engage teachers in active learning; build professional learning communities; be integrated with other aspects of school change; be sustainable.

"Regardless of the amount of technology or its sophistication, technology will not be used unless staff members have the skills, knowledge, and attitudes necessary to infuse into the curriculum" (Baylor & Ritchie, 2002, p. 398). The authors concluded, in general, this is achieved through self-education or professional development. Schools can assist teachers by providing

in-service training that meet the needs of the staff and by promoting continual growth both within and outside the school boundaries (Baylor & Ritchie, 2002).

Access to the internet. In the fall of 2005, nearly 100% of public schools in the United States had access to the Internet, compared to 35% in 1994, including the move from dial-up to broadband (Wells & Lewis, 2006).

One often-overlooked consideration for school districts in their use of technology in the teaching and learning process is to ensure that access to the Internet is secure for students (Costa, 2012; Samsung & Meru, 2012). Under the Children's Internet Protection Act (CIPA), no school will receive E-rate discounts from the federal government unless it certifies that it is enforcing a policy of Internet safety that includes the use of filtering, or blocking technology (Wells & Lewis, 2006). The Department of Education (2010) stated,

> Ensuring student safety on the Internet is a critical concern, but many filters designed to protect students also block access to legitimate learning content and such tools as blogs, wikis, and social networks that have the potential to support student learning and engagement. (p. 56)

According to the Universal Services Administrative Company (2008) "CIPA has posed challenges to accessing school networks through students' cell phones, laptop computers, and other Internet access devices to support learning activities when schools cannot afford to purchase devices for each student" (p. 7).

Ritchie (1996) stated that the administrative support might be the most critical factor for teachers since it can have a direct influence on all of the other critical factors. Support comes in a variety of forms and as schools continue to acquire more technology for students to use, and as teachers are able to find more ways to integrate technology into daily instruction, the problem

will no longer be insufficient numbers of computers, but not enough time (Becker, 2000; Byron & Bingham, 2001).

Studies have found that educators are more likely to incorporate technology into their instruction when they have access to coaches and mentors who can engage in leveraging technology (Strudler & Hearrington, 2009). Similarly, Baylor and Ritchie (2002) stated "Regardless of the amounts of technology or its sophistication, technology will not be used unless faculty members have the skills, knowledge, and attitudes necessary to infuse it into the curriculum" (p. 398).

"If teachers are engaged in an explicit, integrated process of learning that includes mentored support and both individual and collaborative experimentation, they can develop their capacities to integrate technology actively and meaningfully into their own classroom practices" (O'Hara, Pritchard, Huang, & Pella, 2013, p. 206).

Intrinsic or Second-Order Barriers

Brickner (1995) defined barriers that interfere with or impede fundamental change as second-order or intrinsic barriers to technology integration. Donnelly, McGarr, and O'Reilly (2011) referred to second-order barriers as ones that have an impact on fundamental change and are typically rooted in teachers' core beliefs and are, therefore, the most significant and resistant to change.

Meaningful relationships among teachers' levels of computer use and their beliefs about, and confidence in, using technology was not a direct predictor of teachers' classroom applications (Russell, Bebell, O'Dwyer & O'Connor, 2003). Subsequently, the reduction or elimination of the first-order barriers allowed second-order barriers or issues to surface based on the research by the Apple Classrooms of Tomorrow (ACOT) (Sandholtz et al., 1997).

Teacher beliefs. Teacher beliefs are regarded as one of the most valuable constructs for teacher education (Kagan, 1992; Pajares, 1992). Some regard teacher beliefs, in relation to technology integration, as a combination of self-efficacy, beliefs about the value of technology, and beliefs about teaching and learning with technology (Park & Ertmer, 2008).

Russell et al. (2003) highlighted the same three components as predictors of teachers' classroom technology uses: pedagogical beliefs about teaching and learning, self-efficacy about technology use, and beliefs about the perceived value of computers for student learning are related and independent of each other.

Teacher beliefs have multiple definitions that are broad and complex. Kagan, (1992), who described teacher beliefs as "tacit, often unconsciously held assumptions about students, classrooms, and the academic material to be taught" (p. 65). Kagan (1992) and Pajares (1992) expressed that teacher beliefs have more influence on teacher practice than teacher knowledge.

Fulton and Torney-Purta (2002) explained teachers' beliefs regarding learning and technology as experiences they had with teacher preparation programs and early teaching assignments. Attempting to implement new methods without enough time to practice, pre-service teachers were likely to revert to traditional methods (Russell et al., 2003).

Becker (2000) conducted a survey among 4,000 U.S. teachers and concluded that teachers with a constructivist belief used computers more frequently and in more challenging ways than teachers with more traditional beliefs. Becker further asserted that teachers with the constructivist belief created environments in which students deepened their understandings by exploring how and when their knowledge applied to new situations.

Some researchers have described inconsistencies between teacher beliefs and their classroom practices (Calderhead, 1996; Ertmer, Gopalakrihnan, & Ross, 2001; Fang, 1996; Kane

et al., 2002). Etmer, Conklin, and Lewandowski (2001) reported that teachers' visions of, or beliefs about, classroom technology use did not always match their classroom practice. Despite the fact that most of the teachers described themselves as having a constructivist's philosophy, they implemented technology in ways that might best be described as representing a mixed approach, at times engaging their students in authentic, project-based work, but at other times asking their students to complete tutorials, practice skills, and learn isolated facts.

According to Ertmer (2005), if educators are to achieve fundamental or second-order changes in their classroom teaching practices, they need to examine the teachers themselves and the beliefs they hold about teaching, learning, and technology. Likewise, Marcinkiewicz (1993) voiced, "Full integration of computers into the educational system is a distant goal unless there is reconciliation between teachers and computers. To understand how to achieve integration, we need to study teachers and what makes them use computers" (p. 234).

Self-efficacy and previous success. Self-efficacy is the capacity to produce a desired or intended effect (Tschannen-Moran & Woolfolk, 2007). Teachers' knowledge of practice, underpinned by beliefs, is difficult to articulate as they are often times tacit and implicit within the practice of teachers (Berry, Loughran, Smith, & Lindsay, 2008). Teachers' beliefs and their ability to use technology play a significant role in the effectiveness of technology integration. Eachus and Cassidy (1999) stated, "Self-efficacy has repeatedly been reported as a major factor in understanding the frequency and success with which individuals use technology" (p. 2). However, it is not the only factor. Ability, knowledge, and skill must be present; without them, a high level of self-efficacy will not produce increased results (Schunk, 1996).

Schunk (1996) insisted that increased self-efficacy leads to increased performance. "A sense of self-efficacy for learning is beneficial because it motivates individuals to improve their

competence." (p. 5) In a study conducted by Niederhauser and Perkman (2008), teachers who were provided staff development in the discipline of technology exhibited a significant inflation in their self-efficacy. In a continuation of their research Niederhauser and Perkman, found that the same teachers, when administrated the same instrument, achieved the same results after finalizing their training.

According to Davis (1989) perceived usefulness and perceived ease of use are the two main variables in intentionally making productive and quality use of technology. As observed by Zuber ad Anderson (2013), "Teacher confidence and positive experiences is a major determinate of teacher use of technology across all subject disciplines" (p. 281). "It seems clear that examining teachers' intrapersonal beliefs is essential to our understanding of the teachers' predisposition to integrate technology into their classroom" (Niederhauser & Perkman, 2008, p. 109). Teachers who recounted positive experiences integrating technology in their classrooms had positive feelings regarding the utilization of technology in their classrooms (Glasset & Schrum, 2009).

Usage of technology. The growing phenomenon of 1:1 laptop or iPad initiatives in schools is increasing at a rapid race (Mueller, Wood, Willoughby, Ross, & Specht, 2008), though to date, there is a lack of evidence that connects the use of technology in 1:1 settings with measuring student achievement. However, when focused on educational outcomes and individualized learning using technology, teachers have been able to provide higher quality collaboration among students, project-based instruction, and further develop students' inquiry skills (Spektor-Levy & Granot-Gilat, 2012). Research has revealed that when teachers are able to use technology-rich devices in instruction, students become more apt to employ critical thinking and problem-solving skills (Gulek & Demirtas, 2005).

School districts throughout the country are utilizing technology initiatives to personalize learning for an increasing number of students. The success of these initiatives can be more effectively assessed by examining the value of teacher usage of technology, the frequency with which technology is used, and the overall quality of the technology used.

Value of teacher usage of technology. The value of using technology, at the aforementioned schools, included reports of lower dropout rates, above average college enrollment, and higher academic achievement Moeller and Reitzes (2011). Moreover, Spektor-Levy and Gronot-Gilat (2012) found that students who were taught in a 1:1 environment outperformed those who were taught in a conventional classroom setting.

Moeller and Reitzes (2011) reported that schools with technology-rich integration such as High Tech High School and New Tech Network have similar qualities including the use of project-based learning, course work in design and video production, and real-world legitimate events that occur in the workplace with an emphasis on the advancement of the student's 21st century skills.

To this point, one hundred percent of Tech High School's students enrolled in some form of college with over 80% transitioning on to a 4-year institution of higher learning; while New Tech Network schools reported a 0% dropout rate for two-thirds of their schools (Moeller & Reitzes, 2011). Technology use alone does not equate to student success. However, Moeller and Reitzes (2011) found that:

> Technology can support key practices of student-centered learning such as assessing individual students' strengths and needs, flexible scheduling and pacing, advising, presenting content in alternate forms, project-based learning, and involving the

> community. Technology also has been successfully integrated into curriculum-based and school-based approaches to personalize learning. (p. 45)

Efe's (2011) study of pre-service science teachers revealed not only their intention to use technology exceedingly more, but concluded a stronger belief in its value. Efe goes on to state that an increase of confidence in a pre-service teacher heightens their belief in the value of technology integration.

Bransford et al. (2000) believed the value of technology integration into the learning process can be accomplished in five different ways:

1. Bringing real-world experiences into the classroom.
2. Providing scaffolding that allows students to participate in complex cognitive tasks.
3. Increasing opportunities to receive sophisticated and individual feedback.
4. Building communities of interaction between students, teachers, parents, and other interest groups.
5. Expanding opportunities for teacher development.

Efe (2011) voiced that a teacher's belief in the value of educational technology in conjunction with a teacher's confidence in using technology heightens the use of technology within the classroom.

Frequency of technology usage. Becker (1999) stated the frequency of usage was the indicator of a teacher's capability to integrate technology. Whereas, Hsu (2010) defined usage as, "How much or how often a person is doing something" (p. 311). Hsu's study results suggested a teacher's capacity in integrating technology commonly demonstrated a greater usage of technology integration. Hsu used six constructs in the study based on a usage scale:

(a) Information collection and preparation;

(b) Material production and trouble-shooting;

(c) Communication and sharing;

(d) Planning, teaching and evaluation;

(e) Professional development and self-study;

(f) Ethical, health, and safety issues.

Hsu's (2010) study revealed,

> A positive correlation between teacher's ability and usage in technology integration, and suggest that well-trained teachers successfully integrate technology. Using the (ISTE-T) performance indicators for teachers' technology integration, this study found that teachers who regard themselves as having high ability in technology integration generally do more technology integration than those who report they have lower skill levels. (p. 320)

Quality of technology use. Bebell, Russell, and O'Dwyer (2004) stated that studies on technology can differ dramatically depending on how technology is being used and its specific intent. Multiple studies have related the use of technology to a teacher's ability and suspected that some lack the propensity and wherewithal to use the technology (Hsu, 2010). Additional factors that impeded teacher use of technology include staff development, support, and access (Windschitl & Sahl, 2002). Regardless of the factors, Earle's (2002) studied stated,

> The focus of integration is on pedagogy–effective practices for teaching and learning. Teachers need to be able to make choices about technology integration without becoming technocentric by placing undue emphasis on the technology for its own sake without connections to learning and the curriculum. (p. 12)

Bebell et al. (2004) suggests that quality technology integration is conceivable in developing teaching and learning practices.

Chapter III: Methodology

Introduction

Integrating technological tools and devices have become popular as aids in closing the achievement gap for schools and providing a nexus between all students as it creates a fairness in terms of access and communication in the classroom (Buckingham, 2007). The National Center for Education Statistics (2008) stated that, "When students are able to choose and use technology tools to help themselves obtain information, analyze, synthesize, and assimilate it, and then present it in an acceptable manner, then technology integration has taken place" (p. 79). However, according to Hechter, Phyfe, and Vermette (2012) "Administrative, technological, organizational, and philosophical barriers exist that seriously hinder the effective implementation of technology into classroom teaching and learning" (p. 137). Current research suggests that access to technology alone has limited effect on learning results from lower elementary to the conclusion of high school (Schaffhauser, 2017).

Whether the barriers to technology integration are primarily related to hardware or software, inadequate training, or self-efficacy, teachers continue to attempt to provide their students with the tools necessary to become prepared for the 21st century. It remains to be seen if the barriers outweigh the benefits of technology integration.

Included in the contents of Chapter III are an introduction, the purpose of the study, research questions, participants, human subject approval, data collection procedures, data analysis, research design, procedures and timelines, and a summary of the chapter.

Purpose of the Study

Due to the limited research that has been conducted on the topic, the purpose of the study, and select ISTE standards, was to examine the relationship between teachers' self-reported

technology competency, their ratings of the frequency, and quality of technology usage, in supporting their teaching, and the quality of the technology professional development they received in a select sample of Minnesota school districts. Furthermore, study respondents were requested to identify types of professional development that would increase their usage of technology in the teaching process and barriers to technology integration in their schools and school districts.

Research Questions

The research questions were:

1. How did select Minnesota teachers rate their level of technology competency based on ISTE standards?
2. How did select Minnesota teachers rate the frequency of their use of technology in supporting their teaching?
3. How did select Minnesota teachers rate the quality of their use of technology in supporting their teaching?
4. What did select Minnesota teachers rate as their level of need for further/additional technology professional development?
5. What did select Minnesota teachers identify as the types of professional development that would increase their usage of technology in the teaching process?
6. What did select Minnesota teachers identify as barriers to the integration of technology in their schools and school districts?

Participants

The participants in the study were secondary school teachers selected in a sample of four Minnesota secondary schools with grade level configurations of 5-8, 6-8, 7-12, and 9-12.

According to Slavin, (2007), “Samples of convenience are usually less problematic in experimental, single-case, and correlational research, where we are interested in relationships between variables” (p. 115).

The study’s sample was selected from among Minnesota secondary schools that were using 1:1 technology in their perspective school. Study participants surveyed included 166 secondary teachers. Teachers with less than 1 year of experience were not selected for participation in the study.

Human Subject Approval–Institutional Review Board (IRB)

The researcher completed the training on the conduct of the study involving human subjects as required by the St. Cloud State University Instructional Review Board on November 19, 2017. The study was found to be in compliance with the IRB and received authorization to conduct the proposed research on February 20, 2018.

The rights of all human subjects were preserved during the course of the study. Participation was completely voluntary with no penalty for non-participation. There would be no foreseen liability for participating in the survey, and the data will be confidential with no specific identifiers of participants’ answers. In addition, the participants may determine to abstain from any segment of the survey.

Upon completion of the study, a copy of the research findings will be furnished to each participating school or school district. Upon request, the researcher is willing to present the findings of the study to the staff, administration, and school board of the participating schools or school districts.

Instrument for Data Collection and Analysis

The study's survey instrument was constructed by the researcher based on the ISTE Standards and a review of the literature. The study's survey instrument is comprised of twelve questions. Seven of the instrument questions are adapted versions of the ISTE standards, gathering information on the respondents' perceptions of their technology literacy. Five of the instrument questions are intended to gather information about the frequency and quality of the use of technology in the classroom, the quantity and quality of technology staff development, the types of needed technology professional development, and barriers to technology integration in the school/school district.

According to Gall and Borg (2003), “The purpose of a survey is to use questionnaires or interviews to collect data from a sample that has been selected to represent a population to which the findings of the data analysis can be generalized” (p. 223).

Teachers responded to the Secondary School Technology Questionnaire developed by the researcher. In order to determine the teachers’ beliefs with regards to technology integration, the survey instrument will employ Likert-type items, requiring one of four forced-choice responses by study respondents: 1: strongly disagree; 2: disagree; 3: agree; 4: strongly agree.

Each teacher was asked to indicate the extent in which the respective statements characterized their beliefs by selecting the appropriate responses.

When each respondent has been scored, an aggregated school score was calculated for each item via internet-based Survey Monkey development system and compiled by the Center of Statistics at St. Cloud Stated University. This aggregated school score was determined to which degree teachers’ self-reported technology competency and the frequency, quality, and value of technology usage by teachers in the technology process.

The Center for Statistics at St Cloud University prepared the survey and provided the informed consent agreement and electronic survey link for distribution to participants by email.

Finally, a variety of research questions for the study were based around the ISTE Standards for Educators and its seven components: Learner, Leader, Citizen, Collaborator, Designer, Facilitator, and Analyst.

Research Design

The research design was a quantitative method of inquiry. According to Slavin (2007), "In quantitative research, researchers collect numerical data, or information, from individuals or groups and usually subject these data to statistical analyses to determine whether there are relationships among them" (p. 7). For the purpose of this study, a Likert-style questionnaire was used to collect numerical data from teachers belonging to four Minnesota Secondary Schools. Secondary School Technology Rating Questionnaire was used to collect data.

Procedures and Timelines

The research for the study was conducted in January and February 2018. After selecting the secondary schools that were part of the study, the researcher met with the respective secondary school principals and superintendents. Once permission to conduct the study has been obtained, the researcher began the data collection process by meeting with the teachers at regularly scheduled faculty meetings. Upon completion of the questionnaires, the data will be collected and analyzed.

The data collection process began by meeting with the superintendents, building principals, and teachers. The rational for this procedure was to seek approval, explain the importance of candid responses, to ensure that the terms of anonymity were guaranteed, and to conduct the survey in a timely and professional manner.

The researcher met with respective building principals prior to administering the survey. The meeting included an overview of the study and an opportunity to seek permission to conduct the study. The researcher was available to answer any questions or concerns by district representatives. Only 1:1 secondary schools were selected; electronically mailed potential respondents a brief description of the study's purpose and an invitation for participation; Follow up by researcher and principal along the fourteen day period

Summary

Through the quantitative research methodology, they study was able to gain comprehensive data regarding the research questions.

It was the researcher's goal to take the data and use the results of the study to be able to answer the stated questions and provide some insight into where teachers were in their provision of technology integration in their classroom lessons and activities and how to become better at doing so.

Chapter IV outlines the findings of the study organized by the research questions.

Chapter IV: Results

Introduction

With the dramatic increase in 1:1 initiatives in the United States, teaching which involves the use of technology has become more of a necessity than an option for many school districts. The increase in schools with 1:1 iPads, Chromebooks, or laptops has been a major methodological change in public education, providing technology tools to all learners and empowering their learning experiences. Providing students with technology access has supported the advancement of their academic horizons by providing them access to a wealth of resources that heretofore had not been available to them.

A literature review determined that teachers are increasingly using technology to assist in their planning, instruction, and assessment. Many of the obstacles teachers experienced a decade ago are no longer issues, though, there are still many barriers that prevent consistent usage of the technologies available to them. Barriers formerly were related to hardware and software, but now more frequently focus on time, support, and lack of professional development. Additionally, as a result of technology expansion, there has been more collaboration among students and staff, using technology as a vehicle for delivering instruction and differentiating that instruction at a higher level of quality.

An examination of research in Minnesota displayed that one of the problems encountered by secondary school classroom teachers has been the integration of technology into teaching. Because school districts continue to experience barriers to technology integration, understanding those barriers and being in a position to develop plans to address them will provide teachers with the support required to become more effective in using this valued tool.

Study Overview

The purpose of the study was to examine, in a select sample of Minnesota school districts, the relationship between teachers' self-reported technology competency, their ratings of the frequency and quality of technology usage in supporting their teaching, and the quality of the technology professional development they received. Furthermore, study respondents were requested to identify the types of professional development that would increase their usage of technology in the teaching process and barriers to technology integration they experienced in their schools and school districts.

Six research questions were developed to guide the study. The six study questions were as follows:

1. How did select Minnesota teachers rate their level of technology competency based on ISTE standards?
2. How did select Minnesota teachers rate the frequency of their use of technology in supporting their teaching?
3. How did select Minnesota teachers rate the quality of their use of technology in supporting their teaching?
4. What did select Minnesota teachers rate as their level of need for further/additional technology professional development?
5. What did select Minnesota teachers identify as the types of professional development that would increase their usage of technology in the teaching process?
6. What did select Minnesota teachers identify as barriers to the integration of technology in their schools and school districts?

The research design was a quantitative method of inquiry. According to Slavin (2007), "In quantitative research, researchers collect numerical data, or information, from individuals or groups and usually subject these data to statistical analyses to determine whether there are relationships among them" (p. 7). The data collection instrument for the study was the Secondary School Technology Rating Questionnaire which was designed by the researcher and employed multiple Likert-type items and one open-ended item. The instrument was used to collect numerical data from teachers serving in four Minnesota secondary schools. Results from the four participating schools were combined Data tables are provided and organized by individual research question. Results from the four participating schools were combined and tables designed to match each research question.

On research questions one and four, teachers were asked to rate on a Likert scale descriptive questionnaire from among the following four choices: 1 = Strongly Disagree; 2 = Disagree; 3 = Agree; 4 = Strongly Agree.

On research question two, teachers were asked to rate on a Likert scale descriptive questionnaire from among the following four choices: 1 = Never; 2 = A Few Times A Month; 3 = A Few Times A Week; 4 = Daily.

On research question three, teachers were asked to rate on a Likert scale descriptive questionnaire from among the following four choices: 1 = Poor; 2 = Fair; 3 = Good; 4 = Excellent.

On research question five, teachers were asked to describe the types of professional development that would increase their usage of technology.

On research question six, teachers were asked to choose from among six identified professional development opportunities and detail specific types of professional development that would increase their usage of technology.

The data displayed in the tables include percentages related to teacher beliefs, the frequency of their use of technology, the quality of their integration of technology, and the level of their need for professional development including specific types of technology that would increase technology usage in the teaching process.

The average completion time for the survey instrument was approximately 10 minutes.

Analysis of the data was conducted at the Saint Cloud State University Statistical Consulting and Research Center by utilizing the IBM Statistical Package for the Social Sciences (SPSS) version 22. The data for the four secondary schools were analyzed and reported collectively.

The sample survey was disseminated to teachers employed by four Minnesota secondary schools. There were a total of 182 potential teacher respondents. The number of respondents who indicated that they had read the information about the study and agreed to complete the Secondary School Technology Questionnaire was 154. When study surveys were gathered and tabulated, 134 teachers had completed the survey.

The survey was initiated on Monday, March 5, 2018 and concluded on Thursday, March 22, 2018. In each case, the potential respondents were sent emails with information describing the survey, administrative district support, and the link to complete the Secondary School Technology Questionnaire.

Findings: Research Question One

How did select Minnesota secondary school teachers rate their level of technology competency based on ISTE standards?

The research question was analyzed through an examination of participating teachers' responses to survey questions related to their levels of technology competency based on ISTE standards. Tables 1 through 7 provide the combined results of the respondents from the four participating Minnesota secondary schools.

The first instrument question sought to determine if teachers believed they improved technology practices based upon learning by themselves or by others. Respondents were asked to rate the degree to which they agreed or disagreed with the following statement: "I have been able to improve student learning through technology practices by what I have learned myself or by others."

Table 1 data indicate that 125 respondents or 89.9% reported they strongly agreed or agreed they were able to improve student learning using technology practices they had learned. The data reveal that 68.3% of the teachers agreed (n = 95) and 19.5% strongly agreed (n = 30) with the statement.

Table 1

Frequency of Teachers' Improvement of Student Learning Through Technology Learned

	Frequency # of Respondents	Percent
Strongly Agree	30	21.6
Agree	95	68.3
Disagree	14	10.1
Strongly Disagree	0	0.0
Total	139	100.0

The second instrument question sought to determine if teachers believed they supported student empowerment and success using technology practices based on what they had learned by themselves or by others. Respondents were asked to rate the degree to which they agreed or disagreed with the following statement: "I have been able to support student empowerment (e.g., exploration, analysis, evaluation) and success through technology practices I have learned myself or by others."

Table 2 data report that 117 respondents or 84.2% strongly agreed or agreed they were able to support student empowerment and success based on what they had learned by themselves or from others. The data depict that 66.2% of the teachers agreed (n = 92) and 18.0% strongly agreed (n = 25) with the statement, while 15.8% of teachers disagreed or strongly disagreed with the statement (n = 22).

Table 2

Frequency of Teachers Reporting Ability to Support Student Empowerment and Success Through Technology Learned

	Frequency	Percent
Strongly Agree	25	18.0
Agree	92	66.2
Disagree	22	15.8
Strongly Disagree	0	0.0
Total	139	100.0

The third instrument question sought to determine if teachers believed they inspired students to employ safe, legal, and instructional practices in their technology usage. Respondents were asked to rate the degree to which they agreed or disagreed with the following statement: "I have been able to inspire students to employ safe, legal, and instructional practices in their technology usage."

Table 3 data reveal that 108 respondents or 78.2% reported they strongly agreed or agreed they were able to employ safe, legal, and instructional practices in their use of technology. The data illustrate that 71.0% of the teachers agreed (n = 98) and 7.2% strongly agreed (n = 10) with the statement. Conversely, 21.7% of teachers disagreed or strongly disagreed with the statement (n = 30).

Table 3

Frequency of Teachers Reporting They Inspired Students to Employ Safe, Legal, and Instructional Practices Through Technology Learned

	Frequency	Percent
Strongly Agree	10	7.2
Agree	98	71.0
Disagree	30	21.7
Strongly Disagree	0	0.0
Total	138	100.0

The fourth instrument question sought to determine if teachers believed they collaborated with colleagues and students on technology to improve practices, share resources, and solve problems. Respondents were asked to rate the degree to which they agreed or disagreed with the following statement: "I have been able to collaborate with colleagues and students on technology to improve practices, discover or share resources, and solve problems."

Table 4 data reveal that 115 respondents or 84.5% reported they agreed or strongly agreed they were able to collaborate with colleagues to improve practices, discover or share resources, and solving problems. The data show that 61.0% of the teachers agreed (n = 83) and 23.5% strongly agreed (n = 32) with the statement, while 15.5% of teachers strongly disagreed or disagreed with the statement (n = 21).

Table 4

Frequency of Teachers Reporting Ability to Collaborate with Colleagues and Students on Technology to Improve Practices, Share Resources, and Solve Problems Through Technology Learned

	Frequency	Percent
Strongly Agree	32	23.5
Agree	83	61.0
Disagree	19	14.0
Strongly Disagree	2	1.5
Total	136	100.0

The fifth instrument question was posed to determine if teachers believed they used technology to design activities that work with student differentiation. Respondents were asked to rate the degree to which they agreed or disagreed with the following statement: "I have been able to use technology to design learning activities that recognized and accommodated student variability (differences)."

Table 5 data reveal that 106 respondents or 78.7% reported they agreed or strongly agreed they were able to design activities that recognize and accommodate student variability. The data report that 57.4% of the teachers agreed (n = 78) and 21.3% strongly agreed (n = 28) with the statement, while 21.3% of teachers strongly disagreed or disagreed (n =29) with the statement.

Table 5

Frequency of Teachers Reporting Ability to Use Technology to Design Learning Activities and Accommodate Student Variability Through Technology Learned

	Frequency	Percent
Strongly Agree	28	21.3
Agree	78	57.4
Disagree	28	20.6
Strongly Disagree	1	.7
Total	136	100.0

The sixth instrument question was posed to determine if teachers believed they facilitated learning with technology to support students taking ownership of their goals. Respondents were asked to rate the degree to which they agreed or disagreed with the following statement: "I have been able to facilitate learning with technology to support students taking ownership of their learning goals and outcomes."

Table 6 data reveal that 91 respondents or 67.4% reported they agreed or strongly agreed they were able to support students in taking ownership of their learning goals and outcomes. The data indicate that 55.6% of the teachers agreed (n = 75) and 11.8% strongly agreed (n = 16) with the statement, while 32.8% of teachers strongly disagreed or disagreed (n = 44) with the statement.

Table 6

Frequency of Teachers Reporting Facilitate Learning with Technology to Support Students Taking Ownership of Their Learning Goals and Outcomes Through Technology Learned

	Frequency	Percent
Strongly Agree	16	11.8
Agree	75	55.6
Disagree	43	31.9
Strongly Disagree	1	.7
Total	135	100.0

The seventh instrument question inquired if teachers believed they used technology to drive data decision making to support students. Respondents were asked to rate the degree to which they agreed or disagreed with the following statement: “To what extent do you believe you have been able to use technology to understand and use data to drive instruction and support students in achieving their learning goals?”

Table 7 data indicate that 95 respondents or 70.9% reported they strongly agreed or agreed they were able to use technology to understand and use data to drive instruction and support students in achieving their learning goals. The data reveal that 55.9% of the teachers agreed (n = 75) and 15.0% strongly agreed (n = 20) with the statement, while 29.1% of teachers strongly disagreed or disagreed (n = 39) with the statement.

Table 7

Frequency of Teachers Reporting the Use of Technology to Understand and Use Data to Drive Instruction to Support Students in Achieving Their Learning Goals Through Technology Learned

	Frequency	Percent
Strongly Agree	20	15.0
Agree	75	55.9
Disagree	33	24.6
Strongly Disagree	6	4.5
Total	134	100.0

Findings: Research Question Two

How did select Minnesota secondary school teachers rate the frequency of their use of technology in supporting their teaching?

The eighth instrument question sought to determine the frequency with which teachers used technology to support their instruction. Respondents were asked to rate the frequency of their use of technology for that purpose on the following statement: “How often do you use technology to support your teaching?” Response choices were never, a few times a month, a few times a week, and daily.

Table 8 data indicate that 61 respondents or 44.5% (n = 61) reported they used technology on a daily basis to support their teaching, while 34.3% of the teachers used technology a few times a week (n = 47) and 21.2% used technology either a few times a month or not at all (n = 29).

Table 8

Frequency of Teachers Reporting How Often They Used Technology to Support Their Teaching

	Frequency	Percent
Daily	61	44.5
A few times a week	47	34.3
A few times a month	26	19.0
Never	3	2.2
Total	137	100.0

Findings: Research Question Three

How did select Minnesota secondary school teachers rate the quality of their use of technology in supporting their teaching?

The ninth instrument question was structured to determine how teachers rated the quality of their use of technology to support their teaching. Respondents were asked to rate the quality of their use of technology by employing one of the four response choices–poor, fair, good, and excellent–to the following statement: "How do you rate the quality of your use of technology in supporting your teaching?"

Table 9 data reveal that 57 respondents or 41.6% reported the quality of their use of technology in support of their teaching was good. The data also indicated that 38.7% reported the quality of their use of technology to support their teaching was either fair or poor (n = 53), while 19.7% reported excellent (n = 27).

Table 9

Frequency of Teachers Reporting on the Quality of Their Use of Technology to Support Their Teaching

	Frequency	Percent
Excellent	27	19.7
Good	57	41.6
Fair	49	35.8
Poor	4	2.9
Total	137	100.0

Findings: Research Question Four

What did select Minnesota secondary school teachers rate as their level of need for additional technology professional development?

The tenth instrument question was posed to determine how teachers rated their need for additional technology professional development. Respondents were asked to rate the degree to which they agreed or disagreed with the following statement: "How do you rate your level of need for additional technology staff development?"

Table 10 data reveal that 93 respondents or 79.5% strongly agreed or agreed they were in need of additional staff development. The data illustrate that 60.7% of the teachers agreed (n = 71) and 18.8% strongly agreed (n = 22) they needed additional staff development. Conversely, 20.5% (n = 24) of teachers disagreed or strongly disagreed they needed additional staff development.

Table 10

Frequency of Teachers Reporting on the Need for Additional Technology Staff Development to Support Their Teaching

	Frequency	Percent
Strongly Agree	22	18.8
Agree	71	60.7
Disagree	21	17.9
Strongly Disagree	3	2.6
Total	117	100.0

Findings: Research Question Five

What did select Minnesota secondary school teachers identify as the types of professional development that would increase their usage of technology in the teaching process?

The eleventh instrument question sought to determine the types of professional development that would assist respondents in using technology more frequently. Respondents were asked to choose from among a list of five professional development options provided by the researcher and, also, an open-ended option in which study participants could cite additional types of professional development they viewed as worthy of mention.

Table data 11 reveal respondents' preferences for the following types of professional development that they believed would increase their use of technology: conferences (n = 34; 26.2%); mentoring or coaching (n = 32; 24.6%); participation in a network of teachers (n = 27; 20.8%); observation visits to classrooms (n = 22; 16.9%).

Table 11

Frequency of Teachers Reporting Types of Professional Development to Increase Usage of Technology

	Frequency	Percent
Conferences or workshops	34	26.2
Mentoring or coaching	32	24.6
Participation in a network of teachers	27	20.8
Observation visits to classrooms	22	16.9
College/ University Courses	2	1.5
Other	13	10.0
Total	130	100.0

Findings: Research Question Six

What did select Minnesota secondary school teachers identify as barriers they experienced in achieving technology integration in their schools and school districts?

The twelfth instrument question sought to determine the types of barriers that respondents believed prevented technology integration in their schools or school districts. Respondents were asked to choose from a list of five barrier options provided by the researcher and, also, an open-ended option in which study participants could cite additional types of barriers they viewed as worthy of mention.

Table 12 data indicate respondents viewed the following as barriers to the integration of technology in their schools or school districts: time (n = 70; 52.2%); hardware/software access (n = 19; 14.2%); and lack of professional development (n = 13; 9.7%). It should be noted that 21 respondents or 15.7% cited Other as an option with varying themes.

Table 12

Frequency of Teachers Reporting Barriers to Integration of Technology to Support Their Teaching

	Frequency # of Respondents	Percent
Time	70	52.2
Hardware/Software Access	19	14.2
Lack of professional development	13	9.7
Your personal beliefs	5	3.7
Self-efficacy	4	3.0
Peer Support	2	1.5
Other	21	15.7
Total	134	100.0

Summary

Chapter IV provided an introduction, the study's six research questions, data findings by research question, and analyses of table data by research question. The methodology employed in the study was quantitative in nature.

The study data collection instrument was comprised of 12 questions, 10 of which were force-choice questions and two of which were open-ended questions (Fink, 2009). The instrument was delivered on-line to respondents. Study respondents were 139 teachers from four Minnesota middle schools and high schools in which 1:1 technology methodologies were employed.

Chapter V provides a summary of the data, conclusions, discussion, limitations, and recommendations for further research and practice.

Chapter V: Conclusions and Recommendations

Study Overview

School districts throughout the United States have made technology a priority in their classrooms by providing devices to individual students despite the budgetary constraints those districts have faced. As such, tablets and laptops are continuing to expand as popular vehicles for engaging and deepening the learning experiences of students.

It has been a challenge for the American educational system to leverage the learning sciences and modern technology to create engaging, relevant, and personalized learning experiences for all learners that mirror students' daily lives and the realities of their future (U.S. Department of Education, 2010).

In examining literature on the benefits and barriers of technology integration, there was a significant volume of research conducted on this topic throughout the United States and the world. Nonetheless, the objective of the study was to broaden the accumulation of that research by examining technology integration in 1:1 settings in four Minnesota secondary schools.

The study gathered data from four Minnesota secondary schools that were engaged in the usage 1:1 devices to determine the technological barriers that were impacting classroom instruction, ascertain teachers' professional development needs, and probe teachers' personal views about technology in the classroom. The data were analyzed and the findings organized according to each research question.

Chapter V provides conclusions of the study, discussions of the significant findings, and limitations as they relate to the literature and research questions. Further, Chapter V contains recommendations for further research and professional practice.

Research Purpose

The purpose of the study was to examine teachers' self-reported ratings of their technology competencies, their ratings of the frequency and quality of technology usage in supporting their teaching, and the quality of the technology professional development received by teachers from a select sample of Minnesota school districts. Furthermore, study respondents were requested to identify the types of professional development that would increase their usage of technology in the teaching process and reduce barriers to technology integration in their schools and school districts.

For the purposes of the study and in order to address the research questions, 182 middle and high school teachers who were members of the Minnesota Association of Secondary School Principals (MASSP) were asked to complete the Secondary School Technology Questionnaire. Subsequently, study data were analyzed by St. Cloud State University's Center of Statistical Consulting and Research employing the IBM Statistical Package for the Social Sciences (SPSS) version 22.

Research Questions

Study data were analyzed and findings reported according to each of the following research questions:

1. How did select Minnesota secondary school teachers rate their level of technology competency based on ISTE standards?
2. How did select Minnesota secondary school teachers rate the frequency of their use of technology in supporting their teaching?
3. How did select Minnesota secondary school teachers rate the quality of their use of technology in supporting their teaching?

4. What did select Minnesota secondary school teachers rate as their level of need for additional technology professional development?
5. What did select Minnesota secondary school teachers identify as the types of professional development that would increase their usage of technology in the teaching process?
6. What did select Minnesota secondary school teachers identify as barriers they experienced in achieving technology integration in their schools and school districts?

Conclusions

The section addresses each research question and includes links to recent research and observations by the researcher regarding the study's results.

Research Question One

Research Question One: How did select Minnesota secondary school teachers rate their level of technology competency based on ISTE standards?

Research question one was designed for the purpose of determining the degree to which respondents rated their level of technology competencies based on ISTE standards. From the study's electronically distributed online survey, 139 responses were received from respondents. The more significant findings are detailed below.

- Nine of every 10 respondents reported they strongly agreed or agreed they were able to improve student learning using technology practices they had learned.
- Respondents who reported they strongly agreed or agreed they supported student empowerment and success based on what they had learned by themselves or from others totaled 84.2%.

- Respondents agreed or strongly agreed on 84.5% of occasions they were able to collaborate with colleagues to improve practices, discover or share resources, and solving problems.
- Respondents who reported they strongly agreed or agreed they were able to use technology to understand and use data to drive instruction and support students in achieving their learning goals totaled 70.9%.
- Slightly greater than 1 in 5 teachers (21.7%) disagreed or strongly disagreed they had the ability to employ safe, legal, and instructional practices in their use of technology, while 21.3% of respondents disagreed or strongly disagreed they had the ability to use technology to design learning activities that recognized and accommodated student variability (differences) and 31.9% strongly disagreed or disagreed they had the ability to facilitate learning with technology to support students taking ownership of their learning goals and outcomes.

Research Question Two

Research Question Two: How did select Minnesota secondary school teachers rate the frequency of their use of technology in supporting their teaching?

From the study's electronically distributed online survey, the researcher received 137 responses. The more significant outcomes were as follows:

- Teachers who reported using technology very little to support their teaching totaled 21.2%.
- Teachers who reported use of technology on a daily basis totaled 44.5%.
- Slightly greater than 1 in 3 teachers (34.3%) reported they used technology a few times a week.

Research Question Three

Research Question Three: How did select Minnesota secondary school teachers rate the quality of their use of technology in supporting their teaching?

From the study's electronically distributed online survey, the researcher received 137 responses from teachers. The most significant outcome is reported below:

- Teachers who rated the quality of their use of technology in support of their teaching as fair to poor totaled 38.7%

Research Question Four

Research Question Four: What did select Minnesota secondary school teachers rate as their level of need for additional technology professional development?

From the study's electronically distributed online survey, the researcher received 117 responses. The most significant outcome derived from an examination of the survey results was as follows:

- Data revealed that 79.5% of teachers strongly agreed or agreed they were in need of additional technology staff development.

Research Question Five

Research Question Five: What did select Minnesota secondary school teachers identify as the types of professional development that would increase their usage of technology in the teaching process?

The researcher received 130 responses from the study's electronically distributed online survey. The most significant outcomes derived from an examination of the survey results are reported below:

- Teachers who reported conferences or workshops as the preferred avenue to increase their usage of technology in their classroom totaled 26.2%; while teachers who reported being coached or learning from a mentor as the preferred vehicle to increase their usage of technology in their classrooms totaled 24.6%.

Research Question Six

Research Question Six: What did select Minnesota secondary school teachers identify as barriers they experienced in achieving technology integration in their schools and school districts?

From the study's electronically distributed online survey, the researcher received 134 responses. The more significant outcomes derived from an examination of the survey results are reported below:

- Responding teachers cited time (52.2%) as the greatest barrier for them in integrating technology into their school or school district.
- Twenty-one respondents or 15.7% reported some "Other" barrier for integrating technology into their school or school district. No specifics were provided by any of the respondents.
- Teachers who reported self-efficacy or personal beliefs were barriers to integrating technology into their schools or school districts totaled 6.7%.

Discussion

The study results found that teachers from four Minnesota secondary schools believed in technology integration, and 89.9% of those who responded to Secondary School Technology Questionnaire believed they were able to improve student learning using technology they learned. The researcher was led to believe that this was true due to the fact that respondents'

personal beliefs and self-efficacies rated extremely low on technology integration making a difference in their students' learning.

More than half (52.2%) of the respondents indicated time was the biggest barrier to integrating technology into lessons, and 69.5% of respondents expressed that they needed additional staff development to support their teaching. This revealed to the researcher that teachers need additional time to both learn more about technology and how to integrate the tools and resources with support.

It was interesting to note that staff development support was not confined to one particular format. Respondents differed on the staff development method they preferred from workshops to coaching and from observing or participating in a network of teachers.

One of the unanticipated results revealed in the study of the four school districts employing 1:1 devices was that 21.2% of the respondents (n = 29) used technology only a few times a month or never. Bandura (1982) defined self-efficacy as a personal judgment of "how well one can execute courses of action required to deal with prospective situations." It should be noted that peer support was evident in the schools as respondents related they collaborated as needed to support one another.

As the researcher reviewed the study data, it was interesting to note that over one in five respondents (n = 30; 21.7%) believed they did not have the ability to employ safe, legal, and instructional practices in their use of technology. When school leaders consider implementation of one-device per-student learning environments, it is suggested that school district leaders provide quality professional development on safe, legal, and instructional practices that benefit students.

Limitations

According to Roberts (2010), limitations are features of a study that are out of the control of the researcher and may negatively affect the results or the ability to generalize the data. Limitations of the study include the following:

- Respondents had the ability to complete the survey from a variety of technology devices, potentially resulting in biased data.
- It was determined that some survey questions lacked clarity, particularly those related to barriers to technology integration and types of professional development that would increase respondents' usage of technology in the teaching/learning process.
- Only 13.5% (n = 18) of respondents answered the open-ended question on the types of professional development that would increase their usage of technology in the teaching process. Answers provided were broad, thus disallowing specificity and conclusions.

Recommendations for Further Research

The following recommendations for further research or expansion of the study:

- It is recommended a comparison study be conducted on the academic effectiveness of traditional classrooms and the use of 1:1 devices in the classrooms.
- It is recommended a comparison qualitative study be conducted to interview teachers to ascertain strategies that may be of value in supporting their involvement in the implementation of 1:1 devices for students.
- It is recommended a study be conducted on the types of technology training designed for aspiring teachers that is provided in higher education teacher development programs in Minnesota.

- It is recommended a replication of the study be conducted with Minnesota elementary school teachers who work in 1:1 settings.
- It is recommended that qualitative study be undertaken to gain specific information on the extent of technology integration in secondary school instructional settings.
- It is recommended a study be conducted with a larger sample of Minnesota secondary schools than the four school districts involved in the study.

Recommendations for Practice

Prior to the leaders of school districts and individual schools considering adopting 1:1 technology programs, it would be advisable that a number of issues be weighed before adoption, including current staff knowledge and usage of technology, professional development needs, and potential barriers that may affect successful adoption.

The following recommendations for practices in the field are tendered by the researcher:

1. It is recommended that school district and building administrators consider undertaking a technology audit of their staff to ascertain the status of staff members' understanding and usage of technology in the teaching/learning process.
2. It is recommended that school district and building administrators consider providing increased training to their staffs on technology. A comprehensive professional development plan on technology integration is optimal.
3. It is recommended that school district and building administrators consider providing specific training to assist their staff in the use of technology to enhance the quality of instruction in the teaching/learning process.

4. It is recommended that school district administrators consider providing university professors in teacher preparation institutions feedback on technology requirements essential for aspiring teachers.
5. It is recommended that school district administrators consider initiating audits on the presence of technology barriers within their school districts in order to enhance the frequency and quality of technology usage by teachers in the teaching/learning process.

Summary

The study explored the integration of technology in select secondary school settings in Minnesota. The findings of the study, including conclusions, discussion, and recommendation for future study and practice, may be of value to school superintendents, principals, technology coordinators, or teachers as a reference on technology integration.

The study examined Minnesota secondary school teachers' roles in technology integration and how technology is utilized in the classroom setting. The study's results indicated that time, professional development, and purposeful planning for individuals using technology are essential for successful implementation. Further, engagement and student achievement are two main driving forces for classroom teachers who have found themselves challenged by having to transform the manner in which their instruction is being delivered to best meet the needs of the students. An interesting result from the study, to which school district leaders should pay attention, is that slightly more than one in five teachers participating in the study used 1:1 technology from a few times a month to never.

Students today only know the world as one that is connected–connected by the Internet with a device in hand. The integration of technology in the classroom has shown not only to be a

best practice but a necessity. The ever-changing world of education continues to evolve even as school districts consider adopting new curricula. A technology component within the curricula is critical. New teachers beginning their careers are expected to deliver content in a different way–non-traditional–and that requires a qualitative understanding and working knowledge of technology.

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Appendic A: Implied Informed Consent Form

Teacher Barriers and Benefits of Technology Integration Study
Implied Informed Consent

You are invited to participate in this study to determine your beliefs and barriers to technology integration. You were selected as a possible participant because you are a secondary school teacher. This research project is being conducted by Anthony Greene, for an educational doctorate.

Background Information and Purpose
The purpose of this study is to improve professional development among secondary school teachers by meeting their needs at their current level of competency.

Procedures
If you decide to participate, you will be asked to complete a survey which is completely anonymous so no one will be able to identify a specific individual's form. It is important that we have as many people as possible complete the survey to compile an accurate representation to better serve you.

Risks
There are no foreseeable risks associated with participation in this study.

Benefits
The questions on this survey were developed by reviewing the research on technology integration in secondary schools and identifying the factors based off the International Society for Technology in Education (ISTE) standards for educators. I cannot and do not guarantee or promise that you will receive any benefits from this study. The data will only be examined in group format. Your information will be confidential and no answers that could identify a specific individual will be used.

Confidentiality
Your information will be confidential and no answers that could identify a specific individual will be used.

Research Results
If you are interested in learning the results of the survey, a copy will be provided to the district office, or contact the researcher, Anthony Greene at 218.689.0583 or request a copy via US mail at 101 Westwood Ct., Thief River Falls, MN 56701.

Contact Information
If you have any additional questions please contact the researcher at 218.689.0583 or gran1304@stcloudstate.edu, or the advisor, Dr. Roger Worner, at 320.308.4265 or rbworner@stcloudstate.edu.

Voluntary Participation/Withdrawal
Participation is voluntary. Your decision whether or not to participate will not affect your current or future relations with St. Cloud State University, or the researcher. If you decide to fill out the survey and there are any questions you are not comfortable answering, you do not need to answer them. We ask you to please remember this information is confidential and is designed to help us serve you better. If you decide to participate, you are free to withdraw at any time without penalty.

Acceptance to Participate Your completion of the survey indicates that you are at least 18 years of age and you consent to participation in the study.

Appendix B: IRB Approval Letter

ST. CLOUD STATE UNIVERSITY
EDUCATION FOR LIFE.

Institutional Review Board (IRB)

720 4th Avenue South AS 210, St. Cloud, MN 56301-4498

Name: Anthony Greene

Email: gran1304@stcloudstate.edu

IRB PROTOCOL DETERMINATION: Exempt Review

Project Title: Teacher Benefits and Barriers of Technology Integration in Secondary Schools

Advisor Roger Worner

The Institutional Review Board has reviewed your protocol to conduct research involving human subjects. Your project has been: **APPROVED**

Please note the following important information concerning IRB projects:

- The principal investigator assumes the responsibilities for the protection of participants in this project. Any adverse events must be reported to the IRB as soon as possible (ex. research related injuries, harmful outcomes, significant withdrawal of subject population, etc.).

- For expedited or full board review, the principal investigator must submit a Continuing Review/Final Report form in advance of the expiration date indicated on this letter to report conclusion of the research or request an extension.

-Exempt review only requires the submission of a Continuing Review/Final Report form in advance of the expiration date indicated in this letter if an extension of time is needed.

- Approved consent forms display the official IRB stamp which documents approval and expiration dates. If a renewal is requested and approved, new consent forms will be officially stamped and reflect the new approval and expiration dates.

- The principal investigator must seek approval for any changes to the study (ex. research design, consent process, survey/interview instruments, funding source, etc.). The IRB reserves the right to review the research at any time.

If we can be of further assistance, feel free to contact the IRB at 320-308-4932 or email ResearchNow@stcloudstate.edu and please reference the SCSU IRB number when corresponding.

IRB Chair:

Dr. Benjamin Witts
Associate Professor- Applied Behavior Analysis
Department of Community Psychology,Counseling, and Family Therapy

IRB Institutional Official:

Dr. Latha Ramakrishnan
Interim Associate Provost for Research
Dean of Graduate Studies

OFFICE USE ONLY

SCSU IRB# 1766 - 2239	**Type:** Exempt Review	**Today's Date:** 2/20/2018
1st Year Approval Date: 2/20/2018	**2nd Year Approval Date:**	**3rd Year Approval Date:**
1st Year Expiration Date:	**2nd Year Expiration Date:**	**3rd Year Expiration Date:**

Appendix C: School District Letters of Agreement to Participate

Home of the Rams

Roseau Public Schools
Independent School District #682
509 Third Street NE
Roseau, Minnesota 56751

(218) 463 – 1471
(218) 463 – 3243 Fax

www.roseau.k12.mn.us

Date: November 27, 2017

To: Mr. Tony Greene
101 Westwood Ct.
Thief River Falls, MN 56701
e-mail: tgreene@trf.k12.mn.us

From: Roseau Public School District ISD #682

RE: Agreement to Participate in Proposed Research Study

The Roseau School District has agreed to participate in a research study. The objective of this study is to determine the barriers and benefits to technology integration in secondary schools. The results of this study will provide the Roseau School District with information that can lead to a more comprehensive professional development technology plan. Furthermore, it is understood that participation is voluntary and there will be nothing to identify individuals who participate in the study.

Sincerely,

Larry Guggisberg, Ed. D.

Superintendent of Schools

EAST GRAND FORKS PUBLIC SCHOOLS
INDEPENDENT SCHOOL DISTRICT #595
P.O. Box 151
EAST GRAND FORKS, MN 56721
(218) 773 - 3494

To: Tony Greene
101 Westwood Ct.
Thief River Falls, MN 56701
Email: tgreene@trf.k12.mn.us

From: East Grand Forks ISD 595

Date: November 27, 2017

RE: Agreement to Participate in Proposed Research Study

The East Grand Forks ISD 595 has agreed to participate in a research study. The objective of this study is to determine the barriers and benefits to technology integration in secondary schools. The results of this study will provide your school with information that can lead to a more comprehensive professional development technology plan. Furthermore, it is understood that participation is voluntary and there will be nothing to identify individuals who participate in the study.

Sincerely,

Mike Kolness
Superintendent of Schools
East Grand Forks ISD 595

SAUK RAPIDS-RICE Public Schools

Sauk Rapids-Rice Middle School
Enthusiasm, Energy, Excellence, Engaged
901 First Street South, Sauk Rapids, MN 56379
Phone: 320.654.9073 • Fax: 320.259.8909 • www.isd47.org/srrms

To: Tony Greene
101 Westwood Ct.
Thief River Falls, MN 56701
Email: tgreene@trf.k12.mn.us

From: Sauk Rapids-Rice School District 47

Date: November 27, 2017

RE: Agreement to Participate in Proposed Research Study

The Sauk Rapids-Rice School District has agreed to participate in a research study. The objective of this study is to determine the barriers and benefits to technology integration in secondary schools. The results of this study will provide your school with information that can lead to a more comprehensive professional development technology plan. Furthermore, it is understood that participation is voluntary and there will be nothing to identify individuals who participate in the study.

Sincerely,

Nate Rudolph

Dr. Nate Rudolph
Principal
Sauk Rapids-Rice Middle School

Nate Rudolph
Middle School Principal
nate.rudolph@isd47.org

Jessica Messerich
Assistant Principal
jessica.messerich@isd47.org

Phillip Klaphake
Recreation and Middle School Activities Director
phillip.klaphake@isd47.org