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Barriers Affecting Teacher Integration of Technology in 1:1 Classrooms

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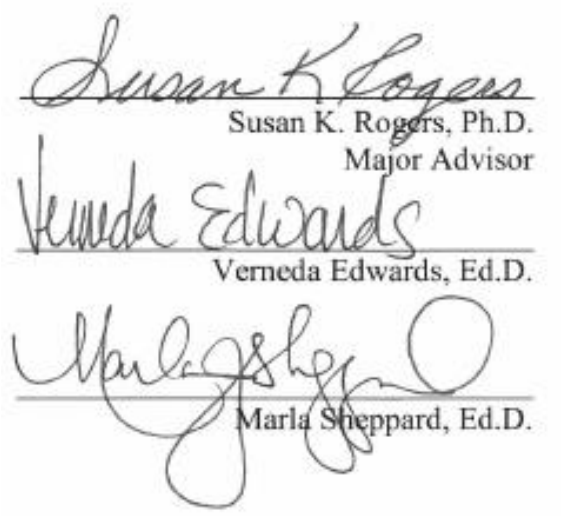
Submitted to the Graduate Department and Faculty of the School of Education of
Baker University in partial fulfillment of the requirements for the degree of
Doctor of Education in Educational Leadership



Date Defended: April 22, 2019

Abstract

The acceptance of technology in the classroom has been met with doubt and skepticism from the beginning. We are now living in a digital global society, and widespread use of technology in the classroom is still an elusive goal for many school districts. The purpose of this study was to investigate the barriers teachers face when attempting to integrate technology into the classroom effectively. Additionally, the study was designed to analyze if teacher gender and department are factors to consider when evaluating these barriers. The participants in the study were seventh through twelfth-grade teachers in an urban school district (District K) located in the state of Missouri. District K implemented a 1:1 initiative beginning in the 2014-2015 school year. A survey was administered, and data was collected from the participants over six weeks.

Barriers were categorized as first-order, second-order, and third-order. First-order barriers are identified as equipment, resources, and support. Second-order barriers are beliefs/attitudes, and skills/knowledge. Third-order barriers are structure/organization and school culture. Respondents rated components listed within each barrier to determine the significance of first order, second order, and third order barriers to effective technology integration. Barriers were also analyzed to determine if teacher gender or department played a role in the identification and categorization of barriers.

All teachers perceived first-order barriers were significant barriers to technology integration. Female teachers perceived first-order barriers were a significant barrier to technology integration compared to their male counterparts. Data revealed the ELA department perceived first-order barriers to be significant, Foreign Language department perceived third-order barriers to be significant, and the Math department perceived first

and second-order barriers to be significant hindrances to technology integration in the classroom.

The results of this study could be useful as school leaders examine more closely the barriers experienced by teachers according to department and ways to overcome first-order barriers if effective technology integration is to be achieved. Recommendations to the school district would be to include teachers on the curriculum committee to give teachers a voice about the technology related curriculum and resources they need and would use. The district could also examine the deployment of their technology support personnel to ensure buildings receive the support they need, in the format they need, and the support provided is timely.

Dedication

To my mother, Nannette Young, who passed away before I started coursework: You were always my biggest fan and strongest supporter, and I know you would be happy and proud to know I have received my doctoral degree. Your life was an example of hard work and dedication to the people and things that were important to you. I hope I have lived up to the example you worked so hard to place before me. Your love and support have been the guiding force that helped me to complete this journey.

Acknowledgements

The completion of this dissertation would not have been possible without the encouragement, motivation, and patience of those who have been with me and survived the journey. I would like to thank my husband whose patience allowed me to pursue this dream and complete the work. I would also like to thank my children who have encouraged me to continue and complete this journey. I hope I have shown you that whenever you have a dream to pursue it and to persevere to the end. Education is something I hold dear, and I can only hope that you will pursue those things you hold to be just as dear.

I would like to thank my major advisor, Dr. Susan Rogers. Your continual prodding, check-ins, feedback, encouragement, and guidance helped me find the light at the end of the tunnel, and for that, I am eternally grateful. Dr. Peg Waterman, your data analysis was a godsend. I truly appreciate the time, detail, and attention you gave my research. To my remaining committee members, Dr. Verneda Edwards and Dr. Marla Sheppard, your feedback, knowledge, and support are greatly appreciated.

I would also like to thank my many friends and colleagues who have encouraged me throughout this journey and checked with me to see how I was progressing. To have people on your side who believe in your ability to accomplish great things is invaluable and for that I am grateful. Your thoughtfulness and gentle prompts to finish were always welcome reminders of your support.

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Chapter 1

Introduction

Technology in education has been met with mixed reception from the time overhead projectors and reel-to-reel movies were brought into the classroom. In the 1960s technology began to make its way into classrooms in the form of overheads, projectors, televisions, and calculators (Wade, Rasmussen & Fox-Turnbull, 2013). Fullan (1989) asserted that widespread systemic change takes time because of the organizational changes that must occur with the education of the organization and those that work for them. The classroom teacher is the primary influence on what information is disseminated to students in classrooms and the extent to which digital resources are utilized to extend, remediate, or enhance classroom instruction. According to Saye (1998), studies have shown that teachers are the gatekeepers to their classrooms and regulate what happens within those four walls, although other factors have been identified as significant barriers to technology adoption.

The ability to connect digitally to resources, information, and others with 1:1 devices could become as indispensable to learning as the chalkboard once was. Liang et al. (2005) reported, "It is expected that in approximately 10 years, more and more students will bring a range of computing devices into the classroom for learning. Ultimately, these devices will become indispensable educational tools like pens, papers, or chalkboards" (p. 181). Gullen and Zimmerman (2013) observed that teachers were most successful using new technology when it was used with current practices to help them collaborate and connect with others and enrich learning. With the academic and the societal advantages of digital literacy that technology brings to the classroom, the

resistance of educators to implement and utilize these resources continues to be a challenge. Cuban (1986) observed, "Teachers, then, still control how much the classroom door opens to admit computers and how much they are used—provided, of course, that machines and appropriate software are accessible" (p. 78). More recently, Thies (2017) stated, "The educational professionals in this study are the gatekeepers of technology, which could affect equity, academic achievement, cultural capital, and future career choices of students" (p. iv).

Barriers to using technology in the classroom can range from a lack of technology and equipment to lack of useful and relevant professional development designed to prepare and expand teacher's knowledge and understanding of technology integration (An & Reigeluth, 2012). Understanding the barriers educators face with implementation and utilization of technology provides school districts the information they need to increase teacher usage and transform the educational model to align more closely with how students are learning in our global digital society.

Background

District K, a high-poverty, under-achieving, urban school district in the state of Missouri, joined the growing number of districts around the country with the deployment of electronic devices to its students. In 2017, the district consisted of 25 kindergarten through sixth-grade elementary schools, four ninth through twelfth-grade secondary schools, two seventh and eighth-grade middle schools, two seventh through twelfth-grade schools, one vocational school, and two alternative schools (one kindergarten through seventh grade and one eighth through twelfth-grade school). Of the 16,000 students in District K, 89% qualified for free or reduced lunch status, 23% of the district's

enrollment included English language learners, and 13% included students receiving special education services.

Students in the elementary and middle schools were provided laptops to use in their classrooms but were not permitted to take them home. All elementary and middle school classrooms were provided a cart of computers with enough for each student to use while in the classroom. Beginning in the 2014-2015 school year, students in each of the high schools were issued a laptop to be used not only in their classes but also could be taken home. The laptops had all approved textbooks loaded on them as well as digital resources available for students without the need for Internet access.

Six of the seven high schools started the initiative together with the same resources and training. One high school started the initiative a year earlier as a test school. Teachers from all district high schools were invited to participate in the study (Assistant Superintendent, personal communication, March 2, 2015). The remaining high schools began the 1:1 initiative a year later at the same time, had access to the same resources, and staff received the same technology-related professional development (assistant superintendent, personal communication, March 2, 2015).

Statement of the Problem

With the expanding access to information and increasing reliance on technology, students are being exposed to more information than ever before. Purcell et al. (2012) asserted, "The Internet provides students with much greater volume, depth, and breadth of information than was accessible to prior generations" (p. 25). Jones-Kavalier and Flannigan (2006) reported, "Our students are natives to cyberspace—they are digitally savvy" (p. 4). It has become necessary that schools use digital and electronic media to

teach and facilitate learning by capitalizing on skills students have already developed and use when they are not in the classroom. Pearlman (2010) claimed, "At home, they are likely to be equipped with computers, Internet access, iPods, and smartphones. At school, they typically sit at small desks, push a pencil or pen, and do worksheets" (p. 119). Project Tomorrow (2012) found "The digital learners have different expectations for school today and quite often the heart of that expectation is centered around their use of technology tools and resources to self-direct and self-monitor their learning experiences" (p. 3).

With the proliferation of smartphones, tablets, laptops, and gaming systems, most students own and regularly use at least one of these devices. Educators have struggled to keep pace with the educational use of technology and the profuse and inexhaustible desire for technology use outside of education.

> We all know that technology has transformed our larger society. It has become central to people's reading, writing, calculating, and thinking, which are the major concerns of schooling. And yet technology has been kept at the periphery of schools, used for the most part only in specialized courses. (Collins & Halverson, 2009, p. xiv)

In the classroom, chalkboards have been replaced with smartboards, overhead projectors have been replaced with document cameras, three-ring and spiral notebooks have been replaced with laptops and tablets (Rasmussen, 2012). Also, the use of Learning Management Systems such as Google Classroom, Moodle, and others have replaced the traditional methods of completing assignments on paper and physically submitting them. In District K, professional development focusing on technology integration is offered

throughout the year with special sessions designed for new teachers to ensure they are aware of the digital tools available for classroom use (coordinator of instructional technology, personal communication, August 2016). However, with all these advancements and the implementation of 1:1 initiatives, the integration of technology in the classroom remains marginal (coordinator of instructional technology, personal communication, August 2016).

Other school districts in the metropolitan area such as District G (2014), District L (2015), and District H (2015), have also implemented 1:1 initiatives designed to place laptops or tablets into the hands of each student to prepare and equip them with 21st-century skills and bridge the digital divide. This endeavor would appear to be a tremendous undertaking with the potential to increase student achievement and provide students access to unlimited resources and transform traditional methods of classroom instruction. Project Tomorrow (2009) reported, "Teachers tell us that as a result of using technology in the classroom students are more motivated to learn (51%), apply their knowledge to practical problems (30%) and take ownership of their learning (23%)" (p. 2). Technology in the classroom does provide educational benefit; however, according to the National Center for Education Statistics (2009), "only 40% of teachers and students use technology for instructional purposes in the classroom" (p. 3).

Currently, classrooms exist where the expectation is students have their electronic devices with them daily and understand teaching, assignments, and communication is facilitated through their devices (coordinator of instructional technology, personal communication, August 2016). Some classrooms are essentially paperless, and students appear to be engaged and prepared (assistant superintendent, personal communication,

August 2015). In the same building, there are also classrooms where students use their devices sporadically, with an occasional assignment that requires their use and the role of technology in the course is unclear and inconsistent (assistant superintendent, personal communication, August 2015). Gunn and Hollingsworth (2013) noted, "The effective and transparent integration of technologies is not uniformly and consistently implemented, and in some cases, it is somewhat invisible in formal educational settings" (p. 201). Fullan (2013) observed, "Within schools, technology is conspicuous by its absence or superficial, ad hoc use" (p. 14).

Seeking to understand the perceived barriers to effective technology integration in classrooms could allow district leaders to eradicate these obstacles by providing effective, applicable supports and resources at the appropriate times. It is unknown why teachers are inconsistent in their efforts to use digital resources and devices, but some things are evident. Education has remained virtually unchanged since its inception. Schools were built, and a factory model of education ensued, designed to teach large numbers of children. Although the industrial revolution is long behind us, the basic format of education has remained unchanged. The classrooms of today look much like the classrooms of a century ago. Collins and Halverson (2009) asserted, "The schools as they are currently constituted are preparing people to live in the last century rather than the new century" (p. 65). New strategies have been implemented to increase student engagement and deepen critical thinking skills; however, content delivery, which comprises teaching is largely unchanged, while the way students learn is changing. According to Rosen (2010), "Education has not caught up with this new generation of tech-savvy children and teens. It is not that they don't want to learn. They just learn

differently" (p. 10). It would seem logical that teaching would adapt to keep up with how students learn, but it has not and acquiring an understanding of why is important. Some teachers are able to easily integrate technology with minimal problems while others face significant issues with implementation and usage. The ability to understand the root cause of these barriers might allow school leaders to effectively address this challenge while educating and preparing students for the 21st century and beyond.

Purpose of the Study

The purpose of this study was to determine what teachers in an urban setting identify as the significant barriers to effectively integrating technology into classroom instruction. Additionally, the purpose was to determine whether the difference in the identification of significant barriers to effectively integrate technology into classroom instruction among teachers was affected by the teacher's department and gender. This study was conducted to identify whether a relationship exists between department, gender, and variables that may contribute to the confidence and comfort level teachers have with using technology. Barriers to integration were identified as first-order, second-order, and third-order barriers. First-order barriers are equipment, resources, and support. Second-order barriers are beliefs or attitudes, and skills or knowledge. Third-order barriers are structure/organization and school culture (see Appendix A).

Significance of the Study

The results of the study could help identify the most significant barriers to technology integration. The results of the study could also provide information to school districts to aid them with better preparation of teachers for the integration of technology into classroom instruction. The results of this study may also extend the current

knowledge in the field and benefit districts by improving professional development for technology integration and new teacher induction programs, and to understand better the motivations of teachers related to the implementation of technology in the classroom.

Delimitations

Delimitations are parameters determined by the researcher that help define the study. According to Lunenburg and Irby (2008), "Delimitations are self-imposed boundaries set by the researcher on the purpose and scope of the study" (p. 134). There are three delimitations of this study:

1. Only District K teachers working in the four high schools serving grades 9-12 and those in the two schools serving grades 7-12 were included in this study. The perceptions of elementary and middle school teachers in District K or high school teachers in private, charter, rural, and suburban high schools were not included.
2. Data were collected during the 2017-2018 school year.
3. Only data as it relates to 1:1 use is examined in this study. General classroom technology use is not examined.

Assumptions

Assumptions are beliefs and can affect the way actions, behaviors, and responses are perceived. According to Lunenburg and Irby (2008), "Assumptions are postulates, premises, and propositions that are accepted as operational for purposes of the research" (p. 135). The following assumptions were made in this study:

1. The participants understood the items in the survey and responded appropriately.

2. The participants responded honestly and accurately to the survey administered.
3. The participants responded individually and did not collaborate with either another teacher or teachers to complete the survey.

Research Questions

Research questions are used to guide and formulate the study. They assist with providing focus and serve to anchor the method and direction of all aspects of the research, and according to Lunenburg & Irby (2008), "teamed with a tightly drawn theoretical framework, the research questions or hypotheses become a 'directional beam for the study" (p. 126). The following questions guided this study:

RQ1. What do teachers identify as the significant barriers to effectively integrating technology into classroom instruction?

RQ2. To what extent is there a difference in the identification of significant barriers to effectively integrating technology into classroom instruction among teachers based on department?

RQ3. To what extent is there a difference in the identification of significant barriers to effectively integrating technology into classroom instruction among teachers based on gender?

RQ4. To what extent is the identification of significant barriers to effective technology integration into classroom instruction different among first-order, second-order, and third-order barriers?

RQ5. To what extent is the difference in the identified significant barriers to effective technology integration into classroom instruction among first-order, second-order, and third-order barriers affected by department?

RQ6. To what extent is the difference in the identified significant barriers to effective technology integration into classroom instruction among first-order, second-order, and third-order barriers affected by teacher gender?

Definition of Terms

According to Lunenburg and Irby (2008), all major terms vital to a study should be defined to provide clarity.

1:1. "The ratio indicates that there is one computer, laptop, or tablet for each student" (Power Up Making the Shift to 1:1, 2015, p. 2).

Digital resources. Harley, Henke, Lawrence, and Perciali (2007) stated, **"**Digital resources include rich media objects (maps, video, images, simulations, and so forth) as well as text. These digital resources may reside in or outside digital libraries and include those developed by individual scholars and by other entities" (p. 13).

Digital or electronic devices. PC Magazine (2018) defines a digital or electronic device is a physical unit of equipment that contains a computer or microcontroller. Examples of these devices would include computers, iPads or tablets, smartphones, and smartwatches.

Digital literacy. Jones-Kavalier and Flannigan (2006) indicated "Digital literacy is defined as the assortment of cognitive-thinking strategies that consumers of digital information utilize. Digital literacy is usually regarded as a measure of the ability of users to perform tasks in digital environments" (p. 6).

Educational technology. Januszewski and Molenda (2013) indicated "Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources" (p. 1).

First-order barriers. "Barriers to technology are considered to be first order are described as being extrinsic to teachers and include lack of access to computers and software, insufficient time to plan instruction, and inadequate technical and administrative support" (Ertmer, 1999, p. 2).

Perception. Merriam-Webster (2018) defined perception as a thought, belief, or opinion, often held by many people based on appearances.

Second-order barriers. "Barriers to technology are considered to be second order are described as intrinsic to teachers and include beliefs about teaching, beliefs about computers, establishes classroom practices, and unwillingness to change" (Ertmer, 1999, p. 2).

Third-order barriers. "Barriers to technology that are considered to be third order include school culture and institutional structure and encapsulate how a teacher negotiates physical resources and pedagogical beliefs within the school environment" (Wallace, 2012, p. 14).

Organization of the Study

The study is organized into five chapters. Chapter 1 consisted of the introduction, background, statement of the problem, the purpose of the study the significance of the study, delimitations, assumptions, the research questions, the definition of terms, and organization of the study. Found in Chapter 2 is a review of the literature that addresses

the issue of barriers to technology integration in the classroom. Chapter 3 contains the research design, selection of participants, measurement, data collection procedures, data analysis and hypothesis testing, and limitations. Chapter 4 covers the descriptive statistics and the results of the hypothesis testing. Finally, Chapter 5 includes a study summary, finding related to the literature, and conclusions.

Chapter 2

Review of the Literature

This chapter provides a summary of selected literature related to technology integration in 1:1 classrooms and the barriers that have hindered this integration. First, the history of technology and its use in education is discussed with emphasis on barriers that significantly hamper technology integration and its adoption by teachers in classrooms. Included in this section is a discussion of how instructional strategies related to technology integration have changed to utilize technology in the classroom. The next section contains digital learning and 21st-century skills. Included is an examination of the changes that must occur for teaching styles to change, student engagement to increase, and 1:1 computing to be successful in today's classroom. In the last section, the barriers that have been shown to hinder classroom technology integration are presented. These barriers are discussed as first-order, second-order, and third-order.

History of Technology in Education

Instructional technology has a long history in education. From fountain pens to paper and slates to computers, these forms of technology have faced implementation resistance. Barriers to technology implementation have always existed, but it was not until Ertmer (1999) categorized them that they were systematically examined. Researchers and educational institutions were then able to methodically address the hindrances that prevented widespread adoption and implementation of educational and instructional technology in the classroom. Innovations and technology use in education have received a mixed reception from the time of the one-room schoolhouse to today. Collins and Halverson (2009) purported, modernizations that jeopardize the way

curriculum is delivered and how the classroom operate are met with resistance. They also reported, when one part of this intricate system changes, the other parts will resist in order to revert to the original system.

It is difficult to understand that when paper replaced the individual slate, pen and ink replaced pencils, and ballpoint pens replaced fountain pens, some detractors questioned their validity. These skeptics felt they were just an easy, wasteful, and lazy alternative to what was known as standard and acceptable classroom items. It was thought these items would benefit both teachers and students, but there was widespread resistance to their adoption and use. Collins and Halverson (2009) reported, "For every researcher, teacher, and policymaker excited about the possibility of how information technologies can change education, there is a skeptic who questions the possibility or the value of technology in schools" (p. 30).

When film became popular in the early 1900s, some thought the classroom use of film would replace the textbook. In 1922, Edison asserted, "I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks" (as cited in Cuban, 1986, p. 9). There was fierce competition between educational film businesses to produce educational films designed specifically for school use (Cuban, 1986). The use of films in the classroom was viewed as a symbol of progressive teaching, and many school districts began establishing visual education departments (Cuban, 1986). According to Cuban (1986), film provided validity and life to the spoken and written word in classrooms leading promoters and education officials to join the movement to bring motion pictures there next. With the apparent advantages that film offered, there was still not widespread

use of this technology. Cuban (1986) also believed some of the reasons for the lack of classroom use were the cost of the films, unpredictable or inaccessible equipment, and the ability of teachers to find an appropriate film for their class that fit their curriculum. When sound came to the film industry this further exacerbated issues with hardware. The difficulty teachers experienced with hardware to show films also contributed to an already growing list of frustrations that hindered widespread usage of this medium (Cuban, 1986).

Radio was soon introduced as another technological innovation that would revolutionize the way students learned. Radio was called the textbook of the air, and many thought it would change education. Radio would allow students to learn from experts in different fields of knowledge and enable teachers to provide outside information to students from sources that would have otherwise been inaccessible. Darrow (1932) asserted, "The central and dominant aim of education by radio is to bring the world to the classroom, to make universally available the services of the finest teachers, the inspiration of the greatest leaders" (p. 79). By the 1930s, the cost of radio receivers decreased making them more affordable and widely available in most schools across the nation (Cuban, 1986). A School of the Air (SOA) movement began with numerous SOAs operating in several states and providing regularly scheduled programming (Cuban, 1986). Radio did enjoy utilization in the classroom but also faced issues by teachers.

Despite the availability of programming and apparent advantages of radio, some obstacles prevented the desired widespread usage. Cuban (1986) reported some of the barriers faced by teachers were the availability of programming that fit their needs, no

radio receiving equipment, limited or no reception, inferior equipment, lack of information on programming and availability, programs not related to curriculum, classwork more available, and teachers not interested. Promoters of radio in the classroom felt these reasons were not valid because of the widespread availability of equipment that was being mass produced, so excuses that stemmed from poor to no equipment were not viewed as legitimate (Cuban, 1986). Promoters of radio began looking at more profound reasons that prevented widespread use of radio in the classroom (Cuban, 1986). Woelfel and Tyler (1945) offered, "Radio grew from childhood through adolescence into maturity too rapidly for organized education, with its fixed courses of study and rules of conduct, to keep pace" (pp. 4-5). The rigid structure of education could not adapt to the rapidly changing technological environment to support innovations such as radio to support and enhance education in the classroom.

The next advancement on the forefront of education to support and enhance instruction in the classroom was the television. The television was thought to be a powerful medium capable of combining the benefits of film and radio (Cuban, 1986). Very early on, Darrow (1932) reported, "When the eye and the ear have been re-married in television, then we shall indeed be challenged to open wide the school door" (p. 266). Radio and film never gained the widespread support and usage many felt they would bring, but television was heavily supported and received funding from the Ford Foundation, the National Defense Act, and the Communications Act; adequate funding remained an issue (Saettler, 1990). According to Cuban (1986), "the Ford Foundation's Fund for the Advancement of Education invested over $20 million in 250 school systems and 50 colleges across the nation to pioneer its use" (p. 28). Cuban (1986) commented

that during this same period, President Kennedy also appropriated funding from Congress that provided over $32 million for television research. A teacher shortage existed during this time, and it was felt that using the television to provide lessons was one way to overcome the shortage and reduce classroom overcrowding.

Television failed to live up to the expectations of those who felt the marriage of film and radio in television would result in educational reformation. Fabos (2001) asserted, "consequently, television was, like film, a medium that was commercialized before it was considered educational. Unlike film, however, members of the television industry did not attempt to tap into any so-called educational market" (p. 61). Consequently, according to Fabos (2001), the FCC received information regarding the lack of educational programming available resulting in 252 channels reserved for education. The costs of producing quality programming were prohibitive, and few stations were able to create, produce, and air suitable programming. Kent and McNergney (1999) reported that programming of radio and television had the disadvantage of scheduling conflicts. Programming that was thought to be appropriate and suitable for classroom viewing was scheduled at odd times making it difficult for teachers to plan for their classes to view programming. Saettler (1990) observed that programming appropriate for the classroom was scheduled irregularly, with rotating and split schedules, while other programming broadcasted in the morning only.

In the 1980s when VCRs became popular, teachers began using them to record material to be used in their classrooms. Fabos (2001) reported the ability to skip commercials, view specific portions of programming, rewind and replay information was crucial and allowed teachers to control how content was used and ensure it directly

correlated to the curriculum being taught. Cable television provided more choices and specialized programming educators could choose to record and replay in their classes at their discretion.

Channel One was introduced as a way to keep teens informed of current events. Channel One did provide televisions and VCRs to schools who agreed to air its programming daily and require students to watch content and commercials (Fabos, 2001). According to Fabos (2001), by this time there was not as much opposition to the commercialization of programming, and although programming was not specialized to any particular content and concentrated on current events, teachers did welcome it into their classrooms.

During this same time, cable television became popular and offered a variety of programming that was suitable for and could be used in the classroom. Fabos (2001) observed, as cable television began to offer more specialized programming such as history, geography, travel, nature, and news documentary, teachers had a variety of material to choose from, and it provided them with more control over material to match with their curriculum. Channels were developed with programming devoted to specific content areas and could be accessed, recorded, and viewed when convenient and fit into the curriculum. These options along with the ability to record and view later allowed teachers to retain control of their classrooms and use these materials when they felt it would best fit their lessons (Fabos, 2001). These options also allowed teachers to decide what they would use, when they would use it, and even if they would use it.

The next new technology to enter the forefront of education was the microcomputer. The microcomputer was viewed as the culmination of all technology

before it. According to Cuban (1986), "The versatility of the machine's uses for drill, problem-solving, motivation, and interaction suggest differences of such a magnitude as to dwarf comparisons with earlier classroom technologies that usually possessed only one or two of these characteristics" (p. 74). Computers first entered the classroom as a tool for teachers to keep better records (Cuban, 1986). Computers were used for taking attendance, recording grades, and communicating with others in the building and school district (Cuban, 1986). As the computer grew in popularity, schools began to equip computer labs where students were able to take computer related classes, and teachers could reserve labs to take their classes to research topics, write papers, and prepare presentations (Cuban 1986).

The Internet flourished, and the ability to access information became faster and less expensive. Kent and McNergney (1999) commented, "Students can access data from NASA, the current news from the *Washington Post*, or the latest stock market prices. …The variety and sheer volume of the information available free of charge through the Internet is staggering" (p. 31). Education sought ways to capitalize on these elements for the benefit of students. Soon many classrooms were equipped with a few computers for students to use as they worked on assignments and researched information.

With the increased usage of computers in the classroom, new programs and applications designed for teachers to use as supplements to their existing materials were developed. These programs were designed to help teachers integrate technology into their classrooms and harness the power of the Internet. According to Herold (2016), many schools use a variety of digital content because of the increased learner engagement, the ability to personalize learning, updated content, and the ability to have

interactive and adaptive content. During this period, businesses were relying more on the Internet and the ability to communicate in a digital environment. The need for employees who were already familiar with computers and how to navigate the Internet was needed. According to Kent and McNergney (1999), today's employees are expected to be proficient on the computer to perform their jobs, and the pervasiveness of computers in our society has placed pressure on our educational systems to graduate students who are skilled in their use. This need has driven educations' desire to prepare students with 21st-century skills to help them become digitally literate. Partnership for 21st Century Skills (2008) reported, "For students, proficiency in 21st-century skills – the skills, knowledge, and expertise students must master to succeed in college, work and life – should be the outcome of a 21st-century education" (p. 12).

The move towards digital literacy and the plethora of digital resources available propelled many school districts toward 1:1 initiatives that were designed to provide each student in a school district with a laptop or tablet. The increased use of electronic devices in the classroom created the need for teachers to approach the process of teaching and learning differently. Christensen, Horn, & Johnson (2011) asserted, "Teachers will act more as learning coaches and tutors to help students find the learning approach that makes the most sense for them" (p. 107). Neebe and Roberts (2015) commented, "Teachers by nature of their clientele need to be futurists, and the future is digital; we must prepare our students for that" (p. 4).

Digital Learning and 21st-Century Skills

The changes that are slowly occurring in education, which are evident in the form of electronic devices in the hands of each student require new approaches to the

traditional methods of teaching. Neebe and Roberts (2015) observed that students today learn when they are ready to learn and are not bound by the traditional limitations of school hours. If they do not understand something or want to learn more about a topic, they unleash the power of the Internet on their device. Today's students do not have to ask a teacher for help but will instead explore the Internet for answers and solutions.

> With one click on a smartphone, students can read not only the original text of the Odyssey if they wish, but watch a TedTalk video about its relevancy in today's society and listen to a podcast debate amongst modern day scholars about the legacy of Greek lyric poems on today's modern songwriting. (Project Tomorrow, 2015, p. 2)

In 2018, students had access to computers, the Internet, social media, and smartphones from the time they were born. For them, digital access is how they keep in touch, learn, and find information. Prensky (2001) coined the term digital natives and digital immigrants. Prensky posited that digital natives, born in 1980 or later, are those who have grown up with access to computers, video games, and the Internet. Digital immigrants, born in 1979 or earlier, are those who have had to learn how to navigate their way through technology and integrate it into their environment since they did not grow up with it. According to Prensky (2001), these differences in understanding and technology utilization for learning have created challenges for those in education. In most schools, classrooms are filled with digital natives being taught by digital immigrants, and the inconsistencies in experiences and attitudes towards technology can create obstacles in the process of teaching and learning. Jones-Kavalier and Flannigan

(2006) reported, "A common scenario today is a classroom filled with digitally-literate students being led by linear-thinking, technologically stymied, instructors" (p. 4).

Ally (2009) observed, "mobile learning through the use of wireless mobile technology allows anyone to access information and learning materials from anywhere and at any time" (p. 1). Now that students can learn anywhere and at any time, education is struggling to develop instructional formats that capitalize on these advantages and complement the way students learn with their devices. Project Tomorrow (2012) reported, "the school's monopoly on information, knowledge, and world experiences is long gone and yet unfortunately, some education leaders still cling to this old paradigm as it represents their ideal of education" (p. 3). A popular strategy that has been used with some degree of success is the flipped classroom. Neebe and Roberts (2015) asserted, "This model—where guided practice is done in class, and some portion of the instruction is delivered as homework—is often called *flipped teaching* or *blended learning*" (p. 78).

Fullan (2013) observed, "Khan is an incredibly great 20th-century pedagogue using 21st-century technology…Khan has not invented a new way to teach math but has improved the delivery system of the old way" (p. 38). Flipped classrooms are one way teachers are integrating technology into their instructional practices, but other practices have also shown to be effective. Holland and Holland (2014) reported, "providing meaningful integration of new technologies through the careful selection of quality tools aligning to best instructional practices can alter how learners and instructors engage with concepts and each other to achieve powerful learning" (p. 18).

Inquiry learning, problem-based learning, and multimedia-rich learning are a few of the instructional strategies considered as best practices when integrating technology in

the classroom. Holland and Holland (2014) observed in inquiry learning, students learn by working collaboratively to discover, solve problems, and think critically through active learning to build new knowledge. Inquiry and problem-based learning are close in practice. The learner is given a problem that must be solved, and they must go through several steps to arrive at a solution based on research, questioning, and reflection. Barrell (2010) commented, problem-based learning "goes well beyond these short-term instructional instances or simple questions . . . such as pollution of the planet—that is so complex, messy, and intriguing that they do not lend themselves to a right or wrong answer approach" (p. 179). Inquiry learning is similar to problem-based learning but may involve more detailed processes that allow the learner to explore their assumptions for a particular problem methodically and systematically. Holland and Holland (2014) asserted, "learners often work together to conduct research, experiment, synthesize, classify, infer, communicate, analyze, draw conclusions, evaluate, review and justify findings" (p. 19).

Multimedia-rich learning can involve integrating video clips, sound or animation to a presentation or used independently to enhance and reinforce learning. The utilization of multimedia as an instructional tool can aid in the retention of material and increase engagement in the subject matter. Holland and Holland (2014) reported that using an assortment of media increases engagement and provides distinctive opportunities to reach diverse learners. Holland and Holland (2014) asserted, "By appropriately aligning rich media to the content message, it can provide additional clarity and increase student focus rather than detract from it" (p. 20). Hicks (2011) purported that the use of technology in the classroom allows teachers the opportunity to reach students with content they can

relate to and connect with them digitally. These strategies have a common denominator, which is their preparation of students with 21st-century skills.

With input from educators, the Partnership for 21st Century Skills has developed a list of skills they feel are necessary for students to learn if they are to be successful in post-secondary education, work, and life. Kay (2010) asserted, "even if all students earned a high school diploma . . . They still would be ill-prepared for the expectations of the new economy. Today, a different set of skills-21st century skills-increasingly powers the wealth of nations" (p. xviii). The skills that have been identified by the Partnership for 21st-Century Skills (2008) are content knowledge and 21st-century themes, learning and innovation skills, information, media and technology skills, and life and career skills.

Skinner (2013) conducted research using a descriptive methodology to assess the role of technology in education according to standards of the Partnership for 21st-Century Skills. Skinner's investigation was performed in Milwaukee among public school teachers and examined global and national technology integration in K-12 schools and how 21st-century technology prepares students for postsecondary careers and education. Skinner (2013) also examined the need for technology-related professional development and technology integration support for teachers. Skinner's findings indicated that although teachers understand the importance of integrating technology in the classroom, their levels of implementation were much lower than expected and were limited in application. Her findings also revealed more professional development was needed for teachers on how to use technology and the pedagogy of its use.

Information, media, and technology skills are key competencies students should attain during their educational careers and could prove valuable in both higher education

and employment. The Partnership for 21st Century Skills (2008) observed, "for students, proficiency in 21st-century skills—the skills, knowledge and expertise students must master to succeed in college, work and life—should be the outcome of a 21st-century education" (p. 12). The ability to use technology advantageously, navigating it to find credible information through the assessment of information available for validity and reliability is but one skill students need to possess.

Although the literature has indicated districts are spending more money on technology, device availability is no longer an issue, and teachers have increased classroom technology usage, significant barriers to classroom technology integration remain. Young (2012) performed qualitative research in a suburban school district in the state of New Jersey. Young explored elementary teachers' perceived barriers to technology integration related to 21st-century learning goals. The most significant barrier revealed in Young's study was the lack of resources. Other barriers uncovered in Young's research were a network system that obstructs Internet access, the lack of accessible, operational technology resources, and the lack of technology-related professional development that promotes 21st-century learning for teachers who are intimidated by technology.

Similarly, Pine-Thomas (2017) conducted quantitative research among charter high school teachers in North Carolina. Thomas' research was designed to examine whether charter school teachers were unable to integrate technology into their classrooms because of technological barriers. Pine-Thomas also investigated whether teacher self-efficacy affected their technology integration practices and how competitive their students are as global 21st-century professionals. The results of Pine-Thomas' research

revealed that teachers felt confident about their ability to integrate technology and did not feel this was a barrier. Pine-Thomas also revealed that although charter school teachers integrated technology at basic levels, such as word processing, their students were not adequately prepared. Pine-Thomas (2017) commented, "educators need the ability to pedagogically apply technology into specific areas of the curricula for students to use technology to communicate, collaborate and solve problems" (p. 169).

Barriers to Technology Integration

Districts are increasingly implementing 1:1 plans, have improved infrastructure, and increased tailored technology-related professional development to meet specific building needs. Hanson (2014) reported, "one-to-one computing initiatives have become more commonplace in K-12 education as school leaders endeavor to infuse technology into classrooms to meet the needs of the 21st-century learner" (p. 156). With these benefits available to educators, the lack of strong implementation is difficult to understand.

Ertmer (1999) categorized those barriers that make technology implementation difficult for teachers as first-order and second-order barriers. Ertmer (1999) categorized first-order-barriers to technology integration as those that are extrinsic to teachers such as lack of time to plan instruction, lack of access, and less than optimal technical and administrative support. These first-order barriers related to equipment and resources have been more appropriately addressed in recent years than in the early years of educational technology implementation. Districts have addressed the issue of not enough equipment by implementing 1:1initiatives.

Rifkind (2011) conducted a qualitative study in a small school district in Long Island to identify disparities in teachers' understanding of classroom technology. Rifkind hoped to pinpoint those barriers that prevented teachers from implementing technology in their classrooms. Rifkind (2011) asserted, "A lack of formal training for teachers and students on applications and hardware slows the process of integrating technology into classroom pedagogical practice" (p. 157). The results of his research revealed that professional development needs to be personalized to meet the needs of teachers according to the subject matter and available resources. Four themes emerged from Rifkind's research that teachers felt hindered their classroom integration of technology and needed improvement. Those emerging themes were support and training, Internet/Web 2.0, Smartboard initiatives, and student engagement.

Herold (2016) observed, "Increasingly, schools are moving to provide students with their own laptop computer, netbook, or digital tablet" (p. 3). Infrastructure concerns persist, but even this challenge was not as severe as the past. Many school districts improved their infrastructure as part of their technology plan when they committed to providing electronic devices to each student as part of their 1:1initiatives.

Barriers related to technology-related resources are not as significant as they were in the early years and have evolved. Resource related barriers of the earlier years have been reduced as well. In the earlier years, the resource-related barriers pertained to the availability and ability to access resources related to and in some cases a part of the curriculum. Today, resource-related barriers are different. Herold (2016) asserted, "Digital instructional content is the largest slice of the (non-hardware) K-12 educational technology market, with annual sales of more than $3 billion". So many resources are

available to teachers that sometimes just knowing where to look, what to use, how to use and access the appropriate materials can be time-consuming and frustrating. According to White (2014), "Advances in computing technology over the past 15 years have provided educators with powerful instructional technology tools to use in instructional planning and lesson delivery" (p. 3). To combat this barrier, some districts have provided technology-related professional development to help teachers gain a better understanding of available resources and how to properly implement them in their classrooms. White (2014) reported, "Teachers must receive the proper training not only with respect to how to use such technology but also with respect to using technology in a pedagogical manner that will improve student learning" (p. 3). Most of these extrinsic factors that affect technology integration have been reduced but not eliminated. Herold (2016) commented, "For all the technological progress, though, implementation remains a major challenge" (p. 2).

Second-order barriers were categorized as those intrinsic to teachers consisting of attitudes and beliefs about educational technology, classroom practices and reluctance to change (Ertmer, 1999). Technology-related professional development has been identified as an area that can improve technology integration in the classroom. More districts are focusing on providing a variety of technology-related professional development to meet the needs of teachers who are at different stages of implementation.

Inan (2007) examined archival data from 54 Tennessee public school teachers to ascertain factors affecting their adoption of technology. Results from Inan's study showed that technology integration is strongly impacted by the personal beliefs of teachers about the effectiveness of technology in teaching and learning. Inan purported

that when teachers feel technology use is beneficial, have positive feelings about it, and are comfortable using technology; they will implement it more readily. Although Inan's research is dated, his findings are similar to those from more current research.

Although technology-related professional development has been identified as an area that can improve technology integration, educators have identified other areas that can hinder technology integration in the classroom. Pereira-Leon (2010) conducted a qualitative study to examine how Indiana K-12 teachers' decisions to implement instructional technology were influenced by their participation in technology-based professional development. Pereira-Leon's findings showed that decisions to use technology were based on beliefs, the perception of educational technology, and professional identity.

Cooper (2014) examined Texas secondary teacher beliefs related to their perceptions of job-embedded professional development and efficacy in technology implementation. The study was conducted among 71 teachers with more than one year of experience. Cooper revealed that efficacy in technology implementation is influenced by job-embedded professional development. Cooper asserted, "Job-embedded professional development may be the catalyst that motivates teachers to improve their teaching practices and develop a sense of effectiveness with regard to classroom instruction" (p. 65). Cooper also felt that job-embedded professional development could propel other changes in a building by helping to change school climate, build capacity among staff, and increase academic success.

In 2014, White completed a quantitative study among teachers across the United States who taught grades 6-12. White's study was designed to determine which

professional development activities correlated to high levels of technology integration in the classroom and identify other barriers to technology integration. The results of White's research revealed the longer teachers attended technology-related professional development, the more likely they were to integrate it into their instruction. White also uncovered that teachers understood how to use basic software but needed training on tools like Moodle, Blackboard, Google Docs, using an interactive whiteboard, and other tools like blogs and podcasts. Other barriers identified by White (2014) were not having enough computers, equipment being outdated, and inadequate budget allocation. Barriers identified by teachers who participated in technology professional development were additional time to plan and write technology-rich lessons. Professional development activities were a common theme echoed by others as a barrier to technology integration in the classroom.

Hanson (2014) conducted a qualitative study to examine the impact of professional development on instructional changes that occurred after a 1:1 initiative in three Southwest Missouri high schools. The professional development focused on hardware and software use, management platforms, and the integration of portable technology into classroom instruction. The focus of instructional change was on teacher planning, instructional delivery, student assessment, digital resource use to supplement curriculum and create presentations, differentiation, and personalization of instruction to meet individual student needs, and the utilization of websites and content management platforms to improve student access to classroom instructional materials. Hanson's results revealed that teachers rated professional development activities consisting of learning how to integrate technology into instruction the highest, followed by learning

how to use software and hardware, with learning to use content management platforms the lowest. Hanson (2014) uncovered the instructional practices that changed most were the use of web pages or content related platforms, which allow student access to assignments, instructional resources, and other academic-related content when needed.

Gomes (2015), conducted a mixed methods study among 60 K-12 teachers in the Northeastern United States. The purpose of the study was to understand the lack of teacher use of technology with students while covering the curriculum. According to Gomes (2015), "in order for teachers and students alike to be proficient in the use of digital technology, they must use it consistently" (p. 3). Gomes uncovered four themes that were related to why teachers were not using technology. The themes fell into the two categories of first-order and second-order barriers. The themes were lack of usable equipment, lack of administration support, lack of professional development, and lack of time to plan.

A study was conducted by Amuko, Miheso, and Ndeuthi (2015) to discover the challenges and obstacles that influenced the use of technology in mathematics at secondary schools in Nairobi County in Nairobi, Kenya. The qualitative study was conducted by interviewing 24 mathematics teachers across 12 secondary schools in Nairobi County. The study objectives were to explore issues influencing the use and integration of technology in teaching and learning of mathematics in Nairobi County secondary schools. Amuko et al. (2015) found teachers felt they were not sufficiently trained on the use of computers in the mathematics curriculum, they lacked support from administration, and the infrastructure for instructional computer technology was inadequate. Teachers strongly felt there was not enough time to adequately integrate

technology into the mathematics curriculum. Amuko et al. (2015) indicated that respondents felt training should be continuous and done at least every six months.

Project Tomorrow (2015) reported that approximately 40% of districts now offer professional development online for their teachers and have online classes for students. This data represent a 15% increase in two years and further validates the importance placed on technology innovation in education. These intrinsic factors are areas that have been addressed as technology usage has become more widespread with resources and support.

Boatwright (2016) conducted a qualitative study to examine the challenges and opportunities for teachers to use iPads in the classroom. This research was performed in three elementary schools in South Carolina, and the results uncovered three major themes, which were time management, school level support, and teacher beliefs. Time management referred to the teacher's ability to learn software, hardware, plan engaging lessons, and teach students how to use particular applications and features. School level support referred to support by school level administration including their technology vision and plan, as well as including teachers in decisions related to building-wide technology integration. When school level administration supported teacher efforts of technology integration, teachers were more easily able to achieve it. Boatwright (2016) reported "With proper and on-going professional development and administrative support, all of the teachers in this study have integrated this technology seamlessly" (p. 76). Boatwright found the more positive teachers were about the use of technology, the more receptive they were to its use in the classroom.

Alkahtani (2017) conducted a mixed-methods study in Saudi Arabia examining four schools in two cities. The study was conducted to see how students, teachers, and principals were responding to the challenge of integrating technology as part of the educational reforms and the King Abdullah Public Education Development project. Two major areas of deficiency were uncovered in the study: insufficient training and a shortage of working equipment. Insufficient training encompassed the lack of understanding of how the equipment operates, inadequate training on instructional practices that incorporate technology and issues with obtaining repairs quickly. The major themes that emerged from this study were lack of resources and lack of initiative. Lack of resources refers to funding to provide more technical support, equipment repair, and maintenance. Lack of initiative refers to principals taking the lead and finding creative ways to overcome the obstacles and promoting the use of technology to their stakeholders and peers. The recommendations related to these issues were to increase the communication between and among teachers, principals, students, and project managers. These discussions may help to find solutions to potential problems and help alleviate others before implementation. Alkahtani (2017) felt the most significant finding from the research was the information gathered that could guide future technology initiatives in the country by helping to avoid the same or similar challenges.

Second-order barriers can be more difficult to overcome because they deal with knowledge, skills, beliefs, and attitude. Ertmer (1999) felt eliminating second-order barriers would require teachers to question what they believe about technology, what constitutes learning, and how a classroom should look. As seen in previous studies (Boatwright, 2016; Lang, 2016; Pereira-Leon, 2010; Young, 2012), beliefs and attitudes

are variables that can affect the implementation of technology in the classroom. Teachers have immense control over what information and resources are used in the classroom, the decision to implement technology, and to what degree it is implemented in classrooms. If teachers are not comfortable using technology and do not feel as though they are the expert in the deployment of digital resources, they will use it as little as possible. Also, if beliefs and attitudes are negative towards technology utilization in the classroom, teachers will not use it or implement it with fidelity. Less than full implementation will occur if teachers do not believe there are benefits to its use or feel it increases their workload by giving them added work and responsibilities in the classroom. Research has shown that providing teachers with data and research that prove the benefits of employing technology in the classroom along with continuous professional development work well to overcome second-order barriers.

Second-order barriers to technology integration remain, and unless teachers can reframe their beliefs about teaching, education, and the role of technology, widespread adoption of technology will not be seen. Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur (2012) observed, "Teachers' own beliefs and attitudes about the relevance of technology to students' learning were perceived as having the biggest impact on their success" (p. 423). When teachers believe that technology will positively impact their classrooms, can easily be integrated into their lessons, and are confident in their technology skills, they will make the necessary changes to use it regularly in their classrooms.

Henry-Young (2013) conducted research to identify, classify, and interpret the subjective barriers to the use of communications technology in the classroom.

Participants in this qualitative study included 19 Bermuda senior high school teachers. Henry-Young's results revealed five themes, which are lack of teacher training, lack of technical support, equipment issues, lack of funding, and teacher attitudes. Of the participants, 89% indicated they felt training was one of the critical components needed if teachers were to improve their use of technology. Additionally, 53% of the participants voiced their dissatisfaction with Internet connectivity. Other concerns revealed were lack of resources which translated to human and time. Also, a lack of technical support when needed and a lack of time to learn and explore new technology were concerns. A lack of funding was a concern felt by 37% of participants because it prevented and limited access to software, upgrades, and accessories. Equipment issues were listed as a constraint by all participants in the study. Other problems included issues with timely maintenance and repairs as well as having outdated equipment. These issues create other ones related to learning outcomes and expectations, which in some cases can cause teachers to feel unmotivated about using technology in their classrooms.

Manglicmot (2015) examined whether teacher beliefs on self-efficacy and expected outcomes from technology integration are related to classroom technology use. Manglicmot conducted a quantitative study of middle and high schools, grades 6-12 in urban, suburban, and rural public schools in southeast Virginia. The results of Manglicmot's research showed there were significant relationships between self-efficacy, outcome expectations, and the level of technology used in the classroom. The results also revealed that self-efficacy and the outcomes expected by teachers played a central role in the decision by teachers on whether to use technology in the classroom.

In 2016, Alenzi reviewed type one and type two obstacles educators face when using technology in the classroom. This study was conducted in a large suburban school district in Saudi Arabia and was conducted through the use of interviews and survey administration. The study participants were students, teachers, and administrators in grades 3-12. Alenzi (2016) sought to discover why there is a disconnect between the belief that technology must be used in the classroom of today and the actual practices of integrating technology in the classroom.

Type one obstacles were classified as professional development, technical support, access to resources, and time. Type 2 obstacles are categorized as self-efficacy and educational philosophies. Alenzi also wanted to determine the reasons why some teachers use technology in the classroom and do not seem to find the obstacles others do with its use and implementation. Alenzi defined a second-level digital divide as having less to do with access and more to do with knowledge of how to use digital tools and having the time to learn how to use it appropriately.

Alenzi (2016) looked at two groups of teachers: typical teachers and exemplars. Exemplar teachers are those that use technology regularly and empower students to use technology in the classroom. Exemplar teachers felt the instructional technology department impeded their ability to access resources and share information with students and felt the instructional technology department did not support them when it came to implementing new technology or innovations in their classrooms because of policies or security restrictions. Typical teachers felt the instructional technology department supported them but needed more operational level support. Exemplars at the secondary level felt the number of resources was sufficient but felt the lack of wireless connectivity

and specialty devices such as iPads and cameras limits how they can use technology. At the elementary level, there are not enough accessible devices, which makes the use of technology feel like a major event and undertaking by all involved. Typical teachers identified major obstacles as insufficient time and lack of comfort with technology. Of concern for typical teachers was also the loss of instructional time if something were to go wrong with the technology or if they were unable to get all students logged in.

Zyad (2016) conducted a mixed methods study in which he examined secondary teachers' attitudes towards information and communication technology integration in the El-Jadida province of Morocco. The primary purpose of the study was to examine what barriers prevent secondary teachers who teach English as a foreign language from implementing information and communication technology (ICT) in their instructional practices. Barriers that were revealed as major impediments were inferior equipment, insufficient time to collaborate, and lack of communities of practice by female teachers (100%). The results also showed that male teachers seemed to be more prepared to be engaged in collaborative work as only 36% of male respondents said that the lack of communities of practice is a barrier to ICT integration and 47% indicated that the lack of collaboration constituted a hindrance to ICT implementation.

The barrier that received the greatest percentage from both male (100%) and female (95%) teachers is the lack of incentives. Female respondents (100%) and male respondents (97%) roughly expressed unanimity that concern with curriculum coverage is a major impediment that prevents them from fully integrating ICT in their classroom practices. There is almost general consensus among both female (100%) and male (90.9%) teachers that concern with joint local and national examinations represents a

significant barrier to the use of ICT in the classroom. More than two-thirds of female participants rated the lack of technical training as the least serious barrier to ICT integration whereas 84.8% male participants reported that the lack of time is the least important hurdle to the use of technology in the classroom.

According to Zyad (2016), the results of the qualitative data revealed that teachers were also concerned about managing crowded classrooms that had no ICT equipment. Class sizes of 45-50 posed enough challenges without ICT equipment. When something new is added to these classrooms, there are new challenges with which to contend. Additionally, 90% of males and 100% of female teachers stated they would integrate ICT if they were convinced the learning process would benefit from its implementation.

Laronde, MacLeod, Frost, and Waller (2017), conducted a case study in a small Northern Ontario high school that served a reserve populated with Aboriginal people of Ojibway descent. Qualitative and quantitative data were obtained and used in the study to ascertain the challenges and benefits of technology use. The school had iPads, MacBooks, and e-book readers available for students to use while in school, but they were not allowed to take any of the devices home. From the student data collected, 88% of students reported they do use computers outside of school, and 82% reported they either have their own devices or have access to a device outside of school. Students felt very comfortable using technology, and 94% reported they have access to a device and the Internet at home. Additionally, 76% admitted they use the Internet daily at school. Laronde et al. (2017) discovered that although most teachers state they were comfortable using technology, half stated they are not comfortable with or sure of how to use Word to

accomplish school-related tasks, participating in a blog, saving or organizing files, or creating a presentation.

Laronde et al.'s (2017) findings disclosed this school faced some of the same obstacles other schools face when integrating technology. The major detriment according to the school was the inability to supply each student with a laptop that would become theirs at the end of 4 years when they reach graduation. Issues experienced were an increase in cell phone usage resulting in more time spent on Snapchat and reduced bandwidth and slower Internet speed. Once the Wi-Fi became password protected cell phone use decreased, and Internet speed increased. Concerns were voiced by administrators, teachers, and students over the use of technology in the classroom. Administrator concerns centered around having enough devices for each student and limiting access to undesirable sites. Laronde et al. (2017) found other issues voiced such as the increase of students using grammar in the documents that was similar to what they used when texting. Also noticed was an increase in plagiarism from students cutting and pasting information into a document. Teachers felt the use of Google Docs improved the organizational skills of students and allowed them to find documents easily and work collaboratively on a project.

In Canada, Saxena (2017) conducted a mixed methods study examining the current obstacles faced when integrating technology in Canadian classrooms and those related challenges faced by teachers. Budget constraints were a primary issue when the money needed to purchase technology and the price of the technology needed do not match. The issue is further amplified when software and hardware are constantly being updated, making it difficult for educators to stay current with applications and features.

When these obstacles are faced consistently, integration of ICT becomes increasingly difficult. Saxena (2017) found other obstacles faced were teacher attitudes and comfort level with ICT and its integration and no continuous and applicable professional development to help teachers understand how to integrate technology in their classrooms successfully. Another major barrier was equipment which included access, training, and teacher support.

Özdemir (2017) conducted a study to determine barriers to technology integration in Turkish teaching. The qualitative study was conducted by interviewing 14 teachers who worked in public schools in Bartin city center. The biggest problems were the inadequacy of teachers, no guiding curriculum for technology integration and restrictions on the Internet at school for teachers, which limits their ability to access quality resources for their students. Participants in the survey stated they felt Turkish lessons did not provide any opportunity for technology integration, technology hindered the ability of students to think for themselves and think critically, and increased the possibility of cheating and plagiarism. Another hindrance related to Turkish lessons was the curriculum because it did not provide any direction for the use or integration of technology. Özdemir (2017) discovered teachers felt the curriculum did not provide any technology related tips or direction for them. Without the curriculum assisting them on how to implement technology most teachers did not know how to integrate it on their own. The solutions Özdemir (2017) proposed were in-service trainings for teachers, classroom examples of technology integration provided to teachers by teachers, improvement on Turkish curriculum with a focus on technology integration, fiber Internet with unlimited access for teachers, tablet distribution for students, adoption of e-books,

improvement of student technology skills and understanding of ethical use of technology, and software that is easy to use and provided free to teachers.

In her research, Wallace (2012) identified third-order barriers, which modified the barriers categorized by Ertmer (1999). Third-order barriers are barriers referred to by Wallace (2012) that put first-order and second-order barriers in the context of a school. Wallace (2012) asserted, "extrinsic resources and intrinsic beliefs may tell part of the story but examining a school's culture is also key to understanding the difficulties teachers face" (p. 13). Wallace took the barrier of institutional context out of first-order barriers believing it could stand on its own because of the strong influence a school's culture and climate can have on the adoption of technology in classrooms. Wallace (2012) reported, "first-order and second-order barriers are inextricably intertwined within a school's context which this researcher asserted is an additional third order barrier to technology integration" (p. 13). Third-order barriers are those that are related to the organization and its structure such as the bell schedule, class length, insufficient planning time, lack of peer collaboration, no technology plan, and no technology component in the teacher evaluation system. Wallace (2012) asserted, "adding a third-order barrier that encapsulates the school setting including culture and climate may help shed light on how institutional barriers also affect teachers" (p. 33).

Wallace (2012) conducted a quantitative study in northern California among 30 public high schools. The purpose of the study was to determine the most significant barriers teachers face when integrating technology in the classroom. In addition, Wallace sought to determine if there was a difference in the identification of barriers between digital natives and digital immigrants. The results of Wallace's research revealed that

digital natives rated seven of the eight items in second-order barriers as less of a problem than digital immigrant counterparts. Wallace found teachers perceived first-order barriers most significant, followed by third-order barriers and then second-order barriers. Wallace reported in her findings, "by splitting first- and third-order barriers into two domains, the results more clearly showed that material resources and support, more than school structure or climate, discouraged technology use in the classroom" (p. 116). The researcher's findings indicated that third-order barriers had a negligible effect on classroom integration of technology. Wallace (2012) reported, "it could be that since the sample comes from schools in relatively high socioeconomic areas, the participants' concerns about culture, climate, and organization may not be as remarkable as in schools where poverty and a corresponding lack of support might pose greater issues" (p. 100).

Hartley (2014) conducted a mixed methods study that examined barriers to technology integration among 39 teachers in four elementary schools in Michigan. The results of Hartley's study showed third-order barriers to be greatest when looking at reasons that technology integration was hindered. Hartley (2014) discovered among the elementary teachers who participated in the survey that the following were considered to be major barriers: teacher training and support, administrator priorities and support, resource accessibility and convenience, and teacher workload. Hartley opined that teachers move through levels of concern as they become familiar with the technology, the level of support they have, and their comfort level with the technology. At any given point their level of concern may change if one of those factors falters or is absent. With this in mind, Hartley (2014) asserted "Educators must continue to survey staff, meet face

to face, and talk about perceived barriers in order to identify what must be put in place to overcome the challenges in implementing technology" (p. 104).

Researchers have also examined whether teacher gender or content affected classroom technology integration. Inan (2007) analyzed archival data collected by the Center for Research in Educational Policy at the University of Memphis. Inan evaluated the data of 54 Tennessee public school teachers to determine factors affecting technology adoption. Inan's research uncovered teachers' age and years of teaching experience directly affects their computer proficiency and indirectly affects their integration of technology in the classroom. He discovered that technology integration is strongly impacted by how ready teachers are to integrate technology along with their personal beliefs regarding the impact of technology on teaching and learning.

Leech (2010) conducted a descriptive study in a rural western Virginia school district. The purpose of Leech's study was to determine whether teacher perceptions were related to technology integration. Leech examined demographic characteristics such as content area and years of experience to conclude whether they were related to teacher integration of technology. The results of the study indicated that teachers in grades 8-12 integrate technology more frequently than their counterparts in grades pre-k-7. Leech indicated that teachers in non-academic areas (elective classes) integrated technology more than those in academic areas (core content).

Schulze (2014) investigated the relationship between teacher technology perceptions and integration and teacher characteristics of age, gender, years of teaching experience and current subjects taught, and the highest level of college education. The study was conducted among K-12 teachers in west central Ohio. The results of the study

indicated that although teacher perception of technology integration is high, actual classroom integration is low. The results of Schulze's study also revealed that male teachers and high school teachers had the highest positive perceptions of technology integration.

O'Leary (2014) conducted research exploring whether the attitude of a teacher towards technology integration was dependent upon the content area taught, years of experience, grade level taught, and age group of the teacher. This quantitative study was conducted among third through sixth-grade teachers in a Mississippi school district. The results of O'Leary's research revealed that teachers of mathematics and language arts used technology and integrated technology moderately in student learning when compared to teachers of science and reading. O'Leary's findings also indicated teachers who taught sixth grade integrated and used technology more ideally and moderately when compared to their counterparts who taught third, fourth, and fifth grades. The results also indicated that teachers who taught 21 or more years used technology minimally compared to less experienced teachers.

Lang (2016) conducted a qualitative study to determine factors related to and influencing a teacher's instructional technology beliefs. The study was conducted among secondary teachers in a Midwestern, suburban school district. The findings from this study indicate that gender, content area, participation in professional development, stage of integration and pedagogical beliefs are related to one or more of a teacher's expectancy, value, and cost instructional technology beliefs. Lang also concluded that gender is a significant predictor of a teacher's full-scale instructional technology beliefs. The results of Lang's study indicated that female teachers had more positive beliefs

regarding instructional technology and the value of its use. Lang's results also showed that teachers who taught world languages and special education held more positive beliefs about instructional technology than teachers in the core areas. The researcher concluded that school administrators could influence technology use by focusing on pedagogical beliefs and designing professional development to reduce the perceived costs of implementation and increase the perceived value of technology on the learning experience.

Villalba, González-Rivera, and Díaz-Pulido (2017) conducted a quantitative study in Spain examining the perceptions of physical education (PE) teachers of obstacles to integrating technology and its relation to their age. This study looked at obstacles as barriers related to teachers and as barriers related to students. Villalba et al. (2017) determined the barriers related to PE teachers that inhibited technology use were lack of time, time to train teachers, and the context of the PE classroom. Barriers related to students were lack of resources (hardware, software), and lack of funding for technology in the PE course. Also, teachers were unsure of how to integrate technology in the PE curriculum without taking time away from physical activity. The results of the study indicated the most frequently perceived obstacles were loss of time spent on PE activities, limited resources, cost of time and training, unsuitable use, lack of knowledge, and technical problems. The disaggregation by age showed the same obstacles were noted but not in the same order.

Villalba et al. (2017) found the top barriers perceived by PE teachers were the investment in time and teacher training for integrating technology with physical activity and the issues technical problems present such as delays. When looking at different age

groups, the same barriers were noted although in different orders. For obstacles related to students and how it affects them, the highest one was the loss of physical activity in class and the inappropriate use of technology equipment by students.

S**ummary**

Innovations in education have a long history and faced resistance from the beginning. Those reasons for resistance have been categorized into first-order and second-order barriers by Ertmer (1999) and later Wallace (2012) who identified third-order barriers. Digital learning and 21st-century skills were also examined because of the pressure placed on schools to produce digitally literate students. These skills have become increasingly necessary for graduates who will transition to the workforce or attend an institution for post-secondary education. In Chapter 3, the methods employed in the current study are discussed.

Chapter 3

Methods

The purpose of this study was to determine what teachers in an urban setting identify as the significant barriers to effectively integrating technology into classroom instruction. Additionally, the purpose was to determine whether the difference in the identification of significant barriers to effectively integrating technology into classroom instruction was affected by the teacher's department and gender. These barriers were identified as first-order, second-order, and third-order barriers. Research design, selection of participants, measurement, data collection procedures, data analysis and hypotheses testing, and limitations are discussed in detail in this chapter.

Research Design

A quantitative nonexperimental study was formulated to identify, collect, and analyze data about the variables. Creswell (2014) reported, "Quantitative research is an approach for testing objective theories by examining the relationship among variables" (p. 4). In this study, urban teachers identified the most significant barriers to effectively integrating technology into their classroom. The independent variables studied were department and gender which can also be identified as barriers. The dependent variables were first-order, second-order, and third-order barriers. First-order barriers are identified as equipment, resources, and support. Second-order barriers are beliefs/attitudes, and skills/knowledge. Third-order barriers are structure/organization and school culture.

Selection of Participants

The target population for the study was all secondary teachers in the state of Missouri. The population eligible for participation in the study consisted of secondary

teachers from four high schools serving grades 9-12 and two schools serving grades 7-12 in District K. The sample consisted of those participants who responded to the survey.

Nonrandom purposive sampling was the method chosen by the researcher with a purposive sampling technique. According to Lunenburg & Irby (2008), "purposive sampling involves selecting a sample based on the researcher's experience or knowledge of the group to be sampled" (p. 175). This purposive sampling allowed for those identified secondary teachers in District K high schools to participate in this study. Any teacher employed by District K during the 2017-2018 school year and assigned to the four high schools serving grades 9-12 and two schools serving grades 7-12 were eligible and invited to participate in the study.

Measurement

Wallace (2012) created an instrument, Teacher Technology Use and Barriers to Classroom Integration Survey. This survey was developed to identify uses, barriers, and strategies to the implementation of technology integration in secondary schools. Several of the survey items were adopted from earlier surveys (NCES 1999; NCES 2010; TLC Survey, 1998; USEiT, 2001), which had been examined and accepted by social science research standards once they were deemed valid. The remaining survey items were developed and tested by Wallace (2012). The original instrument asked teachers to provide their age within a given range as the first question. However, since teacher gender was a variable of interest in the current study, permission was sought and granted to use the survey and change question one for respondents to provide their gender rather than age range (see Appendix B). Questions three and four from Wallace's survey were omitted because the researcher believed they measured the frequency of use rather than

the identification of barriers to effective technology integration in the classroom. According to Wallace (2012),

> Items comprising the survey were designed from questions relevant to the objective of this study and developed by combining questions about technology barriers from four pre-existing surveys (National Center for Education Statistics (NCES), 2010, 1999; Teaching, Learning, Computing (TLC), 1998; Use Support, and Effect of Instructional Technology (USEiT), 2001) as well as original questions from Wallace. Responses were worded using first-person perspective to encourage teachers to express their own personal experience with technology and decrease the tendency to make generalizations. (p. 53)

The survey utilized in this study consisted of 24 response items and three subscales (see Appendix C). The first item asked participants to identify their gender (male or female). The second item asked participants to identify their department (English Language Arts, Mathematics, Science, Social Studies, Career/Tech Ed/Computers/Business, Foreign Language, Special Education [SPED], and Other). Question three included eight items related to first-order barriers, question four included eight items related to second-order barriers, and question five included eight items related to third-order barriers. Each item for the barriers was measured using a four-point Likert-type scale from 0 *(Not a Barrier)* to 3 *(Significant Barrier).* The eight items in questions 3, 4, and 5 were used to address RQ1-RQ6.

Wallace (2012) field-tested the instrument with 32 teachers in secondary schools who were randomly selected across California. This data was analyzed, and those questions that provided irrelevant or redundant data were eliminated as well as other

questions to reduce data points. Wallace decreased the total number of questions from 13 to eight and decreased the number of items from 10 to eight per question, which was meant to create a stronger, more efficient examination of teachers and technology integration.

Wallace (2012) then used a focus group of five secondary teachers to gather feedback on the revised version. Wallace used the feedback from this group and made further revisions and had the same group complete the final draft online. Based on feedback, corrections were made on the final draft before sending the final version to study participants.

> Cronbach's alpha was the selected measure to gauge internal consistency, as it determines how all items on a survey relate to each other and to the total survey (Gay et al., 2006). The researcher set the acceptable Cronbach's alpha coefficient of reliability at greater than .8 to ensure that the items on the survey were internally consistent and measured each of the three barriers they purported to measure. (Wallace, 2012, pp. 58-59)

Wallace analyzed the items using the Statistical Package for the Social Sciences (SPSS). Table 1 shows Cronbach's alpha calculated for each of the three dependent variables. Two of the Cronbach's alphas were less than .8; however, since single-item measurement was utilized, reliability concerns were avoided (Sacket & Larson, 1990).

Table 1

Final Survey Reliability Using Cronbach's Alpha

Dependent Variable	Cronbach's Alpha	Number of Items	Sample Size
First-order barriers	.856	8	285
Second-order barriers	.781	8	285
Third-order barriers	.752	8	285

Note. Adapted from *Teachers & Technology: Identifying Uses, Barriers, and Strategies to Support Classroom Integration*, by K. Wallace, 2012. Retrieved from ProQuest Dissertations & Theses database. (UMI No. 3541640)

Data Collection Procedures

Before the study was conducted, permission was sought from the Institutional Review Board of Baker University to conduct the study. Once permission was granted (see Appendix D), approval to conduct the study was requested from District K. After permission had been granted (see Appendix E), the names and emails of participants were obtained from the school district email system school distribution lists. The survey was replicated on SurveyMonkey, an online survey generator, to distribute the survey electronically to participants. Included in the distribution were an informed consent letter and a link to the survey. An email was first sent to building principals and vice principals on February 6, 2018, informing them a survey would be sent to their teachers on February 7, 2018. The purpose of this email was to solicit their help in encouraging their teachers to complete the survey (see Appendix F). An email was sent to all participants on February 7, 2018 (see Appendix G). One week after the original email was sent, a reminder email was sent on February 15, 2018. This reminder was followed up with a second reminder email one week later on February 22, 2018, and a final reminder email

was sent two weeks later on March 8, 2018 (see Appendix H). The survey was closed on March 22, 2018, two weeks after the final reminder email was sent. Once the survey was closed, all data were uploaded to an Excel spreadsheet and entered into IBM SPSS Statistics 24 Faculty Pack for Windows and compiled for analysis.

Data Analysis and Hypothesis Testing

The specific tests used to analyze the data gathered from the research questions are presented in detail in this section. The following research questions, hypotheses, and resulting data analysis are found below.

RQ1. What do teachers identify as the significant barriers to effectively integrating technology into classroom instruction?

H1. Teachers identify not having all the technology devices needed for instruction in their classroom (or nearby) as a significant barrier.

H2. Teachers identify the technology devices they have as outdated, unreliable, or incompatible with each other as a significant barrier.

H3. Teachers identify not being able to use non-district approved technologies with their students as a significant barrier.

H4. Teachers identify bringing their class to the computer lab or library as inconvenient or difficult as a significant barrier.

H5. Teachers identify Internet access at their site as unreliable and/or websites they want to use are blocked by district filters as a significant barrier.

H6. Teachers identify a lack of funding for technology they want to purchase for classroom use as a significant barrier.

H7. Teachers identify their district office offers little or no professional development related to integrating technology into instruction as a significant barrier.

H8. Teachers identify the level of tech support in their school/district is inadequate to meet their needs as a significant barrier.

H9. Teachers identify they cannot keep up with the pace of technology change—they feel just when they have mastered one tool, it is already outdated as a significant barrier.

H10. Teachers identify they find it difficult to design and manage technology-based lessons in their classroom as a significant barrier.

H11. Teachers identify they are concerned about students being distracted, cheating, misusing, or accessing inappropriate material as a significant barrier.

H12. Teachers identify using technology for instruction does not fit well with their content area as a significant barrier.

H13. Teachers identify having to give up too much responsibility to the technology—they feel like they are not really "teaching" as a significant barrier.

H14. Teachers identify they are concerned about sacrificing curricular content or losing instructional time as a significant barrier.

H15. Teachers identify they are not sure about how to differentiate instruction using technology for the wide variety of learners in their classroom as a significant barrier.

H16. Teachers identify they often need to have a back-up lesson plan in case the technology fails as a significant barrier.

H17. Teachers identify they are expected to use district-adopted textbooks, curriculum, or pacing guides without a technology component as a significant barrier.

H18. Teachers identify their school bell schedule/length of class periods limits their use of technology with students as a significant barrier.

H19. Teachers identify they are not provided enough prep time to learn or plan ways to use technology for instruction as a significant barrier.

H20. Teachers identify their school/administration has not communicated a clear vision for using technology for instruction as a significant barrier.

H21. Teachers identify the pressure to "cover the curriculum" prior to high-stakes testing keeps me from using technology more as a significant barrier.

H22. Teachers identify they do not feel trusted to use technology in ethical ways with their students as a significant barrier.

H23. Teachers identify they are not sure how to address socioeconomic gaps between students regarding access to and experience with technology in their classroom as a significant barrier.

H24. Teachers identify they have little to no input into technology decisions that impact them as a teacher as a significant barrier.

Twenty-four one-sample *t*-tests were conducted to test H1-H24. The sample means were tested against a null value of 2. The level of significance was set at .05.

RQ2. To what extent is there a difference in the identification of significant barriers to effectively integrating technology into classroom instruction among teachers based on department.

H25. Teachers' identification of not having all the technology devices needed for instruction in their classroom (or nearby) as a significant barrier differs among departments.

H26. Teachers' identification that the technology devices are outdated, unreliable, or incompatible with each other as a significant barrier differs among departments.

H27. Teachers' identification of not being able to use non-district approved technologies with their students as a significant barrier differs among departments.

H28. Teachers' identification that bringing their class to the computer lab or library as inconvenient or difficult as a significant barrier differs among departments.

H29. Teachers' identification that Internet access at their site is unreliable and/or websites they want to use are blocked by district filters as a significant barrier differs among departments.

H30. Teachers' identification of a lack of funding for technology they want to purchase for classroom use as a significant barrier differs among departments.

H31. Teachers' identification that their district office offers little or no professional development related to integrating technology into instruction as a significant barrier differs among departments.

H32. Teachers' identification that the level of tech support in their school/district is inadequate to meet their needs differs among departments.

H33. Teachers' identification that they cannot keep up with the pace of technology change—they feel just when they have mastered one tool, it is already outdated differs among departments.

H34. Teachers' identification that they find it difficult to design and manage technology-based lessons in their classroom differs among departments.

H35. Teachers' identification that they are concerned about students being distracted, cheating, misusing, or accessing inappropriate material differs among departments.

H36. Teachers' identification that using technology for instruction does not fit well with their content area differs among departments.

H37. Teachers' identification of having to give up too much responsibility to the technology—they feel like they are not really "teaching" differs among departments.

H38. Teachers' identification that they are concerned about sacrificing curricular content or losing instructional time differs among departments.

H39. Teachers' identification that they are not sure about how to differentiate instruction using technology for the wide variety of learners in their classroom differs among departments.

H40. Teachers' identification that they often need to have a back-up lesson plan in case the technology fails differs among departments.

H41. Teachers' identification that they are expected to use district-adopted textbooks, curriculum, or pacing guides without a technology component differs among departments.

H42. Teachers' identification that their school bell schedule/length of class periods limits their use of technology with students differs among departments.

H43. Teachers' identification that they are not provided enough prep time to learn or plan ways to use technology for instruction differs among departments.

H44. Teachers' identification that their school/administration has not communicated a clear vision for using technology for instruction differs among departments.

H45. Teachers' identification of pressure to cover the curriculum before high-stakes testing keeping them from using technology more differs among departments.

H46. Teachers' identification of not feeling trusted to use technology in ethical ways with their students differs among departments.

H47. Teachers' identification of their not being sure how to address socioeconomic gaps between students regarding access to and experience with technology in their classroom differs among departments.

H48. Teachers' identification of having little to no input into technology decisions that impact them as a teacher differs among departments.

Twenty-four one factor ANOVAs were conducted to test H25-H48. The categorical variable department used to group the dependent variable, significant barriers to effectively integrating technology into classroom instruction, was department for each of the analyses. The level of significance was set at .05.

RQ3. To what extent is there a difference in the identification of significant barriers to effectively integrating technology into classroom instruction among teachers based on gender?

H49. Teachers' identification that not having all the technology devices needed for instruction in their classroom as a significant barrier differs based on gender.

H50. Teachers' identification that the technology devices they have are outdated, unreliable, or incompatible with each other differs based on gender.

H51. Teachers' identification that not being able to use non-district approved technologies with their students differs based on gender.

H52. Teachers' identification that bringing their class to the computer lab or library as inconvenient or difficult differs based on gender.

H53. Teachers' identification that Internet access at their site is unreliable and/or websites they want to use are blocked by district filters differs based on gender.

H54. Teachers' identification that the lack of funding for technology they want to purchase for classroom use differs based on gender.

H55. Teachers' identification that their district office offers little or no professional development related to integrating technology into instruction differs based on gender.

H56. Teachers' identification that the level of tech support in their school/district is inadequate to meet their needs differs based on gender.

H57. Teachers' identification that they cannot keep up with the pace of technology change—they feel just when they have mastered one tool, it is already outdated differs based on gender.

H58. Teachers' identification that they find it difficult to design and manage technology-based lessons in their classroom differs based on gender.

H59. Teachers' identification that they are concerned about students being distracted, cheating, misusing, or accessing inappropriate material differs based on gender.

H60. Teachers' identification that using technology for instruction does not fit well with their content area differs based on gender.

H61. Teachers' identification that having to give up too much responsibility to the technology—they feel like they are not really "teaching" differs based on gender.

H62. Teachers' identification that they are concerned about sacrificing curricular content or losing instructional time differs based on gender.

H63. Teachers' identification that they are not sure about how to differentiate instruction using technology for the wide variety of learners in their classroom differs based on gender.

H64. Teachers' identification that they often need to have a back-up lesson plan in case the technology fails differs based on gender.

H65. Teachers' identification that they are expected to use district-adopted textbooks, curriculum, or pacing guides without a technology component differs based on gender.

H66. Teachers' identification that their school bell schedule/length of class periods limits their use of technology with students differs based on gender.

H67. Teachers' identification that they are not provided enough prep time to learn or plan ways to use technology for instruction differs based on gender.

H68. Teachers' identification that their school/administration has not communicated a clear vision for using technology for instruction differs based on gender.

H69. Teachers' identification that the pressure to "cover the curriculum" prior to high-stakes testing keeps me from using technology more differs based on gender.

H70. Teachers' identification that they do not feel trusted to use technology in ethical ways with their students differs based on gender.

H71. Teachers' identification that they are not sure how to address socioeconomic gaps between students regarding access to and experience with technology in their classroom differs based on gender.

H72. Teachers' identification that they have little to no input into technology decisions that impact them as a teacher differs based on gender.

Twenty-four two sample *t* tests were conducted to test H49-H72. The two sample means were compared. The level of significance was set at .05.

RQ4. To what extent is the identification of significant barriers to effective technology integration into classroom instruction different among first-order, second-order, and third-order barriers?

H73. The identification of the significant barriers to effective integration of technology into classroom instruction is different among first-order, second-order, and third-order barriers.

A two-factor ANOVA was conducted to test H73. The two categorical variables used to group the dependent variable (identification of barriers to effective technology integration into classroom instruction) were barrier type and department. The two-factor ANOVA can be used to test three hypotheses including a main effect for barrier type, a main effect for department, and a two-way interaction effect (Barrier Type x Department). The main effect for barrier type was used to test H73. The level of significance was set at .05.

RQ5. To what extent is the difference in the identified significant barriers to effective technology integration into classroom instruction among first-order, second-order, and third-order barriers affected by department?

H74. The difference in the identification of the significant barriers to effective integration of technology into classroom instruction among first-order, second-order, and third-order barriers is affected by teacher department.

The interaction effect from the first two-factor ANOVA was used to test H74. The two categorical variables used to group the dependent variable were barrier type and department. The level of significance was set at .05.

RQ6. To what extent is the difference in the identified significant barriers to effective technology integration into classroom instruction among first-order, second-order, and third-order barriers affected by teacher gender?

H75. The difference in the identification of the significant barriers to effective integration of technology into classroom instruction is different among first-order, second-order, and third-order barriers is affected by teacher gender.

A second-factor ANOVA was conducted to test H75. The two categorical variables used to group the dependent variable (identification of barriers to effective technology integration into classroom instruction) were barrier type and gender. The level of significance was set at .05. The two-factor ANOVA can be used to test three hypotheses including a main effect for barrier type, a main effect for gender, and a two-way interaction effect (Barrier Type x Gender). The interaction effect (Barrier Type x Gender) was used to test H75. The level of significance was set at .05.

Limitations

The focus of this study was to identify the significant barriers to effective integration of technology in classrooms where students have been issued a laptop. There were limitations of this study. District K teachers who participated in the survey can only

be considered a sampling because not all teachers who had access completed the survey. The level of professional development teachers have been provided by the school district is another limitation. Four years ago, the school district embarked on a very aggressive plan with intensive professional development for teachers as they began implementation of the 1:1 initiative. However, through turnover, attrition, and reduction in force, a number of those teachers are no longer employed with the district, and those that have been hired since have not been exposed to the same level of professional development. The information and data obtained for this study were collected to examine practices for District K and can only be used to make generalizations for District K and its current practices.

Summary

This chapter examined the methods employed in the study, which included the research design, selection of participants, measurement, data collection procedures, data analysis and hypothesis testing, and the limitations of the study. Chapter 4 contains the descriptive statistics and the results of the data analysis. The results of the data analysis will determine if the barriers identified by teachers could differ between genders and departments.

Chapter 4

Results

This study was designed to determine the barriers that hinder the ability of teachers to integrate technology in the classroom. These barriers have been classified as first-order, second-order, and third-order barriers and were examined by teacher department and gender. The descriptive statistics and the results of the data analysis are presented in this chapter.

Descriptive Statistics

An email was sent to 224 District K teachers who worked in the six district high schools. Four of the six high schools serve students in grades 9-12, and two of the schools serve students in grades 7-12. All six high schools participated in the 1:1 program where each student enrolled in those buildings was issued a laptop. Of the 224 surveys sent, 144 participants completed the 24-question survey. Of the 144 participants, there were six administrators, one counselor, and one attendance specialist who completed the survey whose responses were not included in the results because the researcher was only interested in the responses of secondary classroom teachers. The response rate of 66% was obtained by reminding participants to complete the survey in two-week intervals for four weeks and a final reminder the fifth week. The survey opened on February 5, 2018 and closed on March 12, 2018.

The number of responses from females was slightly higher than the responses from males. Of the 144 survey respondents, there were 81 females and 63 males. Department and gender were two of the variables examined. The number of responses from each department was ELA with 17 respondents, social studies with 20 respondents,

science with 19 respondents, math with 17 respondents, foreign language with seven respondents, special education with 17 respondents, career/tech ed with nine respondents, and 34 respondents from departments in the other category. Departments in the other category included band, orchestra, choir, music, JROTC, art, ELL, dance, visual arts, theater, and other electives. The response rate by department allowed results to be analyzed according to gender and department. Three barriers were examined with eight items related to each barrier for a total of 24 items after gender and department were identified.

Hypothesis Testing

The results of the hypothesis testing that addressed the six research questions utilized in this study are discussed in this section. Each research question addressed in the study is followed by the methods used to test the hypotheses related to the research question, each hypothesis, and the results of each hypothesis test.

RQ1. What do teachers identify as the significant barriers to effectively integrating technology into classroom instruction?

Twenty-four one-sample t-tests were conducted to test H1-H24. For each, the sample mean was tested against a value of 2. The level of significance was set at 0.5.

H1. Teachers identify not having all the technology devices needed for instruction in their classroom (or nearby) as a significant barrier.

The results of the one-sample *t* test to test H1 indicated no difference between the two values, $t = 1.088$, $df = 132$, $p = .279$. The sample mean ($M = 2.10$, $SD = 1.04$) was not different from the null value (2). These results do not support H1.

H2. Teachers identify the technology devices they have as outdated, unreliable, or incompatible with each other as a significant barrier.

The results of the one-sample *t* test to test H2 indicated no difference between the two values, $t = 0.092$, $df = 132$, $p = .927$. The sample mean ($M = 2.01$, $SD = 0.94$) was not different from the null value (2). These results do not support H2.

H3. Teachers identify not being able to use non-district approved technologies with their students as a significant barrier.

The results of the one-sample *t* test to test H3 indicated a statistically significant difference between the two values, $t = -2.059$, $df = 131$, $p = .041$. The sample mean ($M = 1.81$, $SD = 1.06$) was different from the null value (2). These results do not support H3. Teachers do not identify not being able to use non-district approved technologies with their students as a significant barrier to integrating technology into classroom instruction.

H4. Teachers identify bringing their class to the computer lab or library as inconvenient or difficult as a significant barrier.

The results of the one-sample *t* test to test H4 indicated no difference between the two values, $t = -0.544$, $df = 132$, $p = .588$. The sample mean ($M = 1.95$, $SD = 1.12$) was not different from the null value (2). These results do not support H4.

H5. Teachers identify Internet access at their site as unreliable and/or websites they want to use are blocked by district filters as a significant barrier.

The results of the one-sample *t* test to test H5 indicated no difference between the two values, $t = 0.373$, $df = 132$, $p = .709$. The sample mean ($M = 2.03$ $SD = 0.93$) was not different from the null value (2). These results do not support H5.

H6. Teachers identify a lack of funding for technology they want to purchase for classroom use as a significant barrier.

The results of the one-sample *t* test to test H6 indicated a statistically significant difference between the two values, $t = 2.157$, $df = 132$, $p = .033$. The sample mean ($M = 2.20$, $SD = 1.09$) was different from the null value (2). These results support H6. Teachers identify a lack of funding for technology they want to purchase as a significant barrier to integrating technology into classroom instruction.

H7. Teachers identify their district office offers little or no professional development related to integrating technology into instruction as a significant barrier.

The results of the one-sample *t* test to test H7 indicated no difference between the two values, $t = 1.613$, $df = 130$, $p = .109$. The sample mean ($M = 2.14$, $SD = 0.97$) was not different from the null value (2). These results do not support H7.

H8. Teachers identify the level of tech support in their school/district is inadequate to meet their needs as a significant barrier.

The results of the one-sample *t* test to test H8 indicated a statistically significant difference between the two values, $t = 3.998$, $df = 132$, $p = .000$. The sample mean ($M = 2.38$, $SD = 1.08$) was different from the null value (2). These results support H8. Teachers identify the level of tech support in their school/district is inadequate to meet the needs as a significant barrier.

H9. Teachers identify they cannot keep up with the pace of technology change—they feel just when they have mastered one tool, it is already outdated as a significant barrier.

The results of the one-sample *t* test to test H9 indicated a statistically significant difference between the two values, $t = -4.259$, $df = 128$, $p = .000$. The sample mean ($M = 1.68$, $SD = 0.85$) was different from the null value (2). These results do not support H9. Teachers did not identify that they cannot keep up with the pace of technology change—they feel just when they have mastered one tool, it is already outdated as a significant barrier.

H10. Teachers identify they find it difficult to design and manage technology-based lessons in their classroom as a significant barrier.

The results of the one-sample *t* test to test H10 indicated no difference between the two values, $t = -0.682$, $df = 129$, $p = .497$. The sample mean ($M = 1.95$, $SD = 0.90$) was not different from the null value (2). These results do not support H10.

H11. Teachers identify they are concerned about students being distracted, cheating, misusing, or accessing inappropriate material as a significant barrier.

The results of the one-sample *t* test to test H11 indicated a statistically significant difference between the two values, $t = 9.397$, $df = 129$, $p = .000$. The sample mean ($M = 2.88$, $SD = 1.06$) was different from the null value (2). These results support H11. Teachers identify they are concerned about students being distracted, cheating, misusing, or accessing inappropriate material as a significant barrier.

H12. Teachers identify using technology for instruction does not fit well with their content area as a significant barrier.

The results of the one-sample *t* test to test H12 indicated a statistically significant difference between the two values, $t = -8.193$, $df = 129$, $p = .000$. The sample mean ($M = 1.47$, $SD = 0.74$) was different from the null value (2). These results do not support

H12. Teachers did not identify using technology for instruction does not fit well with their content area as a significant barrier.

H13. Teachers identify having to give up too much responsibility to the technology—they feel like they are not really "teaching" as a significant barrier.

The results of the one-sample *t* test to test H13 indicated a statistically significant difference between the two values, $t = -12.060$, $df = 128$, $p = .000$. The sample mean ($M = 1.36$, $SD = 0.60$) was different from the null value (2). These results do not support H13. Teachers did not identify having to give up too much responsibility to the technology—they feel like they are not really "teaching" as a significant barrier.

H14. Teachers identify they are concerned about sacrificing curricular content or losing instructional time as a significant barrier.

The results of the one-sample *t* test to test H14 indicated a statistically significant difference between the two values, $t = -5.346$, $df = 127$, $p = .000$. The sample mean ($M = 1.63$, $SD = 0.79$) was different from the null value (2). These results do not support H14.

H15. Teachers identify they are not sure about how to differentiate instruction using technology for the wide variety of learners in their classroom as a significant barrier.

The results of the one-sample *t* test to test H15 indicated a statistically significant difference between the two values, $t = -3.462$, $df = 127$, $p = .001$. The sample mean ($M = 1.73$, $SD = 0.89$) was different from the null value (2). These results do not support H15. Teachers did not identify they are not sure about how to differentiate instruction

using technology for the wide variety of learners in their classroom as a significant barrier.

H16. Teachers identify they often need to have a back-up lesson plan in case the technology fails as a significant barrier.

The results of the one-sample *t* test to test H16 indicated a statistically significant difference between the two values, $t = 3.022$, $df = 129$ $p = .003$. The sample mean ($M = 2.30$, $SD = 1.13$) was different from the null value (2). These results support H16. Teachers identify they often need to have a back-up plan in case the technology fails as a significant barrier.

H17. Teachers identify they are expected to use district-adopted textbooks, curriculum, or pacing guides without a technology component as a significant barrier.

The results of the one-sample *t* test to test H17 indicated a statistically significant difference between the two values, $t = -6.579$, $df = 127$, $p = .000$. The sample mean ($M = 1.54$, $SD = 0.79$) was different from the null value (2). These results do not support H17. Teachers did not identify they are expected to use district-adopted textbooks, curriculum, or pacing guides without a technology component as a significant barrier.

H18. Teachers identify their school bell schedule/length of class periods limits their use of technology with students as a significant barrier.

The results of the one-sample *t* test to test H18 indicated a statistically significant difference between the two values, $t = -4.781$, $df = 127$, $p = .000$. The sample mean ($M = 1.63$, $SD = 0.89$) was different from the null value (2). These results do not support H18. Teachers did not identify their school bell schedule/length of class periods limits their use of technology with students as a significant barrier.

H19. Teachers identify they are not provided enough prep time to learn or plan ways to use technology for instruction as a significant barrier.

The results of the one-sample *t* test to test H19 indicated a statistically significant difference between the two values, $t = 5.040$, $df = 127$, $p = .000$. The sample mean ($M = 2.50$, $SD = 1.12$) was different from the null value (2). These results support H19. Teachers identify they are not provided enough prep time to learn ways to use technology for instruction as a significant barrier.

H20. Teachers identify their school/administration has not communicated a clear vision for using technology for instruction as a significant barrier.

The results of the one-sample *t* test to test H20 indicated no difference between the two values, $t = 1.367$, $df = 127$, $p = .174$. The sample mean ($M = 2.13$, $SD = 1.03$) was not different from the null value (2). These results do not support H20.

H21. Teachers identify the pressure to "cover the curriculum" prior to high-stakes testing keeps me from using technology more as a significant barrier.

The results of the one-sample *t* test to test H21 indicated no difference between the two values, $t = -1.921$, $df = 126$, $p = 0.057$. The sample mean ($M = 1.83$, $SD = 1.02$) was not different from the null value (2). These results do not support H21.

H22. Teachers identify they do not feel trusted to use technology in ethical ways with their students as a significant barrier.

The results of the one-sample *t* test to test H22 indicated a statistically significant difference between the two values, $t = -13.451$, $df = 127$, $p = .000$. The sample mean ($M = 1.27$, $SD = 0.61$) was different from the null value (2). These results do not support

H22. Teachers did not identify they do not feel trusted to use technology in ethical ways with their students as a significant barrier.

H23. Teachers identify they are not sure how to address socioeconomic gaps between students regarding access to and experience with technology in their classroom as a significant barrier.

The results of the one-sample *t* test to test H23 indicated a statistically significant difference between the two values, $t = -2.827$, $df = 127$, $p = .005$. The sample mean ($M = 1.77$, $SD = 0.91$) was different from the null value (2). These results do not support H23. Teachers did not identify they are not sure how to address socioeconomic gaps between students regarding access to and experience with technology in their classroom as a significant barrier.

H24. Teachers identify they have little to no input into technology decisions that impact them as a teacher as a significant barrier.

The results of the one-sample *t* test to test H24 indicated no difference between the two values, $t = 1.104$, $df = 127$, $p = .272$. The sample mean ($M = 2.10$, $SD = 1.04$) was not different from the null value (2). These results do not support H24.

RQ2. To what extent is there a difference in the identification of significant barriers to effectively integrating technology into classroom instruction among teachers based on department.

Twenty-four one-factor ANOVAs were conducted to test H25-H48. The categorical variable used to group the dependent variable, significant barriers to effectively integrating technology into classroom instruction, was department for each of the analyses. The level of significance was set at .05.

H25. Teachers' identification of not having all the technology devices needed for instruction in their classroom (or nearby) as a significant barrier differs among departments.

The results of the analysis used to test H25 indicated there was not a statistically significant difference between at least two of the means, $F = 1.140$, $df = 7, 125$, $p = 0.343$. See Table 2 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H25.

Table 2

Descriptive Statistics for the Results of the Test for H25

Variable	*N*	*M*	*SD*
ELA	17	2.59	1.28
Math	17	2.12	1.05
Science	19	2.00	0.75
Social Studies	17	1.71	0.77
Career/Tech Ed	8	2.13	0.83
Foreign Language	6	2.50	1.05
SPED	17	2.18	1.13
Other	32	1.97	1.12

H26. Teachers' identification that the technology devices are outdated, unreliable, or incompatible with each other as a significant barrier differs among departments.

The results of the analysis used to test H26 indicated a statistically significant difference between at least two of the means, $F = 2.749$, $df = 7, 125$, $p = 0.011$. See Table 3 for the means and standard deviations for this analysis. The Fisher's LSD post

hoc was conducted to determine which pairs of means were different. The level of significance was set at .05. Eight of the differences were statistically significant. The mean for math teachers (M = 2.59) was higher than the mean for science teachers (M = 1.74), for social studies teachers (M = 1.71), for foreign language teachers (M = 1.33), and for SPED teachers (M = 1.71). The mean for career/tech ed teachers (M = 2.50) was higher than the mean for science teachers (M = 1.74), for social studies teachers (M = 1.71), for foreign language teachers (M = 1.33), and for SPED teachers (M = 1.71). These findings support H26. Teachers' identification that the technology devices are outdated, unreliable, or incompatible with each other as a significant barrier among departments.

Table 3

Descriptive Statistics for the Results of the Test for H26

Variable	*N*	*M*	*SD*
ELA	17	2.18	1.13
Math	17	2.59	0.87
Science	19	1.74	0.87
Social Studies	17	1.71	0.69
Career/Tech Ed	8	2.50	1.07
Foreign Language	6	1.33	0.82
SPED	17	1.71	0.77
Other	32	2.09	0.93

H27. Teachers' identification of not being able to use non-district approved technologies with their students as a significant barrier differs among departments.

The results of the analysis used to test H27 indicated there was not a statistically significant difference between at least two of the means, $F = 0.914$, $df = 7, 124$, $p = 0.498$. See Table 4 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H27.

Table 4

Descriptive Statistics for the Results of the Test for H27

Variable	*N*	*M*	*SD*
ELA	17	1.88	1.17
Math	17	2.00	1.32
Science	18	1.44	0.62
Social Studies	17	1.47	0.80
Career/Tech Ed	8	2.13	1.36
Foreign Language	6	2.17	1.17
SPED	17	1.76	1.03
Other	32	1.94	1.08

H28. Teachers' identification that bringing their class to the computer lab or library as inconvenient or difficult as a significant barrier differs among departments.

The results of the analysis used to test H28 indicated a statistically significant difference between at least two of the means, $F = 2.580$, $df = 7, 125$, $p = 0.016$. See Table 5 for the means and standard deviations for this analysis. The Fisher's LSD post hoc was conducted to determine which pairs of means were different. The level of significance was set at .05. Seven of the differences were statistically significant. The mean for ELA teachers ($M = 2.59$) was higher than the mean for science teachers

(*M* = 1.74), for social studies teachers (*M* = 1.59), for career/tech ed (*M* = 1.13) and other teachers (M = 1.84). The mean for math teachers (*M* = 2.47) was higher than the mean higher for science teachers (*M* = 1.74), for social studies teachers (*M* = 1.59), for career/tech ed (*M* = 1.13). These findings support H28. Teachers' identification that bringing their class to the computer lab or library as inconvenient or difficult as a significant barrier among departments.

Table 5

Descriptive Statistics for the Results of the Test for H28

Variable	*N*	*M*	*SD*
ELA	17	2.59	1.23
Math	17	2.47	1.37
Science	19	1.74	0.87
Social Studies	17	1.59	0.94
Career/Tech Ed	8	1.13	0.35
Foreign Language	6	2.17	0.75
SPED	17	1.88	0.99
Other	32	1.84	1.17

H29. Teachers' identification that Internet access at their site is unreliable and/or websites they want to use are blocked by district filters as a significant barrier differs among departments.

The results of the analysis used to test H29 indicated there was not a statistically significant difference between at least two of the means, *F* = 1.998, *df* = 7, 125,

$p = 0.060$. See Table 6 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H29.

Table 6

Descriptive Statistics for the Results of the Test for H29

Variable	*N*	*M*	*SD*
ELA	17	2.47	1.01
Math	17	2.18	0.73
Science	19	1.79	0.85
Social Studies	17	1.94	0.90
Career/Tech Ed	8	2.00	1.07
Foreign Language	6	1.50	0.55
SPED	17	1.59	0.71
Other	32	2.25	1.05

H30. Teachers' identification of a lack of funding for technology they want to purchase for classroom use as a significant barrier differs among departments.

The results of the analysis used to test H30 indicated there was not a statistically significant difference between at least two of the means, $F = 1.175$, $df = 7, 125$, $p = .322$. See Table 7 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H30.

Table 7

Descriptive Statistics for the Results of the Test for H30

Variable	*N*	*M*	*SD*
ELA	17	2.71	1.16
Math	17	2.41	1.28
Science	19	1.95	1.03
Social Studies	17	1.76	0.90
Career/Tech Ed	8	2.25	1.28
Foreign Language	6	2.17	0.98
SPED	17	2.24	1.15
Other	32	2.19	0.97

H31. Teachers' identification that their district office offers little or no professional development related to integrating technology into instruction as a significant barrier differs among departments.

The results of the analysis used to test H31 indicated there was not a statistically significant difference between at least two of the means, $F = 1.349$, $df = 7, 123$, $p = .233$. See Table 8 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H31.

Table 8

Descriptive Statistics for the Results of the Test for H31

Variable	*N*	*M*	*SD*
ELA	16	2.56	1.03
Math	17	2.24	1.03
Science	19	2.00	0.94
Social Studies	17	2.06	0.66
Career/Tech Ed	17	2.63	1.06
Foreign Language	8	2.50	1.05
SPED	6	1.81	0.83
Other	32	1.97	1.06

H32. Teachers' identification that the level of tech support in their school/district is inadequate to meet their needs differs among departments.

The results of the analysis used to test H32 indicated a statistically significant difference between at least two of the means, $F = 2.149$, $df = 7, 125$, $p = .043$. See Table 9 for the means and standard deviations for this analysis. The Fisher's LSD post hoc was conducted to determine which pairs of means were different. The level of significance was set at .05. Six of the differences were statistically significant. The mean for ELA teachers ($M = 3.18$) was higher than the mean for science teachers ($M = 2.42$), for social studies teachers ($M = 2.35$), for career/tech ed ($M = 2.63$), for foreign language teachers ($M = 2.17$), for SPED teachers ($M = 2.00$), and for other teachers ($M = 2.09$). These findings support H32. Teachers' identification that the level of tech support in their school/district is inadequate to meet their needs differs among departments.

Table 9

Descriptive Statistics for the Results of the Test for H32

Variable	*N*	*M*	*SD*
ELA	17	3.18	1.07
Math	17	2.41	1.06
Science	19	2.42	1.12
Social Studies	17	2.35	1.11
Career/Tech Ed	8	2.63	0.92
Foreign Language	6	2.17	0.75
SPED	17	2.00	1.00
Other	32	2.09	1.06

H33. Teachers' identification that they cannot keep up with the pace of technology change—they feel just when they have mastered one tool, it is already outdated differs among departments.

The results of the analysis used to test H33 indicated there was not a statistically significant difference between at least two of the means, $F = 0.320$, $df = 7, 121$, $p = .944$. See Table 10 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H33.

Table 10

Descriptive Statistics for the Results of the Test for H33

Variable	*N*	*M*	*SD*
ELA	17	1.65	0.93
Math	16	1.56	0.73
Science	19	1.63	0.96
Social Studies	17	1.65	0.79
Career/Tech Ed	8	1.50	0.76
Foreign Language	6	2.00	1.26
SPED	15	1.67	0.72
Other	31	1.81	0.87

H34. Teachers' identification that they find it difficult to design and manage technology-based lessons in their classroom differs among departments.

The results of the analysis used to test H34 indicated there was not a statistically significant difference between at least two of the means, $F = 0.266$, $df = 7, 122$, $p = .966$. See Table 11 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H34.

Table 11

Descriptive Statistics for the Results of the Test for H34

Variable	*N*	*M*	*SD*
ELA	17	2.06	0.90
Math	16	1.88	0.89
Science	19	2.05	1.03
Social Studies	17	1.82	0.81
Career/Tech Ed	8	2.13	0.83
Foreign Language	6	2.17	1.17
SPED	15	1.87	0.74
Other	32	1.88	0.98

H35. Teachers' identification that they are concerned about students being distracted, cheating, misusing, or accessing inappropriate material differs among departments.

The results of the analysis used to test H35 indicated there was not a statistically significant difference between at least two of the means, $F = 2.069$, $df = 7, 122$, $p = .052$. See Table 12 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H35.

Table 12

Descriptive Statistics for the Results of the Test for H35

Variable	*N*	*M*	*SD*
ELA	17	2.53	1.05
Math	16	2.76	1.03
Science	19	3.06	1.06
Social Studies	17	3.47	0.90
Career/Tech Ed	8	3.12	0.86
Foreign Language	6	2.75	1.39
SPED	15	3.17	1.17
Other	32	2.53	1.05

H36. Teachers' identification that using technology for instruction does not fit well with their content area differs among departments.

The results of the analysis used to test H36 indicated there was not a statistically significant difference between at least two of the means, $F = 1.356$, $df = 7, 122$, $p = .230$. See Table 13 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H36.

Table 13

Descriptive Statistics for the Results of the Test for H36

Variable	*N*	*M*	*SD*
ELA	17	1.41	0.62
Math	16	1.69	0.87
Science	19	1.32	0.48
Social Studies	17	1.29	0.47
Career/Tech Ed	8	1.00	0.00
Foreign Language	6	1.50	0.84
SPED	15	1.47	0.74
Other	32	1.69	0.97

H37. Teachers' identification of having to give up too much responsibility to the technology—they feel like they are not really "teaching" differs among departments.

The results of the analysis used to test H37 indicated there was not a statistically significant difference between at least two of the means, $F = 1.498$, $df = 7, 121$, $p = .174$. See Table 14 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H37.

Table 14

Descriptive Statistics for the Results of the Test for H37

Variable	*N*	*M*	*SD*
ELA	17	1.35	0.49
Math	16	1.69	1.01
Science	19	1.42	0.61
Social Studies	16	1.50	0.52
Career/Tech Ed	8	1.00	0.00
Foreign Language	6	1.33	0.52
SPED	15	1.27	0.59
Other	32	1.25	0.44

H38. Teachers' identification that they are concerned about sacrificing curricular content or losing instructional time differs among departments.

The results of the analysis used to test H38 indicated there was not a statistically significant difference between at least two of the means, $F = 1.454$, $df = 7, 120$, $p = .190$. See Table 15 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H38.

Table 15

Descriptive Statistics for the Results of the Test for H38

Variable	*N*	*M*	*SD*
ELA	17	1.53	0.72
Math	16	2.00	0.97
Science	18	1.72	0.75
Social Studies	17	1.53	0.62
Career/Tech Ed	8	1.00	0.00
Foreign Language	6	1.83	0.75
SPED	15	1.53	0.83
Other	31	1.65	0.88

H39. Teachers' identification that they are not sure about how to differentiate instruction using technology for the wide variety of learners in their classroom differs among departments.

The results of the analysis used to test H39 indicated there was not a statistically significant difference between at least two of the means, $F = 0.824$, $df = 7, 120$, $p = .569$. See Table 16 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H39.

Table 16

Descriptive Statistics for the Results of the Test for H39

Variable	*N*	*M*	*SD*
ELA	16	1.63	0.81
Math	16	2.06	0.93
Science	19	1.74	0.87
Social Studies	17	1.94	0.97
Career/Tech Ed	8	1.88	1.25
Foreign Language	6	1.50	0.55
SPED	15	1.47	0.64
Other	31	1.61	0.95

H40. Teachers' identification that they often need to have a back-up lesson plan in case the technology fails differs among departments.

The results of the analysis used to test H40 indicated a statistically significant difference between at least two of the means, $F = 2.260$, $df = 7, 122$, $p = .034$. See Table 17 for the means and standard deviations for this analysis. The Fisher's LSD post hoc was conducted to determine which pairs of means were different. The level of significance was set at .05. Six of the differences were statistically significant. The mean for ELA teachers ($M = 2.88$) was higher than the mean for other teachers ($M = 2.13$). The mean for ELA teachers ($M = 2.88$), math teachers ($M = 2.69$), science teachers ($M = 2.37$), foreign language teachers ($M = 2.50$), other teachers (M = 2.13), and SPED teachers ($M = 2.13$) were all higher than the mean for career/tech ed (M = 1.25). These

findings support H40. Teachers' identification that they often need to have a back-up lesson plan in case the technology fails differs among departments.

Table 17

Descriptive Statistics for the Results of the Test for H40

Variable	*N*	*M*	*SD*
ELA	17	2.88	1.05
Math	16	2.69	1.14
Science	19	2.37	0.96
Social Studies	17	2.18	1.13
Career/Tech Ed	8	1.25	0.71
Foreign Language	6	2.50	0.84
SPED	15	2.13	1.30
Other	32	2.13	1.16

H41. Teachers' identification that they are expected to use district-adopted textbooks, curriculum, or pacing guides without a technology component differs among departments.

The results of the analysis used to test H41 indicated a statistically significant difference between at least two of the means, $F = 3.228$, $df = 7, 120$, $p = .004$. See Table 18 for the means and standard deviations for this analysis. The Fisher's LSD post hoc was conducted to determine which pairs of means were different. The level of significance was set at .05. Seven of the differences were statistically significant. The mean for foreign language teachers ($M = 2.83$) was higher than the mean for ELA teachers ($M = 1.56$), for science teachers ($M = 1.42$), for social studies teachers

(*M* = 1.59), for career/tech ed (*M* = 1.00), for SPED teachers (*M* = 1.47), and for other teachers (M = 1.47). These findings support H41. Teachers' identification that they are expected to use district-adopted textbooks, curriculum, or pacing guides without a technology component differs among departments.

Table 18

Descriptive Statistics for the Results of the Test for H41

Variable	*N*	*M*	*SD*
ELA	16	1.56	1.03
Math	16	1.56	0.89
Science	19	1.42	0.51
Social Studies	17	1.59	0.62
Career/Tech Ed	7	1.00	0.00
Foreign Language	6	2.83	0.98
SPED	15	1.47	0.64
Other	32	1.47	0.76

H42. Teachers' identification that their school bell schedule/length of class periods limits their use of technology with students differs among departments.

The results of the analysis used to test H42 indicated there was not a statistically significant difference between at least two of the means, $F = 1.654$, $df = 7, 120$, $p = .127$. See Table 19 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H42.

Table 19

Descriptive Statistics for the Results of the Test for H42

Variable	*N*	*M*	*SD*
ELA	16	1.88	1.09
Math	16	1.94	1.06
Science	19	1.74	0.87
Social Studies	17	1.47	0.87
Career/Tech Ed	7	1.14	0.38
Foreign Language	6	2.17	1.47
SPED	15	1.53	0.72
Other	32	1.53	0.72

H43. Teachers' identification that they are not provided enough prep time to learn or plan ways to use technology for instruction differs among departments.

The results of the analysis used to test H43 indicated a statistically significant difference between at least two of the means, $F = 2.543$, $df = 7, 120$, $p = .018$. See Table 20 for the means and standard deviations for this analysis. The LSD post hoc was conducted to determine which pairs of means were different. The level of significance was set at .05. Seven of the differences were statistically significant. The mean for math teachers (M = 3.06) was higher than the mean for social studies teachers ($M = 2.24$) and the mean for other teachers ($M = 2.13$). The mean for foreign language teachers ($M = 3.67$) was higher than the mean for ELA teachers ($M = 2.56$), for social studies teachers ($M = 2.24$), and for career/tech ed ($M = 2.14$), for SPED teachers ($M = 2.40$), and other teachers ($M = 2.13$). These findings support H43. Teachers' identification that

they are not provided enough prep time to learn or plan ways to use technology for instruction differs among departments.

Table 20

Descriptive Statistics for the Results of the Test for H43

Variable	*N*	*M*	*SD*
ELA	16	2.56	1.15
Math	16	3.06	1.00
Science	19	2.68	1.06
Social Studies	17	2.24	1.03
Career/Tech Ed	7	2.14	1.21
Foreign Language	6	3.67	0.52
SPED	15	2.40	1.18
Other	32	2.13	1.10

H44. Teachers' identification that their school/administration has not communicated a clear vision for using technology for instruction differs among departments.

The results of the analysis used to test H44 indicated there was not a statistically significant difference between at least two of the means, $F = 1.355$, $df = 7, 120$, $p = .231$. See Table 21 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H44.

Table 21

Descriptive Statistics for the Results of the Test for H44

Variable	*N*	*M*	*SD*
ELA	16	2.25	1.06
Math	16	2.44	1.26
Science	19	2.16	1.01
Social Studies	17	2.12	0.99
Career/Tech Ed	7	2.14	1.07
Foreign Language	6	3.00	1.26
SPED	15	1.87	0.92
Other	32	1.84	0.88

H45. Teachers' identification of pressure to cover the curriculum before high-stakes testing keeping them from using technology more differs among departments.

The results of the analysis used to test H45 indicated there was not a statistically significant difference between at least two of the means, $F = 1.352$, $df = 7, 119$, $p = .232$. See Table 22 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H45

Table 22

Descriptive Statistics for the Results of the Test for H45

Variable	*N*	*M*	*SD*
ELA	16	2.06	1.29
Math	15	2.40	1.06
Science	19	1.89	1.10
Social Studies	17	1.59	0.80
Career/Tech Ed	7	1.57	0.98
Foreign Language	6	1.83	1.17
SPED	15	1.87	0.83
Other	32	1.56	0.91

H46. Teachers' identification of not feeling trusted to use technology in ethical ways with their students differs among departments.

The results of the analysis used to test H46 indicated there was not a statistically significant difference between at least two of the means, $F = 0.392$, $df = 7, 120$, $p = .906$. See Table 23 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H46.

Table 23

Descriptive Statistics for the Results of the Test for H46

Variable	*N*	*M*	*SD*
ELA	16	1.19	0.54
Math	16	1.38	0.89
Science	19	1.21	0.54
Social Studies	17	1.29	0.47
Career/Tech Ed	7	1.29	0.49
Foreign Language	6	1.17	0.41
SPED	15	1.13	0.35
Other	32	1.38	0.75

H47. Teachers' identification of their not being sure how to address socioeconomic gaps between students regarding access to and experience with technology in their classroom differs among departments.

The results of the analysis used to test H47 indicated a statistically significant difference between at least two of the means, $F = 2.354$, $df = 7, 120$, $p = .027$. See Table 24 for the means and standard deviations for this analysis. The Fisher's LSD post hoc was conducted to determine which pairs of means were different. The level of significance was set at .05. Seven of the differences were statistically significant. The mean for foreign language teachers ($M = 3.00$) was higher than the mean for ELA teachers ($M = 1.75$), for math teachers ($M = 2.00$), for science teachers ($M = 1.74$), and for social studies teachers ($M = 1.82$), for career/tech ed ($M = 1.43$), for SPED teachers ($M = 1.47$), and for other teachers ($M = 1.66$). These findings support H47. Teachers'

identification of their not being sure how to address socioeconomic gaps between students regarding access to and experience with technology in their classroom differs among departments.

Table 24

Descriptive Statistics for the Results of the Test for H47

Variable	*N*	*M*	*SD*
ELA	16	1.75	1.00
Math	16	2.00	0.82
Science	19	1.74	0.99
Social Studies	17	1.82	0.88
Career/Tech Ed	7	1.43	0.79
Foreign Language	6	3.00	1.26
SPED	15	1.47	0.64
Other	32	1.66	0.79

H48. Teachers' identification of having little to no input into technology decisions that impact them as a teacher differs among departments.

The results of the analysis used to test H48 indicated there was not a statistically significant difference between at least two of the means, $F = 0.759$, $df = 7, 120$, $p = .623$. See Table 25 for the means and standard deviations for this analysis. No post hoc was warranted. These results did not support H48.

Table 25

Descriptive Statistics for the Results of the Test for H48

Variable	*N*	*M*	*SD*
ELA	16	2.06	1.18
Math	16	2.19	1.22
Science	19	2.32	1.11
Social Studies	17	1.94	0.90
Career/Tech Ed	7	2.14	1.07
Foreign Language	6	2.83	0.98
SPED	15	1.87	0.92
Other	32	2.00	0.98

RQ3. To what extent is there a difference in the identification of significant barriers to effectively integrating technology into classroom instruction among teachers based on gender?

Twenty-four two-sample *t* tests were conducted to test H49-H72. The two sample means were compared for each of the analyses. The level of significance was set at .05.

H49. Teachers' identification that not having all the technology devices needed for instruction in their classroom (or nearby) as a significant barrier differs based on gender.

The results of the analysis used to test H49 indicated the difference was not statistically significant, $t = 1.230$, $df = 127$, $p = 0.221$. See Table 26 for means and standard deviations for this analysis. The results did not support H49. On average female teachers identified not having all the technology devices needed for instruction in

their classroom (or nearby) as a significant barrier (M = 2.17, SD = 1.07) to the same extent as male teachers (M = 1.94, SD = 0.96).

Table 26

Descriptive Statistics for the Results of the Test for H49

Gender	*N*	*M*	*SD*
Female	77	2.17	1.07
Male	52	1.94	0.96

H50. Teachers' identification that the technology devices they have are outdated, unreliable, or incompatible with each other differs based on gender.

The results of the analysis used to test H50 indicated the difference was not statistically significant, t = 1.530, df = 127, p = .129. See Table 27 for means and standard deviations for this analysis. The results did not support H50. On average female teachers identified that the technology devices they have are outdated, unreliable, or incompatible with each other as a significant barrier (M = 2.10, SD = 0.99) to the same extent as male teachers (M = 1.85, SD = 0.85).

Table 27

Descriptive Statistics for the Results of the Test for H50

Gender	*N*	*M*	*SD*
Female	77	2.10	0.99
Male	52	1.85	0.85

H51. Teachers' identification that not being able to use non-district approved technologies with their students differs based on gender.

The results of the analysis used to test H51 indicated the difference between the means was statistically significant, $t = 2.179$, $df = 126$, $p = .031$. See Table 28 for means and standard deviations for this analysis. The results supported H51. On average female teachers identified that not being able to use non-district approved technologies with their students as a significant barrier ($M = 1.99$, $SD = 1.18$) more than male teachers ($M = 1.58$, $SD = 0.80$).

Table 28

Descriptive Statistics for the Results of the Test for H51

Gender	*N*	*M*	*SD*
Female	76	1.99	1.18
Male	52	1.58	0.80

H52. Teachers' identification that bringing their class to the computer lab or library as inconvenient or difficult differs based on gender.

The results of the analysis used to test H52 indicated the difference between the means was statistically significant, $t = 2.325$, $df = 127$, $p = .022$. See Table 29 for means and standard deviations for this analysis. The results supported H52. On average female teachers identified that bringing their class to the computer lab or library as inconvenient or difficult as a significant barrier ($M = 2.13$, $SD = 1.16$) more than male teachers ($M = 1.67$, $SD = 0.98$).

Table 29

Descriptive Statistics for the Results of the Test for H52

Gender	*N*	*M*	*SD*
Female	77	2.13	1.16
Male	52	1.67	0.98

H53. Teachers' identification that Internet access at their site is unreliable and/or websites they want to use are blocked by district filters differs based on gender.

The results of the analysis used to test H53 indicated the difference was not statistically significant, $t = 0.795$, $df = 127$, $p = .428$. See Table 30 for means and standard deviations for this analysis. The results did not support H53. On average female teachers identified that Internet access at their site is unreliable and/or websites they want to use are blocked by district filters as a significant barrier ($M = 2.05$, $SD = 0.93$) to the same extent as male teachers ($M = 1.92$, $SD = 0.86$).

Table 30

Descriptive Statistics for the Results of the Test for H53

Gender	*N*	*M*	*SD*
Female	77	2.05	0.93
Male	52	1.92	0.86

H54. Teachers' identification that the lack of funding for technology they want to purchase for classroom use differs based on gender.

The results of the analysis used to test H54 indicated the difference between the means was statistically significant, $t = 3.140$, $df = 127$, $p = .002$. See Table 31 for means

and standard deviations for this analysis. The results supported H54. On average female teachers identified that the lack of funding for technology they want to purchase for classroom use as a significant barrier (M = 2.44, SD = 1.15) more than male teachers (M = 1.85, SD = .89).

Table 31

Descriptive Statistics for the Results of the Test for H54

Gender	*N*	*M*	*SD*
Female	77	2.44	1.15
Male	52	1.85	0.89

H55. Teachers' identification that their district office offers little or no professional development related to integrating technology into instruction differs based on gender.

The results of the analysis used to test H55 indicated the difference was not statistically significant, t = 1.402, df = 125, p = .163. See Table 32 for means and standard deviations for this analysis. The results did not support H55. On average female teachers identified that their district office offers little or no professional development related to integrating technology into instruction as a significant barrier (M = 2.23, SD = 1.07) to the same extent as male teachers (M = 1.98, SD = 0.80).

Table 32

Descriptive Statistics for the Results of the Test for H55

Gender	*N*	*M*	*SD*
Female	75	2.23	1.07
Male	52	1.98	0.80

H56. Teachers' identification that the level of tech support in their school/district is inadequate to meet their needs differs based on gender.

The results of the analysis used to test H56 indicated the difference between the means was statistically significant, $t = 2.179$, $df = 127$, $p = .031$. See Table 33 for means and standard deviations for this analysis. The results supported H56. On average female teachers identified that the level of tech support in their school/district is inadequate to meet their needs as a significant barrier ($M = 2.53$, $SD = 1.07$) more than male teachers ($M = 2.12$, $SD = 1.06$).

Table 33

Descriptive Statistics for the Results of the Test for H56

Gender	*N*	*M*	*SD*
Female	77	2.53	1.07
Male	52	2.12	1.06

H57. Teachers' identification that they cannot keep up with the pace of technology change—they feel just when they have mastered one tool, it is already outdated differs based on gender.

The results of the analysis used to test H57 indicated the difference was not statistically significant, t = -0.455, df = 123, p = 0.650. See Table 34 for means and standard deviations for this analysis. The results did not support H57. On average female teachers identified that they cannot keep up with the pace of technology change—they feel just when they have mastered one tool, it is already outdated as a significant barrier (M = 1.64, SD = 0.87) to the same extent as male teachers (M = 1.71, SD = 0.83).

Table 34

Descriptive Statistics for the Results of the Test for H57

Gender	*N*	*M*	*SD*
Female	74	1.64	0.87
Male	51	1.71	0.83

H58. Teachers' identification that they find it difficult to design and manage technology-based lessons in their classroom differs based on gender.

The results of the analysis used to test H58 indicated the difference was not statistically significant, t = 1.019, df = 124, p = .301. See Table 35 for means and standard deviations for this analysis. The results did not support H58. On average female teachers identified that they find it difficult to design and manage technology-based lessons in their classroom as a significant barrier (M = 1.99, SD = 0.88) to the same extent as male teachers (M = 1.82, SD = 0.89).

Table 35

Descriptive Statistics for the Results of the Test for H58

Gender	*N*	*M*	*SD*
Female	75	1.99	0.88
Male	51	1.82	0.89

H59. Teachers' identification that they are concerned about students being distracted, cheating, misusing, or accessing inappropriate material differs based on gender.

The results of the analysis used to test H59 indicated the difference was not statistically significant, $t = 0.428$, $df = 124$, $p = .669$. See Table 36 for means and standard deviations for this analysis. The results did not support H59. On average female teachers identified that they are concerned about students being distracted, cheating, misusing, or accessing inappropriate material as a significant barrier ($M = 2.91$, $SD = 1.10$) to the same extent as male teachers ($M = 2.82$, $SD = 1.01$).

Table 36

Descriptive Statistics for the Results of the Test for H59

Gender	*N*	*M*	*SD*
Female	75	2.91	1.10
Male	51	2.82	1.01

H60. Teachers' identification that using technology for instruction does not fit well with their content area differs based on gender.

The results of the analysis used to test H60 indicated the difference was not statistically significant, $t = -0.710$, $df = 124$, $p = .479$. See Table 37 for means and standard deviations for this analysis. The results did not support H60. On average female teachers identified that using technology for instruction does not fit well with their content area as a significant barrier ($M = 1.40$, $SD = 0.68$) to the same extent as male teachers ($M = 1.49$, $SD = 0.73$).

Table 37

Descriptive Statistics for the Results of the Test for H60

Gender	*N*	*M*	*SD*
Female	75	1.40	0.68
Male	51	1.49	0.73

H61. Teachers' identification that having to give up too much responsibility to the technology—they feel like they are not really "teaching" differs based on gender.

The results of the analysis used to test H61 indicated the difference was not statistically significant, $t = -1.091$, $df = 123$, $p = .277$. See Table 38 for means and standard deviations for this analysis. The results did not support H61. On average female teachers identified that having to give up too much responsibility to the technology—they feel like they are not really "teaching" as a significant barrier ($M = 1.32$, $SD = 0.62$) to the same extent as male teachers ($M = 1.44$, $SD = 0.58$).

Table 38

Descriptive Statistics for the Results of the Test for H61

Gender	*N*	*M*	*SD*
Female	75	1.32	0.62
Male	50	1.44	0.58

H62. Teachers' identification that they are concerned about sacrificing curricular content or losing instructional time differs based on gender.

The results of the analysis used to test H62 indicated the difference was not statistically significant, $t = -0.810$, $df = 122$, $p = .420$. See Table 39 for means and standard deviations for this analysis. The results did not support H62. On average female teachers identified that they are concerned about sacrificing curricular content or losing instructional time as a significant barrier ($M = 1.58$, $SD = 0.84$) to the same extent as male teachers ($M = 1.70$, $SD = 0.74$).

Table 39

Descriptive Statistics for the Results of the Test for H62

Gender	*N*	*M*	*SD*
Female	74	1.58	0.84
Male	50	1.70	0.74

H63. Teachers' identification that they are not sure about how to differentiate instruction using technology for the wide variety of learners in their classroom differs based on gender.

The results of the analysis used to test H63 indicated the difference was not statistically significant, $t = 0.059$, $df = 122$, $p = .953$. See Table 40 for means and standard deviations for this analysis. The results did not support H63. On average female teachers identified that they are not sure about how to differentiate instruction using technology for the wide variety of learners in their classroom as a significant barrier ($M = 1.73$, $SD = 0.90$) to the same extent as male teachers ($M = 1.72$, $SD = 0.90$).

Table 40

Descriptive Statistics for the Results of the Test for H63

Gender	*N*	*M*	*SD*
Female	74	1.73	0.90
Male	50	1.72	0.90

H64. Teachers' identification that they often need to have a back-up lesson plan in case the technology fails differs based on gender.

The results of the analysis used to test H64 indicated the difference was not statistically significant, $t = 1.852$, $df = 124$, $p = .066$. See Table 41 for means and standard deviations for this analysis. The results did not support H64. On average female teachers identified that they often need to have a back-up lesson plan in case the technology fails as a significant barrier ($M = 2.45$, $SD = 1.21$) to the same extent as male teachers ($M = 2.08$, $SD = 0.96$).

Table 41

Descriptive Statistics for the Results of the Test for H64

Gender	*N*	*M*	*SD*
Female	75	2.45	1.21
Male	51	2.08	0.96

H65. Teachers' identification that they are expected to use district-adopted textbooks, curriculum, or pacing guides without a technology component differs based on gender.

The results of the analysis used to test H65 indicated the difference was not statistically significant, $t = -1.063$, $df = 123$, $p = .290$. See Table 42 for means and standard deviations for this analysis. The results did not support H65. On average female teachers identified they are expected to use district-adopted textbooks, curriculum, or pacing guides without a technology component as a significant barrier ($M = 1.47$, $SD = 0.76$) to the same extent as male teachers ($M = 1.63$, $SD = 0.85$).

Table 42

Descriptive Statistics for the Results of the Test for H65

Gender	*N*	*M*	*SD*
Female	74	1.47	0.76
Male	51	1.63	0.85

H66. Teachers' identification that their school bell schedule/length of class periods limits their use of technology with students differs based on gender.

The results of the analysis used to test H66 indicated the difference between the means was statistically significant, $t = 2.671$, $df = 123$, $p = .009$. See Table 43 for means and standard deviations for this analysis. The results supported H66. On average female teachers identified that their school bell schedule/length of class periods limits their use of technology with students as a significant barrier ($M = 1.80$, $SD = 0.98$) more than male teachers ($M = 1.37$, $SD = 0.69$).

Table 43

Descriptive Statistics for the Results of the Test for H66

Gender	*N*	*M*	*SD*
Female	74	1.80	0.98
Male	51	1.37	0.69

H67. Teachers' identification that they are not provided enough prep time to learn or plan ways to use technology for instruction differs based on gender.

The results of the analysis used to test H67 indicated the difference was not statistically significant, $t = 1.588$, $df = 123$, $p = .115$. See Table 44 for means and standard deviations for this analysis. The results did not support H67. On average female teachers identified that they are not provided enough prep time to learn or plan ways to use technology for instruction as a significant barrier ($M = 2.64$, $SD = 1.14$) to the same extent as male teachers ($M = 2.31$, $SD = 1.07$).

Table 44

Descriptive Statistics for the Results of the Test for H67

Gender	*N*	*M*	*SD*
Female	74	2.64	1.14
Male	51	2.31	1.07

H68. Teachers' identification that their school/administration has not communicated a clear vision for using technology for instruction differs based on gender.

The results of the analysis used to test H68 indicated the difference was not statistically significant, $t = 1.531$, $df = 123$, $p = .128$. See Table 45 for means and standard deviations for this analysis. The results did not support H68. On average female teachers identified that their school/administration has not communicated a clear vision for using technology for instruction as a significant barrier ($M = 2.23$, $SD = 1.10$) to the same extent as male teachers ($M = 1.94$, $SD = 0.93$).

Table 45

Descriptive Statistics for the Results of the Test for H68

Gender	*N*	*M*	*SD*
Female	74	2.23	1.10
Male	51	1.94	0.93

H69. Teachers' identification that the pressure to "cover the curriculum" prior to high-stakes testing keeps me from using technology more differs based on gender.

The results of the analysis used to test H69 indicated the difference was not statistically significant, $t = 1.303$, $df = 122$, $p = .195$. See Table 46 for means and

standard deviations for this analysis. The results did not support H69. On average female teachers identified that the pressure to "cover the curriculum" prior to high-stakes testing keeps me from using technology as a significant barrier (M = 1.92, SD = 1.06) to the same extent as male teachers (M = 1.68, SD = 0.91).

Table 46

Descriptive Statistics for the Results of the Test for H69

Gender	*N*	*M*	*SD*
Female	74	1.92	1.06
Male	50	1.68	0.91

H70. Teachers' identification that they do not feel trusted to use technology in ethical ways with their students differs based on gender.

The results of the analysis used to test H70 indicated the difference was not statistically significant, t = 0.376, df = 123, p = .707. See Table 47 for means and standard deviations for this analysis. The results did not support H70. On average female teachers identified that they do not feel trusted to use technology in ethical ways with their students as a significant barrier (M = 1.30, SD = 0.61) to the same extent as male teachers (M = 1.25, SD = 0.63).

Table 47

Descriptive Statistics for the Results of the Test for H70

Gender	*N*	*M*	*SD*
Female	74	1.30	0.61
Male	51	1.25	0.63

H71. Teachers' identification that they are not sure how to address socioeconomic gaps between students regarding access to and experience with technology in their classroom differs based on gender.

The results of the analysis used to test H71 indicated the difference was not statistically significant, t = -.003, df = 123, p = .997. See Table 48 for means and standard deviations for this analysis. The results did not support H71. On average female teachers identified they are not sure how to address socioeconomic gaps between students regarding access to and experience with technology in their classroom as a significant barrier (M = 1.78, SD = 0.88) to the same extent as male teachers (M = 1.78, SD = 0.97).

Table 48

Descriptive Statistics for the Results of the Test for H71

Gender	*N*	*M*	*SD*
Female	74	1.78	0.88
Male	51	1.78	0.97

H72. Teachers' identification that they have little to no input into technology decisions that impact them as a teacher differs based on gender.

The results of the analysis used to test H72 indicated the difference was not statistically significant, t = 1.451, df = 123, p = .149. See Table 49 for means and standard deviations for this analysis. The results did not support H72. On average female teachers identified that they have little to no input into technology decisions that impact them as a teacher as a significant barrier (M = 2.22, SD = 1.01) to the same extent as male teachers (M = 1.94, SD = 1.08).

Table 49

Descriptive Statistics for the Results of the Test for H72

Gender	*N*	*M*	*SD*
Female	74	2.22	1.01
Male	51	1.94	1.08

RQ4. To what extent is the identification of significant barriers to effective technology integration into classroom instruction different among first-order, second-order, and third-order barriers?

H73. The identification of the significant barriers to effective integration of technology into classroom instruction is different among first-order, second-order, and third-order barriers.

A mixed two-factor ANOVA was conducted to test H73. The two categorical variables used to group the dependent variable (identification of barriers to effective technology integration into classroom instruction) were barrier type and department. The level of significance was set at .05. The mixed two-factor ANOVA can be used to test three hypotheses including a main effect for barrier type, a main effect for department, and a two-way interaction effect (Barrier Type x Department). The main effect for barrier type was used to test H73. The level of significance was set at .05. The results of the analysis indicated a statistically significant difference between at least two of the means, $F = 6.311$, $df = 2, 240$, $p = .002$. See Table 50 for the means and standard deviations for this analysis. A follow-up post hoc was conducted to determine which pairs of means were different. The Fisher's LSD post hoc was conducted at $\alpha = .05$. Two of the differences were statistically significant. The first-order barrier mean ($M = 2.05$)

was higher than the second-order barrier mean (*M* = 1.87) and the third-order mean (*M* = 1.84). H73 was supported. On average high school teachers perceived first-order barriers to be more significant than second or third-order barriers.

Table 50

Descriptive Statistics for the Results of the Test for H73

Barrier Type	*N*	*M*	*SD*
First Order	128	2.05	0.67
Second Order	128	1.87	0.55
Third Order	128	1.84	0.60

RQ5. To what extent is the difference in the identified significant barriers to effective technology integration into classroom instruction among first-order, second-order, and third-order barriers affected by department?

H74. The difference in the identification of the significant barriers to effective integration of technology into classroom instruction among first-order, second-order, and third-order barriers is affected by teacher department.

The interaction effect from the first mixed two-factor ANOVA was used to test H74. The two categorical variables used to group the dependent variable, effective integration of classroom instruction, were barrier type and department. The level of significance was set at .05. The results of the analysis indicated a statistically significant difference between at least two of the means, $F = 2.347$, $df = 14, 240$, $p = .005$. See Table 51 for the means and standard deviations for this analysis. A follow-up post hoc was conducted to determine which pairs of means were different. The Fisher's LSD post hoc was conducted at $\alpha = .05$. Twelve of the differences were statistically significant.

For the first-order barriers, the ELA department mean (*M* = 2.52) was higher than the science department mean (*M* = 1.89), the SPED department mean (*M* = 1.90), and the other departments mean (*M* = 2.04). The math department mean (*M* = 2.30) was higher than the social studies mean (*M* = 1.82). For the second-order barrier, the math department mean (*M* = 2.07) is greater than the career/tech ed department mean (*M* = 1.56). For the third-order barriers foreign language department mean (*M* = 2.56) was higher than ELA department mean (*M* = 1.91), science department mean (*M* =1.89), social studies mean (*M*=1.76), career/tech ed department mean (*M* = 1.61), SPED department mean (*M* =1.67), and the other departments mean (*M* = 1.70). The math department mean (*M* = 2.12) was higher than departments from the other category mean (*M* = 1.70). H74 was supported. High school teachers from the ELA department perceived first-order barriers as more significant than teachers from the science department, the SPED department, and departments in the other category. Teachers from the math department perceived first-order barriers as more significant than the teachers from the social studies department. Teachers from the math department perceived second-order barriers as more significant than teachers from the career/tech ed department. Teachers from the foreign language department perceived third-order barriers as more significant than teachers from the ELA department, science department, social studies department, career/tech ed department, SPED department, and departments in the other category.

Table 51

Descriptive Statistics for the Results of the Test for H74

Barrier Type	Department	*N*	*M*	*SD*
First Order	ELA	17	2.52	0.86
	Math	17	2.30	0.64
	Science	19	1.89	0.61
	Social Studies	17	1.82	0.49
	Career/Tech Ed	8	2.17	0.53
	Foreign Language	6	2.06	0.65
	SPED	17	1.89	0.67
	Other	32	2.04	0.67
Second Order	ELA	16	1.91	0.52
	Math	16	2.07	0.61
	Science	19	1.96	0.55
	Social Studies	17	1.87	0.43
	Career/Tech Ed	8	1.56	0.41
	Foreign Language	6	2.00	0.46
	SPED	15	1.73	0.53
	Other	32	1.82	0.63
Third Order	ELA	16	1.91	0.72
	Math	16	2.12	0.63
	Science	19	1.89	0.58
	Social Studies	17	1.75	0.47
	Career/Tech Ed	7	1.60	0.53
	Foreign Language	6	2.56	0.54
	SPED	15	1.66	0.49
	Other	32	1.69	0.57

RQ6. To what extent is the difference in the identified significant barriers to effective technology integration into classroom instruction among first-order, second-order, and third-order barriers affected by teacher gender?

H75. The difference in the identification of the significant barriers to effective integration of technology into classroom instruction is different among first-order, second-order, and third-order barriers is affected by teacher gender.

A second mixed two-factor ANOVA was conducted to test H75. The two categorical variables used to group the dependent variable (identification of barriers to effective technology integration into classroom instruction) were barrier type and gender. The level of significance was set at .05. The two-factor ANOVA can be used to test three hypotheses including a main effect for barrier type, a main effect for gender, and a two-way interaction effect (Barrier Type x Gender). The interaction effect from the ANOVA was used to test H75. The level of significance was set at .05. The results of the analysis indicated a statistically significant difference between at least two of the means, $F = 3.583$, $df = 2, 246$, $p = .029$. See Table 52 for the means and standard deviations for this analysis. A follow-up post hoc was conducted to determine which pairs of means were different. The Fisher's LSD post hoc was conducted at $\alpha = .05$. One of the differences was statistically significant. For the first-order barrier the female teachers' mean ($M = 2.21$ was higher than the male teachers' mean ($M = 1.86$). H75 was supported. Female teachers perceived first-order barriers to be more significant than male teachers. There was no difference in the perceptions of the significance of the second and third-order barriers between female and male teachers.

Table 52

Descriptive Statistics for the Results of the Test for H75

Barrier Type	Gender	*N*	*M*	*SD*
First Order	Female	77	2.20	0.73
	Male	52	1.86	0.53
Second Order	Female	75	1.88	0.55
	Male	51	1.84	0.54
Third Order	Female	74	1.91	0.61
	Male	51	1.74	0.59

Summary

The findings from the survey instrument have been presented in chapter 4 using SPSS to analyze the data collected. A response rate of 66% provided the researcher with sufficient data to address the research questions and test the related hypotheses. The statistical outcome for each research question, related hypotheses, and a description of the findings were reported. The relationship between barriers, the effect of barriers by department and gender, along with the identification of significant barriers were examined statistically and described in this chapter. A summary of the study, findings related to the literature, and conclusions are presented in Chapter 5.

Chapter 5

Interpretation and Recommendations

The purpose of this quantitative study was to determine what the barriers to technology integration were perceived by secondary teachers in an urban setting. These teachers worked in buildings where a 1:1 initiative had been implemented but grappled with effective technology integration. This chapter includes a study summary, findings related to the literature, and the conclusions.

Study Summary

Examined in this study were the barriers teachers encounter when attempting to integrate technology in the classroom. These barriers were identified as first-order, second-order, and third-order barriers. Each barrier was also examined in relation to teacher gender and department. In this section, an overview of the problem, the purpose and research questions, a review of the methodology, and the major findings are presented.

Overview of the problem. Technology has become an integral part of our lives at work, home, and school. According to Mundy and Kupczynski (2013), despite increased access to technology by both digital natives and digital immigrants in and out of the classroom, technology is still not being used in ways that can best benefit students. Teachers have access to professional development, participate in programs designed to improve their technology skills, have access to technology-related resources that support curriculum, and are in technology-rich environments where devices are available for every student, but their use of technology in the classroom remains limited. The

researcher sought to determine what teachers identified as the barriers preventing them from integrating technology into classroom instruction.

Purpose statement and research questions. The purpose of this study was to determine what teachers in an urban setting identified as the significant barriers to effectively integrating technology into classroom instruction. The second purpose was to determine whether the difference in the identification of significant barriers to effectively integrate technology into classroom instruction among teachers was affected by the teacher's department and gender. Finally, the study was conducted to identify whether a relationship exists between the department, gender, and variables that may contribute to the confidence and comfort level teachers have with using technology. These variables were identified as first-order, second-order, and third-order barriers. To address the purposes of the study, six research questions were posed, and 75 related hypotheses were tested.

Review of the methodology. A quantitative nonexperimental study was formulated to identify, collect, and analyze data about the variables. The target population for this study was all secondary teachers in the state of Missouri. The sample eligible for participation in the study were teachers from four urban high schools serving grades 9-12 and two schools serving grades 7-12. An email was sent to 224 District K teachers who work in the six high schools for the district to solicit their participation in the research study to identify barriers to their use of technology in the classroom. The data analysis was completed using SPSS and consisted of 24 one-sample *t* tests, 24 one-factor ANOVAs, 24 two-sample *t* tests, two mixed-factor ANOVAs, and Fisher's LSD post hocs.

Major findings. Results of the hypothesis testing associated with teacher identification of the significant barriers to effectively integrating technology into classroom instruction were mixed. The following were perceived to be barriers: lack of funding for technology they want to purchase; level of technical support in school or district; concern about students cheating, being distracted, misusing or accessing inappropriate material; need to have a back-up plan in case of technology failure; and not provided enough prep time. Teachers did not perceive the remaining first, second, and third order barriers as significant barriers to effectively integrating technology into classroom instruction.

As was hypothesized, the department did influence teachers' identification of barriers to classroom integration of technology. The ELA department more than other departments indicated the technology devices were outdated, unreliable, or incompatible with each other; taking their classes to the library or computer lab; the level of technical support in their building/district; and the need to have back-up lesson plans as significant barriers. The career/tech ed department was the only department that did not consider having to have back-up lesson plans as a barrier. Data from the foreign language department disclosed the expectation to use district adopted textbooks, curriculum and pacing guides was a significant barrier, but the career/tech ed department did not view this as a barrier. Foreign language department data also revealed the expectation to use district-adopted textbooks, curriculum, or pacing guides without a technology component, not being provided enough prep time to learn ways to use technology for instruction, and not being sure how to address the socioeconomic gaps between students regarding access to and experience with technology as significant barriers. Teacher

perceptions of the remaining first, second, and third order barriers to effectively integrating technology into classroom instruction were not significantly different among departments.

The hypothesis that gender affects the identification of barriers was also supported by the analysis. Female teachers perceived that the following were more of a barrier to effectively integrating technology into classroom instruction than male teachers: not being able to use non-district approved technologies with their students, difficulty bringing their class to the computer lab or library, the lack of funding for technology they want to purchase, the level of tech support in their school/district is inadequate, and their school bell schedule/length of class periods. Male and female teachers did not differ in their identification of the remaining first, second, and third order barriers as significant barriers to effectively integrating technology into classroom instruction.

When the barriers were categorized as first, second, and third-order (see Table 50) the analysis revealed that first-order barriers were perceived to be more significant than second-order or third-order barriers among all teachers. First-order barriers are those that are extrinsic to teachers such as hardware, software, technology support, resources, and funding. The difference was negligible with respect to second and third-order barriers to effective integration of technology among teachers. Second-order barriers are those intrinsic to the teacher such as teaching philosophy, technology skills, ability to keep up with the pace of technology changes, ability to manage differing technology skills among students, professional development not tied to clear vision and outcomes, and lack of technology pedagogical knowledge/skills. Third-order barriers are those tied to the

culture, climate, and organizational structure of the institution or district and school such as the school bell schedule and length of classes, isolation and lack of collaboration with peers, absence of district technology vision, peer pressure to maintain status quo, climate of mistrust, teacher evaluation system doesn't recognize technology, and insufficient time during school day to plan instruction or develop skills.

When the barriers were categorized as first, second, and third-order and analyzed by department, there were significant findings. It was found that the ELA and Math departments revealed first-order barriers to be significant barriers to effective technology integration in the classroom. Second-order barriers were more significant for the math department, and third-order barriers were more significant for the foreign language department.

When gender was examined in relation to the categorized barriers of first, second and third-order barriers, there were significant findings. The analysis of data revealed female teachers who participated in the study perceived first-order barriers to be significant hindrances to effective technology integration in the classroom. There was no significant difference between female teachers and male teachers when second-order barriers were examined. There was also no significant difference between female and male teachers when third-order barriers were analyzed.

Findings Related to the Literature

In Chapter 2, a variety of studies were reviewed that examined issues related to the integration of technology in classrooms. Several studies found first-order barriers to be the primary influence contributing to the lack of technology integration in classrooms. In a study conducted by Young (2012), first order barriers such as lack of resources, lack

of on-going technology-related professional development and a network system that inhibits Internet access were significant to teachers in the survey. Wallace (2012) discovered first-order barriers of material resources and technical support to be a hindrance to technology integration by teachers. Wallace also examined differences in the responses by teachers between teachers classified as digital natives and those classified as digital immigrants and found no statistical difference. Also, Henry-Young (2013) conducted a study in Bermuda and found first-order barriers of lack of technical support and lack of funding to be the primary barriers hindering technology integration by teachers who participated in the survey. Alenzi (2016) conducted a study in Saudi Arabia and found first-order barriers of policies and security restrictions prevented teachers from accessing resources and Internet sites to be significant in hindering effective integration of technology in classrooms. Boatwright (2016) found first-order barriers of lack of headphones, wi-fi, and district infrastructure were among barriers significant for teachers. Saxena (2017) conducted a study in Canada and determined the first-order barrier of budget constraints affected the ability of teachers to integrate technology in the classroom. The results of the current study, which showed the network system and/or filters that blocked Internet sites, lack of funding, and technology devices are old, outdated or incompatible as significant barriers to technology integration support the findings of Young (2012), Wallace (2012), Henry-Young (2013), Alenzi (2016), Boatwright (2016), and Saxena (2017).

Second order barriers were identified as barriers to technology integration in several studies. Findings by Pereira-Leon (2010) and Manglicmot (2015) indicated that decisions to use technology were based on the teacher beliefs, views of technology,

vision of education, and the professional identity of teachers. The results of several studies (Amuko et al., 2015; Cooper, 2014; Gomes, 2015; Rifkind, 2011; Skinner, 2013) indicated professional development needs are directly tied to effective integration of technology. White (2014) discovered the longer teachers participated in technology-related professional development, the more likely they were to include technology in their instruction. Pine-Thomas (2017) determined that although teachers felt confident with their knowledge of technology, they used it primarily for word processing, and needed intensive training on how to integrate technology at higher levels that prepared students with 21st- century skills. The findings from the current study are in contrast to these studies. Results of the current study did not show that professional development was a hindrance to effective technology integration in the classroom.

Third-order barriers have been recognized as a significant barrier to technology integration. Hartley (2014) discovered that barriers such as lack of administrative priorities, support, and the inability to reduce teacher workload to be significant hindrances to technology integration. The findings of the current study, which are in contrast to Hartley's study determined third-order barriers were not significant when looking at hindrances to technology integration. The results of the current study support Wallace (2012), Zyad (2016), and Özdemir (2015) by demonstrating third-order barriers are not significant factors of technology integration in the classroom.

Several studies examined if other variables had an effect on technology integration in the classroom. Inan (2007) determined that teacher age and years of experience directly affected proficiency with technology and indirectly affected technology integration. The current study did not examine the variables of teacher age

and years of experience. Leech (2010) discovered that teachers in grades 8-12 integrate technology more than teachers in other grades, and teachers in non-academic areas integrate technology more than other teachers. The results of Leech's study also revealed that years of teaching did not affect the level of technology integration. The current study did not measure technology use related to grade level taught but did examine the content area taught. Leech (2010) found that teachers in non-academic areas such as art, physical education, foreign language, library media, technical education, and music and media integrated technology at higher levels than core academic areas. O'Leary (2014) concluded that teachers who teach ELA and math use technology more than teachers in other areas. The results also revealed that sixth-grade teachers integrate technology more than teachers in lower grades and those who have taught 21 years or more have minimal use of technology when compared to teachers with less experience. The current study did not indicate that to be true. The current study found that teachers rated technology integration differently according to content area and barrier. For example, teachers whose department was in the social studies and SPED departments indicated first-order, second-order and third-order barriers had little effect on their ability to integrate technology in the classroom. Next, teachers in the ELA and math departments indicated first order barriers were the most significant hindrances to effective technology integration. Teachers in the math department also perceived second-order barriers were significant, and the foreign language department indicated third-order barriers to be significant hindrances to effective technology integration in the classroom.

A study conducted by Schulze (2014) revealed that male teachers and high school teachers had the highest positive perceptions of technology integration although their

levels of technology integration were low. The results of the current study are in contrast to the findings of a study conducted by Lang (2016) that concluded female teachers had more positive full-scale technology beliefs. The current study examined if technology integration was affected by teacher gender. The results of the current study revealed that female teachers perceive that first-order barriers are more significant hindrances to technology integration in the classroom than their male counterparts.

Conclusions

Included in this section is a summary of the results obtained from the survey analyzing teacher perceptions of the barriers to effectively integrating technology in the classroom. This section also contains implications for action with recommendations school leaders can use to address this issue. Also included in this section are recommendations for future research and concluding remarks.

Implications for action. The results of this study have provided the researcher several items of consideration and recommendation for District K. The data from this study indicate that teacher gender and department were both important factors to consider when implementing technology in secondary classrooms. In most cases, when technology is being introduced, and efforts are underway to increase usage, thought is not given to teacher gender or department. Cherry (2014) asserted "Generally, attempts to increase teacher technology integration start with placing computers in the classroom, providing professional development and technology related resources" (p. 52). Overall, teachers felt first-order barriers were more significant. The district may need to consider including teacher representatives on their curriculum committee with regular meetings to provide teachers a voice about technology related curriculum and resources they want to

utilize in the classroom with teachers. The district also needs to examine the deployment of its technical support to ensure buildings receive the level of support they need, the method of support requested, and the provided support is timely. The school district or individual school can provide professional development for teachers on how to handle technology in the classroom covering topics on cheating, distractions, and misuse and cheating.

Some teachers felt the district devices were outdated, unreliable, and incompatible with each other so the district needs to convene a focus group or disseminate a survey to understand the source of these concerns and how they could best address them. Another concern teachers voiced as a barrier to technology integration was that they are not provided with enough prep time and the need for a back-up plan in case of technology failure. The district and building leaders should examine if concerns were related to plan time minutes or if related to technology components and resources are incorporated into the curriculum. If this is a curriculum related issue, more training should be provided through the Curriculum, Instruction, and Professional Development department for teachers. Career/tech ed were the only ones who did not voice a need to have a back-up plan in case technology fails as a barrier. School leaders may want to have these teachers share with others through a building led professional development about how to plan so this is not an issue. Skomer (2014) asserted "By sharing successes and frustrations with each other, the group can learn from each other and work through problems together even without the help of an expert" (p. 79).

The foreign language department had several barriers related to technology integration and the curriculum. The foreign language department indicated the

expectation to use district adopted textbooks, curriculum, and pacing guides was a significant barrier, and not being sure how to address the socioeconomic gaps between students regarding access to and experience with technology are significant barriers. The district needs to conduct specific training for this department to address and understand their concerns.

Even with these areas addressed, the district and each building need to survey their teachers and monitor technology periodically. Survey monitoring should be done to detect new issues or concerns that may pose significant barriers to the continued integration of technology in the classroom. When one barrier is addressed, it may present other barriers to those who are responsible for technology integration. Wallace (2014) stated these actions might merely replace the first-order barrier of obsolete equipment with a second-order barrier of inadequate technology skills if teachers are not trained on the new equipment.

Recommendations for future research. Based on the results of the current study, other research is recommended related to the effective integration of technology in the classroom. The first recommendation for future research would be to conduct a mixed-methods or qualitative study in schools with the same demographics to see if the data would yield the same results. This study could be conducted in a rural district to see if teacher perceptions of barriers to technology integration closely mirror those of teachers in this study. Also, a study could be conducted to compare the results between urban and suburban school districts to reveal if there are any differences in the barriers experienced by teachers. Additional questions could be added to the survey to determine how technology is used in the classroom and how teachers would like to use technology

in the classroom to determine if there is a gap between how it is being used and how teachers would like to use it and what those barriers are.

Other technology-related areas in which future research could be conducted would be a comparison of student achievement scores in buildings of similar demographics. A study in which student achievement scores could be compared in two buildings that have had 1:1 program implementation for at least five years could be conducted. Building one has a strong implementation program with seamless technology integration, and this building is essentially paperless. Building two is experiencing uneven implementation with teachers who cite specific barriers as the reason for the lack of full technology integration. The examination of data over five years may determine if student achievement has benefitted from the effective implementation and full integration of technology. This study could provide concrete data that would either indicate the benefits or challenges of technology use in the classroom.

Concluding remarks. A variety of factors exist that might contribute to the reasons why technology is not effectively integrated into secondary classrooms. This study adds to the body of literature examining teacher adoption of technology, but much still needs to be examined to understand teacher motivations to use or not use technology in the classroom. According to Larson, Miller, and Ribble (2010), "Administrators and teacher leaders have to take personal responsibility for understanding changes in tech implementation and integration in their buildings and classrooms rather than simply relying on technology support staff" (p. 12). If technology integration is to become widespread and its use be the norm, the responsibility for this has to rest on the shoulders of all stakeholders involved.

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Appendices

Appendix A: Barriers to Technology Integration

First Order Barriers (Extrinsic to Teachers)

Equipment	Resources
Multiple technologies needed are incompatible	Lack of technology funding
Technology malfunctions or is unreliable	Technology needed is inconvenient to access
Slow Internet connection	Need for a back-up lesson plan when technology fails
Websites are blocked by district filters	Lack of on-site technology support
Obsolete equipment is difficult to upkeep	Delayed tech support response to reported problems
Insufficient amounts of equipment within classroom setting	Tech support unable to fix problems
Lack of clarity about which hardware and software available meet a teacher's needs	Lack of security measures to prohibit accessing inappropriate material
	Lack of administrative support for integrating technology into curriculum
	Technology-based materials are inadequate or unavailable

Note: Reprinted from Teachers & Technology: Identifying Uses, Barriers, and Strategies to Support Classroom Integration by K. Wallace, 2012, p. 33-35.

Second Order Barriers (Intrinsic to Teachers)

Knowledge/Skills	Beliefs/Attitudes
Inadequate technology skills	Teaching philosophy (transmission pedagogy vs. constructivism)
Lack of technology- supported pedagogical knowledge/models	
Difficulty managing students' differing ability levels	
Lack of technology-based formative and summative assessments	
Technology training is more related to student data management than technology for instruction	
Unsure which tools to use for which learning objectives	
Can't keep up with pace of technological change	
Professional development not tied to clear vision and outcomes	

Note: Reprinted from Teachers & Technology: Identifying Uses, Barriers, and Strategies to Support Classroom Integration by K. Wallace, 2012, p. 33-35.

Third Order Barriers (Contextual)

Structure/Organization	School Culture/Climate
School bell schedule/ length of class periods	"Subject culture" does not promote technology
Large class sizes/high student to computer ratios	Staff demographics (age, experience, tech background)
Insufficient time within school day to plan instruction or develop skills	Peer pressure to maintain status quo
Inflexible school organization and assessment system	Competing demands from parents, administrators, students
Isolation and lack of collaboration with peers	Lack of parental/community support
Teacher evaluation structure does not recognize technology	Ineffectual technological leadership at district/site
Physical proximity to computer lab/library	Pressure to "cover the curriculum"
Absent district technology master plan	Climate of mistrust
High stakes tests drive curriculum/instruction	Teachers have little input into technology decisions that impact them
Expectation to use adopted textbooks/ curriculum/pacing guides	Concerns about equity issues in the community

Note: Reprinted from Teachers & Technology: Identifying Uses, Barriers, and Strategies to Support Classroom Integration by K. Wallace, 2012, p. 33-35.

Appendix B: Permission to Use Survey

From: Kim Wallace <kwallace@fremont.k12.ca.us>
Sent: Tuesday, January 31, 2017, 7:51 PM
To: Simone E Chambers
Subject: RE: Permission to use Teacher Technology Use and Barriers to Classroom Integration Survey

You have my permission. Please let me know how your study turns out! Thanks, Kim

From: Simone E Chambers [mailto:SimoneEChambers@stu.bakeru.edu]
Sent: Tuesday, January 31, 2017, 5:47 PM
To: Kim Wallace
Subject: Permission to use Teacher Technology Use and Barriers to Classroom Integration Survey

Dr. Wallace,

My name is Simone Chambers and I am a doctoral student at Baker University. I am conducting a study to examine factors affecting teacher adoption of technology in secondary 1:1 classrooms. I am requesting permission to use your survey, Teacher Technology Use and Barriers to Classroom Integration and change question one to identify the gender of those surveyed rather than age.

Please feel free to contact me with any questions. I look forward to hearing from you soon.

Sincerely,

Simone Chambers

Appendix C: Teacher Technology Use and Barriers to Classroom Integration Survey

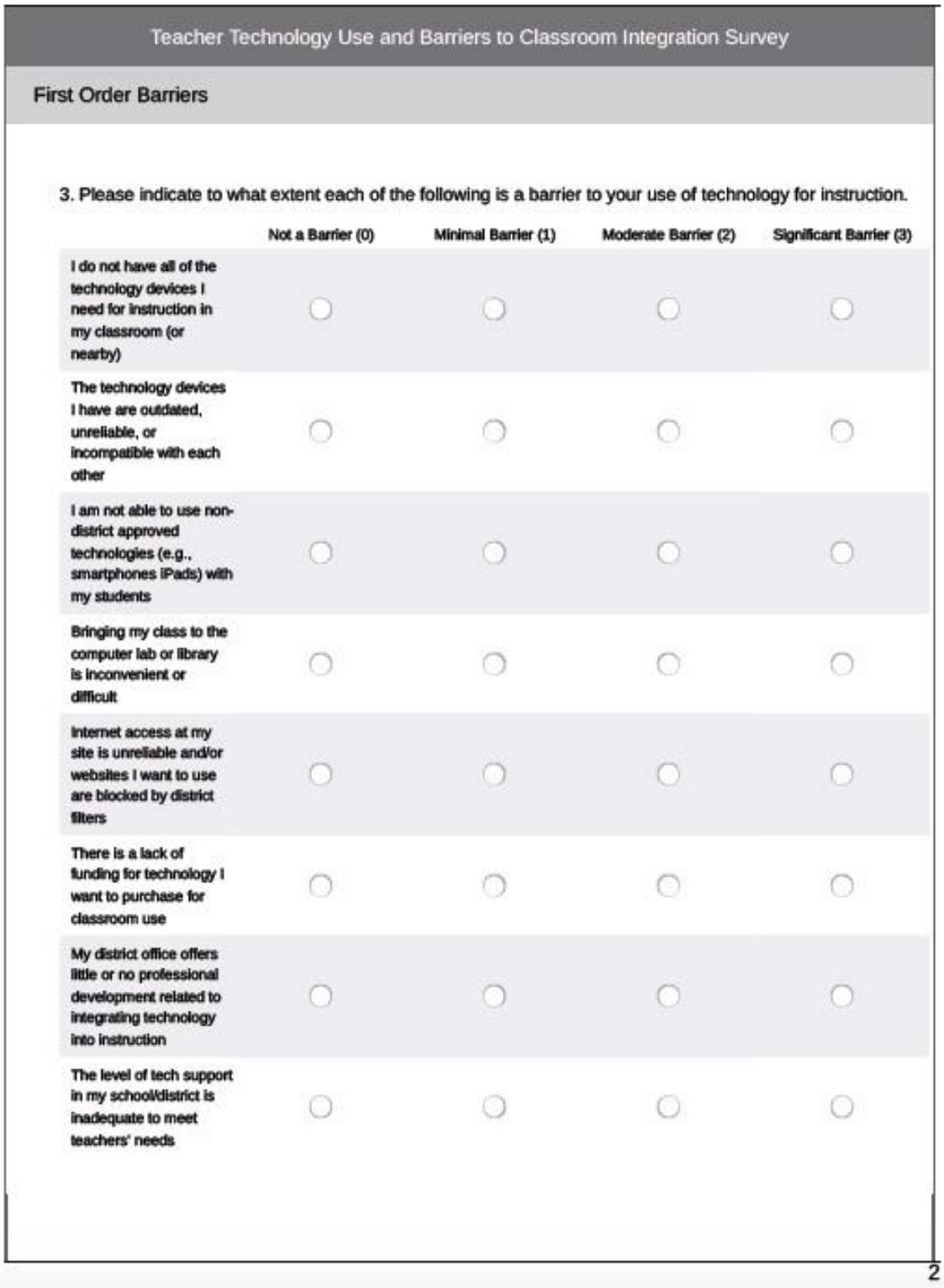
Teacher Technology Use and Barriers to Classroom Integration Survey

Demographic Information

1. Gender

2. What is your main teaching assignment (the field in which you teach the most classes) this school year?

- English Language Arts
- Mathematics
- Science
- Social Studies
- Career/Tech Ed/Computers/Business
- Foreign Language
- Special Education
- Other (please specify)



Teacher Technology Use and Barriers to Classroom Integration Survey

First Order Barriers

3. Please indicate to what extent each of the following is a barrier to your use of technology for instruction.

	Not a Barrier (0)	Minimal Barrier (1)	Moderate Barrier (2)	Significant Barrier (3)
I do not have all of the technology devices I need for instruction in my classroom (or nearby)	○	○	○	○
The technology devices I have are outdated, unreliable, or incompatible with each other	○	○	○	○
I am not able to use non-district approved technologies (e.g., smartphones iPads) with my students	○	○	○	○
Bringing my class to the computer lab or library is inconvenient or difficult	○	○	○	○
Internet access at my site is unreliable and/or websites I want to use are blocked by district filters	○	○	○	○
There is a lack of funding for technology I want to purchase for classroom use	○	○	○	○
My district office offers little or no professional development related to integrating technology into instruction	○	○	○	○
The level of tech support in my school/district is inadequate to meet teachers' needs	○	○	○	○

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Teacher Technology Use and Barriers to Classroom Integration Survey

Second Order Barriers

4. Please indicate to what extent each of the following is a barrier to you use of technology for instruction

	Not a Barrier (0)	Minimal Barrier (1)	Moderate Barrier (2)	Significant Barrier (3)
I can't keep up with the pace of technology change -- just when I've mastered one tool, it's already outdated	○	○	○	○
I find it difficult to design and manage technology-based lessons in my classroom	○	○	○	○
I am concerned about students being distracted, cheating, misusing, or accessing inappropriate material	○	○	○	○
Using technology for instruction doesn't fit well with my content area	○	○	○	○
I have to give up too much responsibility to the technology -- I feel like I'm not really "teaching"	○	○	○	○
I am concerned about sacrificing curricular content or losing instructional time	○	○	○	○
I'm not sure how to differentiate instruction using technology for the wide variety of learners in my classroom	○	○	○	○
I often need to have a back-up lesson plan in case the technology fails	○	○	○	○

Teacher Technology Use and Barriers to Classroom Integration Survey

Third Order Barriers

5. Please indicate to what extent each of the following is a barrier to your use of technology for instruction

	Not a Barrier (0)	Minimal Barrier (1)	Moderate Barrier (2)	Significant Barrier (3)
I am expected to use district-adopted textbooks, curriculum, or pacing guides without a technology component	○	○	○	○
Our school bell schedule/length of class periods limits my use of technology with students	○	○	○	○
I am not provided enough prep time to learn or plan ways to use technology for instruction	○	○	○	○
My school/district administration has not communicated a clear vision for using technology for instruction	○	○	○	○
Pressure to "cover the curriculum" prior to high-stakes testing keeps me from using technology more	○	○	○	○
I don't feel trusted to use technology in ethical ways with my students	○	○	○	○
I'm not sure how to address socioeconomic gaps between students regarding access to and experience with technology in my classroom	○	○	○	○
I have little or no input into technology decisions that impact me as a teacher	○	○	○	○

Appendix D: Institutional Review Board Approval

BAKER UNIVERSITY

Baker University Institutional Review Board

April 20, 2017

Dear Simone Chambers and Dr. Rogers:

The Baker University IRB has reviewed your research project application and approved this project under Expedited Status Review. As described, the project complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

Please be aware of the following:

1. Any significant change in the research protocol as described should be reviewed by this Committee prior to altering the project.
2. Notify the IRB about any new investigators not named in original application.
3. When signed consent documents are required, the primary investigator must retain the signed consent documents of the research activity.
4. If this is a funded project, keep a copy of this approval letter with your proposal/grant file.
5. If the results of the research are used to prepare papers for publication or oral presentation at professional conferences, manuscripts or abstracts are requested for IRB as part of the project record.

Please inform this Committee or myself when this project is terminated or completed. As noted above, you must also provide IRB with an annual status report and receive approval for maintaining your status. If you have any questions, please contact me at EMorris@BakerU.edu or 785.594.7881.

Sincerely,

Erin R. Morris

Erin Morris PhD
Chair, Baker University IRB

Baker University IRB Committee
Joe Watson PhD
Nate Poell MA
Susan Rogers PhD
Scott Crenshaw

Appendix E: Permission from School District

[redacted]

Document Provided to Intended Researcher by:

Signature_____ Date:_____
(Building Principal for District Employee
or Central Office Staff for Out-of-district Researchers)

DISTRICT ASSESSMENT TEAM

[redacted]

REQUEST FOR PERMISSION TO CONDUCT RESEARCH/GATHER DATA
IN THE [redacted] SCHOOLS

DIRECTIONS: The applicant should complete this form, obtain the necessary approval and signatures, and return to:

[redacted]

It may take up to three weeks for requests to be processed; please plan accordingly in order to meet course deadlines.

1. Please describe concisely the basic concepts and goals of your proposed project, and how it is relevant to the field of education.

   I am a doctoral student at Baker University and this research is for my dissertation. The purpose of this quantitative study is to identify the barriers that hinder teacher integration of technology in an urban secondary setting where a 1:1 initiative has been implemented. This study will be conducted to identify a relationship between teacher department and gender and variables that may contribute to the confidence and comfort level teachers have with using technology.

   The results of this study may extend the current knowledge in the field and benefit school districts by improving professional development for technology integration, new teacher induction programs, and to understand better the motivations of teachers

related to implementing technology in the classroom. The results of the study might help identify the most significant barriers to technology integration.

2. List the names of all data collection instruments you intend to use and enclose a copy of each with this application. Also, enclose a copy of each parent/student consent form, if needed. Please describe in detail the distribution, implementation, and collection methods you intend to use in your data collection.

   The name of the data collection instrument is "Teacher Technology Use and Barriers to Classroom Integration Survey." The survey and the invitational email which includes the consent are attached with this request form.

   The survey will be replicated on SurveyMonkey, an online survey generator, to distribute the survey electronically to participants. Included in the distribution are an informed consent letter and a link to the survey. An email will be sent to all secondary teachers on May 1, 2017. One week after the original email is sent to all secondary teachers, a reminder email will be sent on May 8, 2017. This reminder will be followed up with a final reminder email two weeks later on May 22, 2017. The survey will close on May 29, 2017, one week after the final reminder email is sent.

3. Give the names of the [redacted] you intend to involve to meet the project requirements. Are there certain demographics required for the project (i.e., grade level, gender, etc.)?

   [redacted]

4. What amount of time would be required of staff or students in the schools in order to meet project requirements?

   The time requirement would be 10-15 minutes to complete the survey.

[redacted]

8. By what date do you anticipate being finished? May 26, 2017 (Four weeks).

9. If this is a course requirement, please obtain the signature of your instructor responsible for this assignment and attach a copy of the assignment guidelines.

   Signature: Susan K Rogers

   Position: Associate Professor

   University/College/School/Department/Division: Baker University

10. Name of applicant (please print) Simone E. Chambers

Simone E Chambers
Signature

8109 E. 201st Street — Belton, MO 64012
Address

Assistant Principal — schambers[redacted]
Position/Status — Email address

April 20, 2017 — [redacted]
Date — Phone Number

CRITERIA FOR APPROVAL OR DISAPPROVAL

The approval or disapproval of requests will be made within the following general guidelines.

1. The only projects which will generally be approved are those which:
   a) contribute to the improvement of education in the [redacted]
   b) contribute to the improvement of education in general.

2. Even within the above categories, studies will generally be disapproved if they:
   a) appear to infringe on the privacy of pupils, parents, or staff members;
   b) present a burden to pupils or staff members;
   c) threaten school-community relations in any way.

3. Research solely for a course requirement will be considered only for the [redacted] Public School District staff.

4. At any point in the research process, [redacted] staff can terminate the study if determined necessary for any reason.

5. Any results or product created as a result of this project which uses data from the district's students, staff, or facilities must be made available to the [redacted] Schools.

PARTICIPATION OF THE SCHOOLS

Generally, participation in any research study conducted by an outside agency or individual will be completely voluntary on the part of the principals, teachers, pupils and any other personnel involved.

Project Approval Signature Michael Hill Date 5/23/17

Director of Assessment and Research, [redacted]

Appendix F: Email to Building Administrators

February 6, 2018

Good afternoon,

I have received permission to conduct research and gather data needed to complete my dissertation. I am asking for your help encouraging teachers to complete a short survey. An email will be sent to your teachers on February 7, 2018, that contains a link to my survey located on Survey Monkey. The survey should take no longer than 10 minutes to complete and will provide me with much needed information.

Thank you in advance for your assistance.

Respectfully,

Simone Chambers / Vice Principal
[redacted]

Appendix G: Survey Invitation Email

February 7, 2018

Dear Educator,

My name is Simone Chambers, and I am a doctoral candidate at Baker University. This email serves as an invitation for you to participate in a study that I am conducting to complete my Ed. D. program at Baker University. The title of the survey is "Teacher Technology Use and Barriers to Classroom Integration." The purpose of this study is to identify the barriers that hinder teacher integration of technology in an urban secondary setting where a 1:1 initiative has been implemented. Additionally, this study will be conducted to identify whether a relationship exists between teacher department and gender and the variables that may contribute to the confidence and comfort level teachers have with using technology.

Your participation in this study will involve responding to 24 items using a Likert-type rating scale to determine the extent to which a statement expresses a barrier to your use of technonogy for instruction. The approximate time limit to complete this survey is 10-minutes. Completion of this survey will indicate your consent to participate in this study. Your participation is completely voluntary, and responses will be anonymous. You have the right to refuse to respond to particular items that make you feel uncomfortable. Your name will not appear anywhere on the survey. Teacher participation in this survey is extremely important for the completion of my research and the requirements for my Ed.D.

Once the data is analyzed, I will report all findings in summative form so that no one person can be identified in my reports and, or publications.

Although there may be no direct benefit to you, if you choose to complete this survey, your participation potentially will provide a baseline from which specific recommendations can be made for the professional development and technology resources for high school teachers in the district. Should you have any questions about this survey, please contact me at 816-418-1838 or through email at schambers@[redacted] (do not contact [redacted] Public Schools district personnel).

Thank you for your time; please click on the link below to begin the survey

https://www.surveymonkey.com/r/X5Y8G9L

Simone Chambers
Ed. D. Doctoral Candidate
Baker University, Graduate School of Education

Appendix H: Survey Reminder Email

February 21, 2018

Dear Participant,

If you have not completed the Teacher Technology Use and Barriers to Classroom Integration survey, please take a moment to complete it. Your input is invaluable and greatly appreciated.

My name is Simone Chambers, and I am a doctoral candidate at Baker University. This email serves as an invitation for you to participate in a study that I am conducting to complete my Ed. D. program at Baker University. The title of the survey is "Teacher Technology Use and Barriers to Classroom Integration." The purpose of this study is to identify the barriers that hinder teacher integration of technology in an urban secondary setting where a 1:1 initiative has been implemented. Additionally, this study will be conducted to identify whether a relationship exists between teacher department and gender and the variables that may contribute to the confidence and comfort level teachers have with using technology.

Your participation in this study will involve responding to 24 items using a Likert-type rating scale to determine the extent to which a statement expresses a barrier to your use of technonogy for instruction. The approximate time limit to complete this survey is 10-minutes. Completion of this survey will indicate your consent to participate in this study. Your participation is completely voluntary, and responses will be anonymous. You have the right to refuse to respond to particular items that make you feel uncomfortable. Your name will not appear anywhere on the survey. Teacher participation in this survey is extremely important for the completion of my research and the requirements for my Ed.D.

Once the data is analyzed, I will report all findings in summative form so that no one person can be identified in my reports and, or publications.

Although there may be no direct benefit to you, if you choose to complete this survey, your participation potentially will provide a baseline from which specific recommendations can be made for the professional development and technology resources for high school teachers in the district. Should you have any questions about this survey, please contact me at 816-418-1838 or through email at schambers@[redacted] (do not contact [redacted] Public Schools district personnel).

Thank you for your time; please click on the link below to begin the survey

https://www.surveymonkey.com/r/X5Y8G9L

Simone Chambers
Ed. D. Doctoral Candidate
Baker University, Graduate School of Education