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A Teacher Retrospective of a Decade of One-to-One Devices

Sarah J. Irish
Walden University

Walden University

College of Education

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Sarah Irish

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Walden University
2017

Abstract

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BS, Simmons College, 2003

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

One-to-one electronic devices have become commonplace in many educational settings across the globe, but it has been unclear how long-term teaching practices using such devices have evolved and how they relate to recognized best practices for using technology in the classroom. This study examined what a generation of teachers has over time identified as best applications of using these devices; their benefits, drawbacks, and challenges; and whether their use reflected previously identified best application of technologies in the classroom. This case study, conducted in one school system in New England, used the theories of Substitution, Augmentation, Modification and Redefinition (SAMR) and Technology, Pedagogy, and Content Analysis (TPACK) as a conceptual framework. Participants included two groups, one composed of four teachers who have taught only after implementation of one-on-one laptop use and one composed of four teachers who taught both before and after device implementation, selected to determine whether differences existed in attitudes and practices based on types of teaching experience. Data sources included interviews and observations. Results indicated both veteran and established teachers embraced the use of one-to-one devices in their teaching, but both groups lacked the knowledge of SAMR and TPACK theories to best apply them in the classroom. This study contributes to the field by including recommendations for stronger teacher technology implementation, including more in-depth training and support with application of TPACK and SAMR theories in classroom pedagogy.

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Dedication

I would like to dedicate this dissertation to the person who always supported me in my scientific investigations to ask questions and find answers, my mother.

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There are many people who have helped me complete this life project of mine. My family and friends have always been supportive.

I would like to acknowledge the support, knowledge, and detailed timely feedback from both Dr. Brown and Dr. Green for helping me get to this point.

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Chapter 1: Introduction to the Study

Introduction

Over the past few decades, computers have become an essential tool in everyday life. Computers have become commonplace in almost all businesses, homes, and schools. Penuel (2006) stated that "one-to-one computing initiatives that seek to provide laptop computers and Internet access to students for use at home and school are expanding rapidly across the globe" (p. 329). Some schools have begun to implement a one-to-one laptop program where every student in a grade or grades receives an electronic device such as a laptop or tablet to use in school, and sometimes at home as well. Penuel summarized that the possible popularity comes because of decreasing cost, increased Internet connectivity, and the reduced weight of the devices. Because of these three improvements in the area of portable computing devices, one-to-one laptop programs have become a popular topic in the education realm.

According to Penuel (2006), across the United States there has been great interest and investment in creating opportunities to have computers in the hands of students to enhance their learning. Although there has been an increase in providing students in the United States with computers, there was limited research that has looked at the longitudinal implications of such changes. In order to determine if these one-to-one laptop programs are improving student performance, more longitudinal research needs to be conducted. Bebell and Kay (2012) and Lei (2010) concluded that it takes more than a year or two for the administrators, teachers, students, and parents to adjust to the introduction of one-to-one laptops. It can take multiple years for teachers and students to

adjust to the implementation and use of one-to-one devices. This means that studies conducted during the initial years of adjusting to teaching and learning with one-to-one devices are analyzing the adjustments, and not looking at teaching and learning after the adjustments. Fleischer (2012) conducted a meta-analysis of the current research in the area of one-to-one devices and concluded, "Although more than a decade has passed, it is quite hard to concluded if one-to-one projects have the educational value that their advocates claim. There are many blind spots in the research" (p. 120). Studies after this initial phase are needed to determine what types of benefits and challenges exist. Studies such as mine conducted several years after implementation of one-to-one device programs are needed to determine if these programs are meeting the educational goals of the initiative. Secondly, studies conducted after this initial phase could ultimately determine if such programs impact the academic progress of students over the long-term. In this introduction I provide an overview of one-to-one laptop initiatives, demonstrate a gap in the current research, and begin to outline the study I conducted to fill this gap.

Background

The introduction of computers into the classroom as tools to improve student learning started in 1985 with the Apple Classroom of Tomorrow (Donovan & Green, 2009). The ideas, technology, and possibility of laptop inclusion in the classroom have grown since 1985. In the United States, the first statewide one-to-one laptop program began in 2002 in the state of Maine (Waters, 2009). The Maine Learning Technology Initiative (MLTI) program gave all seventh grade students an Apple laptop, and the following year the program was extended to all eighth grade students in the state. The

seventh and eighth grade laptops are funded fully by the state of Maine (Waters, 2009). In 2009 the program was extended to high schools. The laptops at the high school level are funded equally between the state and school districts.

Waters (2009) summarized that when implementing a one-to-one laptop program, the entire system needs to be analyzed to determine how it will change and support the initiative. The MLTI program, for instance, does not just provide a machine for all seventh and eighth grade students in the state, it also has extensive professional development opportunities—organized at the state level—for teachers and administrators that are focused on how to implement the laptops in the classroom. MLTI also requires each school district to have a technology leadership team at the local level. As Waters has noted, "If professional development is the engine of the initiative, local leadership is its driver" (p. 36). The MLTI program was designed to maximize the success of the laptops in the classroom by having a laptop implementation effort supported at both the local and state level.

Donovan, Green, and Hartley (2010), Lei and Zhao (2008), and Maninger and Holden (2009) all concluded that the first year of the implementation of a one-to-one laptop program results in a more enriching learning experience for the students. Maninger and Holden also observed an increase in students' GPA, but their initial study was not able to link the GPA increase with the integration of the one-to-one laptop program. Although there are early indications of improved student learning with one-to-one laptops after the first year of implementation, research has yet to show clear links between

student learning with the one-to-one device and one-to-one laptop programs that have been implemented for an extended period of time.

Data on these projects has been collected since 1986 with the Apple Classrooms of Tomorrow (ACOT) project, and many studies have centered on teachers and students who have continuous access to technology (Dwyer, Ringstaff & Sandholtz, 1994). Currently there is a wealth of research focused on the implementation of laptops into the classroom, starting with ACOT, including studies by Dwyer et al. (1994), Donovan et al. (2010), Suhr, Hernandez, Grimes, and Warschauer (2010), to name a few. Yet, there are few studies such as those by Bebell and Kay (2010) and Waters (2009) that look at large scale one-to-one laptop programs that have been in place for more than a few years. If large amounts of money are invested in getting laptops into the hands of every student, and if considerable time and money is spent on professional development for teachers to learn how to implement the laptops effectively into their classrooms, then the goal should be to create effective long-term implementation plans with the goal of increased student performance.

Problem Statement

Most of the current research on one-to-one laptop programs has been conducted shortly after the initial implementation (Donovan et al., 2010), or 3-5 years after implementation (Bebell & Kay, 2010). There is a current gap in the research regarding the benefits and challenges of teachers and students encounter when participating in a long-term on-to-one laptop program. Without research that analyzes one-to-one laptop programs after the initial 1-5 years of implementation, it is not possible to answer

questions about the long-term success of one-to-one programs. At this point in time, there are countless veteran teachers who have been teaching in one-to-one laptop classrooms throughout the lifespan of the MLTI program. There are also experienced, established teachers who have only taught in one-to-one laptop classrooms. I determined that these teachers were the ones who could potentially answer questions about the long-term benefits and challenges of implementing one-to-one laptop programs.

Purpose of the Study

The purpose of this case study was to determine the effects on veteran and established teachers who were part of the large-scale, long-term implementation of a one-to-one laptop program. My goal was to explore the phenomenon of long-term one-to-one laptop program implementation using a case study to determine what teachers perceived as program benefits and challenges for students and themselves, and to understand the shifts that teachers have made to their teaching. Additionally, I sought to determine how teachers adopted the technology, and adapted their teaching in a setting with one-to-one laptops, in general. By looking at the challenges and benefits, and at how teachers adopt and adapt, I worked to make initial conclusions about the long-term outcomes of one-to-one laptop programs.

Research Questions

In order to determine the effects on veteran teachers and established teachers, I developed six central research questions for this study:

RQ1: What teaching advantages do veteran and established teachers believe exist when teaching with one-to-one laptops?

RQ2: What teaching challenges do veteran and established teachers believe exist when teaching with one-to-one laptops?

RQ3: What benefits do veteran and established teachers believe their students gain from learning in a one-to-one laptop environment?

RQ4: What challenges do veteran and established teachers believe their students have from learning in a one-to-one laptop environment?

RQ5: What benefits and challenges can be observed in the classroom setting of veteran teachers integrating one-to-one laptops into their teaching?

RQ6: What benefits and challenges can be observed in the classroom setting of established teachers integrating one-to-one laptops into their teaching?

Conceptual Framework

The Substitution, Augmentation, Modification, and Redefinition (SAMR) model designed by Puentedura (2008), and the Technology, Pedagogy, Content Knowledge (TPACK) model designed by Koehler and Mishra (2009) are the two technology integration theoretical frameworks that MLTI uses for its state-wide one-to-one laptop integration. As noted on the MLTI website, "Taken together, the two models help teachers by showing them both how to incorporate the best of their past practice into the new domain, and how to accomplish significant changes in their classroom" (MLTI, 2010). The MLTI program was founded with the understanding that teachers would work with the combination of both TPACK, focusing on how the lessons are designed, and SAMR, looking closely at the complexity of the tasks that students do with the use of the one-to-one laptops (MLTI, 2010). The central focus of this study was the

implementation of a large-scale one-to-one laptop program in the classroom. Since the MLTI program, which underwrote the one-to-one laptop program that I analyzed, was founded on the theories of TPACK and SAMR, I chose to use the same conceptual lenses for this qualitative study.

Koehler and Mishra (2009) contended that the effective integration of technology in classrooms was further complicated for teachers because of rapid changes in technology development. Koehler and Mishra developed a theoretical framework that takes into consideration the challenges of integrating digital technologies into the classroom. TPACK look at the intersection "between and among these bodies of knowledge, represented as PCK (pedagogical content knowledge), TCK (technological content knowledge), TPK (technological pedagogical knowledge), and TPACK" (Koehler & Mishra, 2009, p. 62). Their work builds on the earlier work of Shulman who looked at the interaction of PCK.

SAMR was founded on the concept that there are four different ways that digital technologies can be incorporated into the classroom. The first two levels—*substitution* and *augmentation*—are known as the *enhancing* levels because the learning that occurs is enhanced by the inclusion of digital technologies (Puentedura, 2014). At the substitution level, there is not a functional way in which the student task is completed that is different without the use of technology. At the augmentation level, there is a functional shift in how students complete the task (Puentedura, 2014). The third and fourth levels of SAMR are known as the *transformational* levels because the overall learning of students can be increased by at least two letter grades (Puentedura, 2008). The *modification* level is

where the significant change occurs with how students integrate technology into the task. It is at the modification level where there is a substantial redesign of the type of task that students accomplish that would not be possible without the use of the digital tools. Lastly the *redefinition* level is where students accomplish a task that would not be possible without the use of the digital tool (Puentedura, 2014).

The TPACK theory looks at the relationship between the knowledge that teachers have about technology, pedagogy, and content knowledge when they make lesson planning and implementation decisions (Koehler & Mishra, 2009). The SAMR theory analyzes the various levels of intensity that students use when interfacing with digital technologies to gain knowledge in a content area (Puentedura, 2014). These are the two central theories that MLTI used when creating and implementing the statewide one-to-one laptop program (MLTI, 2010). I describe these two theories in more detail in Chapter 2.

My central concern when designing the six research questions was getting at the challenges and benefits that teachers believe both they and the students face in the one-to-one laptop program. By using TPACK as a framework to interview teachers about the challenges and benefits of implementing the one-to-one laptop program into their classroom, I sought to understand the extent of their knowledge about the integration of technology, pedagogy, and content knowledge. Further, by asking the teachers about what types of activities their students use the laptops for, I worked to develop an understanding of the level of SAMR that students typically work.

Nature of the Study

In this case study, the phenomena I analyzed were long-term statewide one-to-one laptop programs. Through this case study, I discovered the benefits and challenges that teachers believe exist in a one-to-one laptop program that has been implemented for over a decade. This longitudinal reflection serves as a historical perspective on how such programs grow, shift, and adjust over time. The longitudinal reflection also allowed teachers to reflect upon the challenges and benefits the one-to-one program had on their teaching environment, an on how students have grown, shifted, and adjusted over time.

Yin (2009) noted that researchers choose to take a case study approach when they want to understand a real-life phenomenon in more depth. The MLTI program is the longest running large-scale one-to-one laptop program in the world; this makes it a unique bounded system. The case study approach allowed me to look at this unique one-to-one laptop program in more depth than would other research methods.

The participants in the case study included veteran teachers who taught both before and after the implementation of the one-to-one laptops, and established teachers who had only been teaching since the implementation. These two types of teachers have had varying perspectives based on their prior teaching experiences or lack thereof. All participants were asked the same series of questions during the recorded interviews that were later transcribed. I analyzed the data using the first cycle and second cycle coding methods as outlined by Miles, Huberman, and Saldana (2014). In keeping with Yin's (2009) observation that case study inquiry "relies on multiple sources of evidence, with data needing to converge in a triangulation fashion" (p. 18), I triangulated the two sets of

data points from the veteran and established teacher interviews with a classroom observation of each participant.

Definitions

One-to-one laptop: A classroom setting where one laptop is provided for each student, thus creating a ratio of one laptop to one student (Larkin & Finger, 2011).

Large-scale one-to-one laptop program: More than one system (multiple school districts, counties, or states) that work together to provide one laptop for each student.

Veteran teacher: A teacher who has been teaching both before and after the implementation of the one-to-one laptop program (Day & Gu, 2009).

Established teacher: A teacher who has been teaching for at least 5 years, but who has only taught in a one-to-one laptop classroom (Day & Gu, 2009).

Assumptions

I made a variety of assumptions about the teacher participants in the case study. Since this study relied on interviews with teachers, I assumed that the teachers would give truthful reflections and responses to the questions. I also assumed that the veteran teachers remember clearly and in detail their classroom prior to the implementation of the one-to-one laptop program. Further, I assumed that the established teachers had a limited knowledge of the classroom prior to the implementation of the one-to-one laptop initiative. I also assumed that students wanted the one-to-one laptops in the classroom, and that they valued the one-to-one devices as important to their learning. Lastly, and possibly most importantly, I assumed that the increased use of computing tools was good for education, and for students.

Scope and Delimitations

The first criterion for participation in this study was the teacher's participation in the MLTI program. Secondly, participation was limited to only teachers who fit the criteria of being either a veteran or established teacher. Further, the teachers needed to have taught in the MLTI program with the one-to-one laptops. Only a participant meeting these criteria had the necessary knowledge to answer the interview questions in depth.

One boundary of this study was that I limited it to only veteran and established teachers; the study did not include retired or pre-service teachers. A second boundary of this study was that both the veteran and established teachers all taught within one geographical region of the state where the one-to-one laptop program has been implemented. Since all teachers in that state have access to the same training, devices, and technical support, it may be possible to transfer the conclusions of this study to other regions throughout the state. If other states, or large scale implementations adopt the same implementation and support process as MLTI did, then the conclusions may be transferred to those settings as well.

Limitations

Yin (2009) outlined three main limitations of case study research: lack of rigor, generalization, and time. In spite of these limitations, case study provided me the ability to "investigate a contemporary phenomenon in depth and within its real-life context" (Yin, 2009, p. 18), and was essential given the research questions for this study. Yin explained how to design a carefully developed case study research plan, and suggested

that the lack of rigor in case study research could result from the lack of creditable sources, bias, or specific procedures that can be followed by researchers. Yin cautioned that there could be increased levels of bias in case studies because the researcher must fully understand the issue being studied before conducting the research. In order to be able to conduct a case study effectively, researchers need to have an in-depth understanding of the phenomena that they are studying. However, this in-depth understanding can lead to increased bias. Yin suggested that a researcher could avoid this bias by asking good questions and being a keen listener. By designing a case study plan in keeping with Yin's guidelines, along with those of other qualitative research designers such as Maxwell (2013), I was able to maintain rigor.

Furthermore, I mitigated researcher bias through the use of data triangulation. Triangulation "involves using different methods as a check on one another, seeing if methods with different strengths and limitations all support a single conclusion" (Maxwell, 2013, p. 102). The data I triangulated in this study were from the transcripts from the veteran teachers, the transcripts from the established teachers, and lastly my classroom observations of each participant. The goal was that through these three sets of data, a single set of conclusions could be made.

The conclusions drawn from this research study can only be generalized to a limited population of teachers working with the same one-to-one laptop program. One of the unique characteristics of case study research is that the case can be analyzed in-depth, yet it may be representative of other cases drawn from a wider population (Maxwell 2013). This case study, although not generalizable, will contribute to the knowledge

about one-to-one laptop programs. Lastly, this study was limited by the time frame of the study, and by available resources.

Significance

The potential contributions of this study include advances in scholarly understanding of teacher beliefs regarding one-to-one laptop programs after long-term implementation. There are countless studies of one-to-one laptop programs such as Dwyer et al. (1994), Donovan et al. (2010), and Suhr et al. (2010), to name a few. Yet, there are few studies such as those of Bebell and Kay (2010) and Waters (2009) that look at large scale one-to-one laptop programs that have been in place for more than a few years. Zucker and Light (2009) stated, "with the continuing decline in costs of technology, programs are proliferating worldwide to put networked laptop computers into the hands of millions of students on a routine basis" (p. 82). It was important to look at this unique setting where one-to-one laptops have been in use for a long period of time to determine what the benefits and challenges are with the inclusion of one-to-one laptops subsequent to a program's initial phase. Through this study, I gathered the perceptions of veteran and established teachers to determine what they believed to be the benefits and challenges of large-scale one-to-one laptop programs.

As Zucker and Light outlined (2009), there are many one-to-one laptop programs throughout the country and globally. In this study, I sought to advance the practices and policies of one-to-one laptop programs, and to determine the impacts of continuing with a one-to-one laptop program after the initial implementation phases. This study had the potential to show whether teachers believed that one-to-one laptop programs are worth

the work and effort after they have gone through the process of learning how to include them meaningfully into their daily teaching.

As Dunleavy, Dextert, and Heinecke (2007) outlined, one-to-one laptop programs are not always simple to implement in the early stages. Dunleavy et al. concluded that teachers were challenged by hardware and classroom management issues. Hardware and classroom management issues are challenges that can be overcome with time. This study, along with those of Dwyer et al. (1994), Donovan et al. (2010), and Suhr et al. (2010), seem to focus on the early stages of one-to-one laptop implementation. If it is true that one-to-one laptops are being put into the hands of millions of students (Zucker & Light, 2009), then it is critical to look at the long-term implications beyond the initial phases. The potential implications for positive social change with this study were to look more deeply into if one-to-one laptop programs are worth pursuing after the initial implementation phases. As well as what benefits and challenges teachers perceive after implementing a one-to-one laptop program for over a decade.

Summary

In this first section, I provided an overview of the history of the large-scale one-to-one laptop program that has been in place for over a decade in the state of Maine. The purpose of this study was to gather information from both veteran and established teachers about believed advantages and challenges for both themselves and their students for teaching and learning in a one-to-one laptop environment. In the next section, I review current peer-reviewed articles to provide an overview of what is currently understood about one-to-one laptop programs. The literature review shows how little

research exists on one-to-one laptop programs beyond the initial phases of their implementation. In the literature review, I also outline the literature I drew on to develop the conceptual framework and used to justify the case study approach.

Chapter 2: Literature Review

Introduction

The goal of this research study was to provide more data for education policy makers to use to make decisions regarding the implementation of one-to-one laptop initiatives. Bebell and O'Dwyer (2010) stated "in recent years, we have seen increased interest in implementing 1:1 computing initiatives in schools. However, for educators and policy makers that wish to invest in these initiatives as a means for improving educational outcomes, there was little empirical evidence upon which to base decisions" (Bebell & O'Dwyer, 2010, p. 5). The purpose of this research was to examine teacher beliefs regarding student learning in one-to-one laptop programs that have been established for an extended period of time. I have divided this literature review into four topical sections: (a) conditions that impact effective implementation, (b) ways that one-to-one technologies are utilized, (c) students, and (d) changes to teaching.

Literature Search Strategy

To search for scholarly literature, I used both traditional research databases and Google Scholar. Using the Education Resources Information Center (ERIC), I conducted an initial search of article abstracts with the keywords *one to one* and *laptop*. From this search, I found the meta-analysis research article from Spires, Oliver, and Corn (2011). Because this article was a meta-analysis, the authors referenced a variety of current articles on the topics covered in this literature review. After reading through the bibliography of the meta-analysis, I used Google Scholar to find the peer-reviewed articles the authors referenced. Google Scholar also served as the engine for additional

searches including the keywords *MLTI* and *one-to-one*, and for searches for articles similar to that of Spires et al. (2010).

Conceptual Framework

TPACK and SAMR are the foundational theories that MLTI uses when providing professional development training for teachers who are part of the statewide one-to-one laptop program. The TPACK model provides a framework for understanding the interconnection between the inclusion of technology, pedagogy, and content knowledge in the classroom. Koehler and Mishra (2009) designed the TPACK framework in 2007 as an extension of the work by Shulman who focused on PCK. Content knowledge (CK) is the knowledge that a teacher has about the subject matter that he is teaching, and pedagogical knowledge (PK) is what a teacher knows about best practices and teaching methods. Technology knowledge (TK) is challenging to define since, by the time a text comes to print, the definition could be outdated (Koehler & Mishra, 2009). Koehler and Mishra urged that in order for effective classroom learning to occur, a teacher not only needs to understand each of the three separate areas of TPACK, but also must understand the relationships between the three areas so that effective classroom instruction takes place. When teachers are effective at integrating these three areas into daily lessons, effective technology inclusion can occur.

The technology inclusion model SAMR was developed by Puentedura (2008) to address the various levels of technology integration. The first two levels of SAMR are substitution and augmentation; this is where the inclusion of digital technologies can enhance the learning of the student. The substitution level of digital technology inclusion

is when the teacher uses a digital tool in substitution for a previous strategy. An example of this would be when students use word processing software to type their work rather than writing it by hand. The key to substitution is that there is no functional change with the use of the digital tool. The augmentation level of digital technology inclusion is similar to substitution in that it replaces a similar way to accomplish a task in the classroom. The key difference between substitution and augmentation is that at the augmentation level, there is an improvement in the functionality of the way in which the technology is included (Puentedura, 2014). Again, with the word processing example, the functional improvement could be the use of the thesaurus or spell checking tools along with the copy and paste features. This means that students have at their fingertips a variety of tools that allows for the improvement of their work (Puentedura, 2014).

The last two levels of SAMR, modification and redefinition, is where the overall learning of students can be transformed. At the modification level there is a significant redesign of the task that the students perform with the digital technology (Puentedura, 2014). Continuing with the word processing example, this could mean that students are using Google Drive to write, allowing for collaboration with peers and the teacher during the writing process. Without the use of technology, this real-time collaboration would not be possible. Lastly, at the redefinition level, tasks are accomplished that would not be possible without the inclusion of digital technology (Puentedura, 2014). An example of a redefinition task could be that students publish their final work from the Google Drive document to a blog, and then have conversations with students from other schools as well

as with experts in the field that the piece of writing covers via the comments section of the blog. Without the use of technology, such a task would not be possible.

In their meta-analysis of current research on one-to-one devices in classrooms, Harper and Milman (2016) concluded that the use of the devices is mostly substitution and augmentation types of activities. The one-to-one devices are used for research, work with productivity tools, and to complete drill and practice work. The ways that teachers incorporate technology into their daily teaching could remain at the substitution and augmentation levels because of the pedagogical and management challenges that arise which may hinder teachers from reaching towards the modification and redefinition levels. Romrell, Kidder, and Wood (2014) suggested that at the lower levels of SAMR, the pedagogical and management obstacles of having the students engage in the learning activity may not be worth the learning gains. At the modification and redefinition levels, the educational gain begins to outweigh the pedagogical and management obstacles.

In a case study of social studies teachers, Hilton (2016) concluded that the SAMR and TPACK models have different strengths and weaknesses, but both provide a concrete way for teachers to reflect on their teaching and technology inclusion to make the best use of the one-to-one technologies available to them. In other specific TPACK-related research, Tallvis, Lundin, and Lindstrom (2012) concluded after interviewing Swedish teachers in secondary one-to-one classrooms that there is a need for explicit in-service training in order for teachers to fully understand and adopt the TPACK model in their teaching.

The MLTI program was founded with the understanding that teachers would work with the combination of both TPACK, which focuses on how the lesson is designed, and SAMR, which looks closely at the complexity of the tasks that students do with the use of the one-to-one laptops (MLTI, 2010). The central concept that grounds this study was the implementation of a large-scale one-to-one laptop program in the classroom. The contextual lens for this qualitative study was the two theories of digital technology inclusion into the classroom that MLTI uses: TPACK and SAMR.

The TPACK theory looks at the relationship between the knowledge that teachers have about technology, pedagogy, and content knowledge when they make lesson-planning and implementation decisions (Koehler & Mishra, 2009). The SAMR theory analyzes the various levels of intensity that students use when interfacing with digital central technologies to gain knowledge in a content area. (Puentedura, 2014). These are the two theories are the central theories that MLTI used when creating and implementing the statewide one-to-one laptop program. (MLTI, 2010).

My central concern when designing the six research questions was getting at the challenges and benefits that teachers believe they and their students face in the one-to-one laptop program. By using TPACK as a framework to interview teachers about their challenges and benefits of implementing the one-to-one laptop program into their classroom, I sought to understand the extent of their knowledge about the integration of technology, pedagogy, and content knowledge. Further, by asking the teachers about the types of activities their students use the laptops for, I worked to develop an understanding of the level of SAMR that students typically work.

Case Study

Creswell (2009) defined case study as "a strategy of inquiry in which the researcher explores in depth a program, event, activity, process, or one or more individuals" (p. 13). The program that I explored in more depth was the statewide one-to-one laptop program. The individuals who participated in this study taught in a large-scale one-to-one laptop learning environment, so the common variable that bound the participants was the state-wide one-to-one laptop program.

Yin (2009) stated, "a case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context" (p. 18). The contemporary phenomenon that I investigated was the use of one-to-one laptops, so I analyzed teachers' beliefs regarding the impacts and effectiveness of such practices. The advantage of this case study was that I investigated two subgroups of teachers, veteran teachers and established teachers. The veteran teachers were those teachers who taught both before and after the implementation of the statewide one-to-one laptop program. The established teachers were those teachers who had been teaching for more than 5 years, but had only ever taught in a one-to-one laptop environment. The veteran teachers were able to discuss the differences and changes in student work and performance before and after the implementation of the one-to-one laptop program. The established teachers, who were likely to be more comfortable with computers in general due to their age, provided a different lens to view classroom activities and believed student benefits.

Through the case study, all participants were asked the same series of open- and close-ended questions. My aim with the questions was to hear what the teacher believed

to be the advantages and challenges of teaching in a one-to-one laptop setting, as well as what they understood to be the benefits and challenges to their students' learning. All interviews were recorded, transcribed, and then analyzed.

Conditions That Impact Effective Implementation

When implementing a one-to-one laptop program, there are a variety of variables that need to be taken into consideration and need to be in place in order for the implementation to be successful. Weston and Bain (2010) concluded that the implementation of a one-to-one laptop program was the largest challenge to the success of a one-to-one laptop inclusion program. There are three main areas that current research suggested affects the implementation of a one-to-one program: teachers, professional development, and leadership. Without all three of these areas working together, the success of a one-to-one program cannot be guaranteed.

Teachers

For most teachers, teaching in a one-to-one environment was not what they were taught in their teacher candidate training programs. Spires et al. (2011) suggested that the most critical element in the successful implementation of a one-to-one program was the pedagogical view of the teacher; this same conclusion was also made by Keane, Lang, and Pilgrim (2012). They observed the pedagogical shift in strategies during their research study on one-to-one devices and concluded that it was the most critical change that took place. Larkin and Finger (2011) expanded the view of Spires et al. that there are three characteristics that impact the effective implementation of one-to-one

technology: the pedagogical approach of the teacher, the confidence the teacher has with computers, and the subject area expertise of the teacher.

The shift to a one-to-one laptop environment is not just pedagogical but it is also a philosophical shift. Larkin and Finger (2011) defined pedagogy as how the teacher views the inclusion of computers in their classroom, and ultimately the one-to-one program in general. If a teacher views the inclusion of computers as a supplement, then the ways that it will be incorporated into teaching will look very different than if the teacher views the inclusion of computers as essential. Bebell and Kay (2010) supported this condition in their research and found that the attitudes and beliefs of the teachers are critical elements in the success of the implementation of a one-to-one program. Pelef, Blau, and Grinberg (2015) discovered that even once a teacher believes that the one-to-one devices are a benefit to teaching, there can be a gap in translating those beliefs into actual teaching practices in the classroom.

There are barriers that can hinder this philosophical shift that are needed in order to successfully adopt a one-to-one device program. Howard, Chan, and Caputi (2015) found even the subject that a teacher teaches can impact the technology integration and the beliefs of that teacher about information and communication technology. Zuber and Anderson (2013) concluded that one specific subject that was hindered by this philosophical shift was math. In the subject of math the belief of teachers that "real math" was done with paper and pencil was a significant barrier to the adoption and use of the one-to-one devices in the classroom. Furthermore, Pinkham and Johnson (2013) concluded from survey results of middle school teachers who were part of the MLTI

program they had a higher perceived benefit of the MLTI program than high school teachers. Beliefs about technology inclusion could vary depending on the subject taught, as concluded by Howard, Chan, and Caputi and they could also vary depending on the grade levels taught as concluded by Pinkham and Johnson.

Shapley, Sheehan, Maloney, and Caranikas-Walker (2010) concluded that without buy-in or support with the correct attitudes and beliefs on the part of the teacher that Bebell and Kay (2010) referred to, a one-to-one program would not be successful. Even with pedagogical and philosophical support for teachers, the meaningful and successful adoption of a one-to-one laptop program did not happen the instant the laptops arrive in the classroom.

The transition for teachers into a classroom with one-to-one technologies was usually not one of immediate acceptance. Shapley et al. (2010) concluded that it could take up to three years for 77% of the teaching staff to fully or substantially support a one-to-one laptop program. Once teachers were able to fully or substantially support the one-to-one laptop program, it was at this point that the buy-in that Shapley et al. discussed happens, as well as the attitudes and beliefs that Bebell and Kay (2010) referenced are in place.

The last condition that impacts the effective implementation of a one-to-one program was the technical skills of the teacher. Lowther, Inan, Ross, and Strahl (2012) suggested that teachers who are more technically skilled are more likely to integrate the one-to-one laptops into their classrooms. This comfort with the one-to-one device was one of the three characteristics that Larkin and Finger (2011) outlined as characteristics

that a teacher needed to have in order for one-to-one laptop inclusion to occur. Blau and Peled (2012) concluded the more open to change a teacher was and the more they used technology in both their personal and professional life. Use in both their personal and professional life increased the level of technical skills the teacher had. The level of technical skills that Lowther et al. and the computer skills comfort that Larkin and Finger both refered to are skills that a teacher could grow and develop the longer they are part of a one-to-one laptop program.

If a teacher had the technical skills to implement technology rich learning experiences for students and the philosophical and pedagogical view to support the use of one-to-one devices in the classroom Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur (2012) concluded that teachers could create a learning environment that closely aligned to their beliefs. Ertmer et al. concluded after interviews with teachers who had received awards for their technology practices in the classroom that the teachers were able to create technology rich learning environments that closely aligned to their beliefs as teachers. It was also concluded from this same study that these teachers who were highly skilled with integrating technology into the classroom were also committed to finding ways to utilize the technology available to them to prepare their students for the future.

According to current research, there are several characteristics that a teacher needed to have in order for the inclusion of one-to-one laptops to occur: support for the one-to-one laptop inclusion program, positive attitudes and beliefs about the inclusion of the one-to-one device program, a view that laptops in the classroom are essential rather

than supplement, a pedagogical view that accepts technology as an essential element of teaching, and lastly the technical skills to utilize the tools.

Professional Development

Current research emphasizes the importance of professional development for participating staff in any one-to-one laptop program. Richardson, McLeod, Flora, Sauers, Kannan, and Sincar (2013) concluded that if the goal was to have teachers utilize technology with students effectively then robust professional development was necessary. The professional development could take place in a variety of ways but professional development was an essential element to the overall success of a one-to-one laptop program. Raulson and Wright (2012) found that simply providing technology did not mean that it would motivate teachers to integrate it into their daily teaching. Professional development was needed in order to ensure that the teachers could integrate the technology in meaningful and effective ways. In the survey portion of the research study conducted by Raulston and Wright found that there was a 32% increase from participants from year one of implementation of a laptop program to year two of implementation who felt they could integrate technology into the curriculum and use technology as an instructional tool due to effective professional development.

Not only are technical skills with using a device essential to the success of the professional development training, Bos, and Lee (2012) concluded that before a teacher could integrate technology effectively they needed to have a solid understanding of the pedagogical and content knowledge, or the PK and CK parts of the TPACK model. Most

importantly, Spires et al. (2011) concluded that a successful one-to-one program was dependent upon a professional development for all staff involved in the implementation.

Other researchers extended the statement made by Spires et al. (2011) to define elements that could lead to successful professional development. Drayton, Falk, Stroud, Hobbs, and Hammerman (2010) stated that the professional development needed to focus on tools for each specific content area, training in different learning strategies used in a one-to-one setting, and time to talk and share with other teachers. Klieger, Ben-Hur, and Bar-Yossef (2010) echoed the concept of time to talk and share with other teachers in their research, suggesting that each professional development session has time built in for sharing. Klieger et al. suggested that the professional development needed to be differentiated to meet the various needs and technical skills of each teacher. Lastly, Klieger et al. noted that the professional development had a larger impact on teaching if it took place in the natural setting where the integration was going to occur such as in the classroom.

Deeson, Journell, and Ayers (2014) concluded after their case study with two social studies teachers using one-to-one devices that it was easy for teachers who had little professional development training to simply use the one-to-one devices as a substitution for current teaching practices. Deeson et al. noted that in order to teachers to stretch beyond substitution professional development specifically on TPACK or project-based instruction was essential in order for the teacher to create a successful one-to-one learning environment. Oakley and Pegrum (2014) also conducted a case study of participants in professional development training in the area of TPACK. They concluded

that the TPACK focused professional development changed the way that the teachers taught. It was also observed that the participants learned unplanned skills as a by-product of the training through a motivation to learn more technical skills that they were exposed to in the training.

There was a difference in the type of professional development that veteran teachers needed versus novice, or established teachers. Hervey (2015) conducted classroom observations and interviews with veteran teachers who taught in one-to-one device settings. One critical conclusion of this study was that veteran teachers needed professional development to help them learn how best to use one-to-one technologies effectively in the classroom. Novice teachers tended to come into the classroom with the background knowledge in how to include the technology into their teaching, but needed more training and support in pedagogical and content knowledge. These two groups of teachers, veteran and novice, could learn and support each other.

Fleischer (2012) outlined two successful implementations of professional development in the meta-analysis of one-to-one device programs. The two successful professional development opportunities combined teachers and students together in the learning about how to incorporate one-to-one devices into the classroom. In one program the students were brought to a local university to learn with their teachers how to use the new tools. In another program the students learned about information literacy for two years prior to having the one-to-one devices. In both of these examples the students were also part of the professional development along with the teachers.

Sometimes professional development could be used to freshen a teachers teaching style. Harris and Hofer (2011) heard repeatedly in interviews with social studies teachers that after participating in professional development that focused on creating a unit plan that integrated technology that the teachers hadn't realized how much of a "rut" they had gotten themselves in with their teaching practices. After the training they learned about a variety of learning activities that they could incorporate into their teaching style.

Professional development allows for teachers to gain the necessary technical skills to be able to integrate one-to-one technology effectively into their daily teaching. Professional development that focuses on content tools and was differentiated to the various needs of the staff attending the training, sessions that take place in the classroom, and time for sharing are essential elements of successful professional development for teachers who taught in a one-to-one device classroom.

Leadership

Williams and Larwin (2016) concluded that simply putting one-to-one devices into the hands of students and teachers was only the first step. Like other educational reforms the ultimate effect of a one-to-one program was directly related to the intended purpose and the fidelity of the implementation. The purpose of the one-to-one device program needed to be communicated clearly by the administrators of the school. Topper and Lancaster (2013) concluded that the successful implementation of a one-to-one program was a solid commitment that was communicated, understood, and promoted at all levels of administration.

Waters (2009), who conducted his research in the state of Maine, concluded that having a technology leadership team was essential to the success of the program. Weston and Bain (2010) suggested that a framework should be created outlining the implementation strategy. This framework was something that the leadership team, that Waters suggested be in place, could work on. Balanskat et al. (2013) echoed the importance of involving and collaborating with key stakeholders such as parents, head teachers, and local industry to help create the framework that Weston and Bain suggested. Oliver, Mollette, and Corn (2012) also discussed the importance of including stakeholders. Wilocks and Redmond (2014) concluded that the key learning from their research study was that it was necessary to develop guidelines for both home and school in order to reduce the risk of distraction for students when using their one-to-one device. One specific area that this leadership team of key stakeholders could work on was this set of guidelines. Drayton et al. (2010) discovered that a school culture of acceptance of the one-to-one program was necessary in order for the program to be successful. A technology leadership team, such as the one Waters suggested, could aid in fostering the system wide-school culture of acceptance.

Leadership from administration was also important for the overall success of implementing of a one-to-one device program. Milman, Hillarious, O'Neil, and Walker (2013) encouraged conversations that were school-wide about policy and the role that technology has in the curriculum. Toy (2012) outlined that in order for one-to-one device programs to be successful the building principals must model the use of the same technology that they expect from their teachers.

The results from Simmons and Martin (2016) outlined two specific goals for principals when it came to the success of a one-to-one device program. First, any training that teachers were going to take part in should also include district leaders including principals. This ensured that leaders not only knew how to effectively integrate and use technology, but they could also answer questions that teachers may have had. Secondly, principals also needed to make sure that they were modeling effective technology use.

Warschauer, Zheng, Niya, Cotton, and Farkas (2014) compared three different one-to-one device programs and found that those that took into consideration the needs of their students and teachers, developed an infrastructure, and had support from stakeholders were more successful than those that did not factor in those three key components.

Leadership that oversaw the direction and attitude of a one-to-one technology implementation was one of the three essential elements in the effective implementation of a one-to-one program. This leadership group could help determine the types and the focus of the professional development opportunities that would be provided for all staff. Professional development was the second essential element in the effective implementation of a one-to-one program. The last critical element in the effective implementation of a one-to-one program was teachers. Without a variety of elements from teachers including buy-in, pedagogical knowledge of computer inclusion in the classroom, and confidence with computers and the implementation, a one-to-one program would not be successful.

Ways that One-To-One Devices Are Utilized

Once the devices were introduced into the classroom, there were a vast number of ways that they could be used: word processing, Internet searching, research, multi-media projects, creating original content, drill and practice activities, and data analysis to name a few. Islam and Andersson (2015) concluded that a laptop was the type of device that teachers preferred, but many also suggested a combination of a tablet and a laptop. No matter what device was implemented in the one-to-one program the ways that teachers and students could utilize them remained mostly the same. In meta-analysis of current research Fleischer (2012) concluded that most ways the one-to-one devices were utilized by students in the classroom fell into one of three general categories: research, expression, or communication.

Bebell and Kay (2010) found in their research that the laptops were most frequently used for communication between students, between teachers, between teachers and students, and between teachers and home. Spires et al. (2011) supported Bebell and Kay's finding suggesting that the use of the laptops allowed for communication beyond the normal school day.

Another common use of the laptops in the classroom was for Internet use. Lowther et al, (2012), Bebell and Kay (2010), Suhr et al. (2010), and Dunleavy et al. (2007) all concluded that one of the most common uses of the one-to-one device was for the Internet. Since the Internet was filled with a variety of resources ranging from research to practice, it was no wonder it was one of the most common uses of laptops in the classroom.

Another common way that the one-to-one laptops were utilized in the classroom was word processing. Maninger and Holden, (2009), Suhr et al. (2010), and Dunleavy et al. (2007) all found that using the laptops for word processing was a common use of the one-to-one tools.

Collaboration, although not a specific tool utilized with the one-to-one devices but rather a pedagogical style of how the one-to-one devices, could be utilized. Babell, Clarkson, and Burraston (2014) observed students created many different types of final products: webpages, presentations, reports, multimedia, pictures, graphs, stories, and videos. Most importantly from these observations Babell, Clarkson, and Burraston also observed an increase in the collaboration between students while they were creating these types of final products. Fallon (2015) also observed teachers exercising the use of collaboration skills between students who are part of a one-to-one device-learning environment.

Differentiation was another pedagogical strategy that is frequent utilized in a one-to-one device-learning environment. G. Morrison, D. Morrison, and Ross (2016) concluded that through a survey to teachers who were part of the MLTI program that teachers reported utilizing differentiation in order to create learning experiences that allowed students to successfully meet the state standards. Milman, Carlson-Bancroft, and Boogart (2014) also observed teachers using one-to-one devices in order to differentiate the types of activities that the students were doing in order to challenge students at the intellectual level that they were at.

Bebell and Kay (2010) found that students used the one-to-one tools less frequently for analyzing data and working with spreadsheets. This aligns with the finding of Donovan, Green, and Lim (2008) that the one-to-one laptops were used less frequently in math and science classrooms since analyzing data and working with spreadsheets was done more traditionally in math and science classes.

Although there are many ways that students can use the one-to-one devices in the classroom to accomplish specific learning activities, they can also be used for non-academic uses. Lindqvist (2015) observed in the first year of implementing a one-to-one device program the devices were used for note taking, writing essays, Internet searching and drawing. This initial observation by Lindqvist was the same as Bebell and Kay (2010), Lowether et al. (2012), Suhr et al. (2010), Dunleavy et al. (2007), and Maninger and Holden (2009). The key difference with the observations made by Lindqvist was that he observed that the students were also not always using the device specifically for class. The students also used their devices to play games, be on social media, and listen to music.

Although every effort was made to make sure that both the teacher and the students understand how the devices are to be used Crook, Sharma, Wilson, and Muller (2013) discovered that in 30% of classrooms there was a high alignment of device use between the teacher and student. In 55% of classrooms there was a moderate alignment of device use between the teacher and student. In 15% of classes there was a misalignment between the teacher and the student on device use. This means that in 85%

of classrooms the teacher and the student agree on the amount of time the one-to-one device is being used and for what tasks the student should be using the device.

There are three main ways that the one-to-one laptops were utilized in the classroom: communication, word processing, and Internet work. The laptops allowed for communication to happen outside of the traditional school day, the Internet allowed for including the endless resources found on the Internet ranging from research and activities, and word processing allowed students to put their ideas together in a polished piece. Groff (2013) concluded that the success of any one-to-one program, like the other technologies that have come before it, was more about how the one-to-one devices were utilized than the technology itself.

Students

Students are the main reason why one-to-one device programs were implemented with the main goal being to impact their learning. Since one of the main goals of most one-to-one device programs was to influence student learning, researchers have focused on student classroom engagement, standardized test scores, and both the positive and negative impacts that participating in a one-to-one device program can have on students.

Student Engagement

Bebell and Kay (2010) concluded that student engagement improved for students who were part of one-to-one laptop programs. Bebell and Kay went on to find that this improved engagement for students was not just for some students, but also for all types of students: at-risk, low achieving, and high achieving. Lowther et al. (2012) found through student interviews and surveys that students reported being more engaged when learning

with one-to-one laptops and that the laptops significantly improved their study and learning skills. The research of Keengwe, Schnellert, and Mills (2012) also supported that with the integration of a one-to-one device program students had an increased sense of engagement, learning, motivation, and the ability to work individually. Bebell and Kay found through student surveys that they were most engaged with their academic work with one-to-one laptops when they were using the laptops in innovative ways.

Lin and Shao (2012) conducted a research study that compared a one-to-one classroom with a classroom where there was one device per group (1:m) and how well the group preformed a group project. Lin and Shao concluded that the one-to-one groups "demonstrated better quality interactions compared to those of the 1:m groups" (p. 110). This suggested that when each student had their own device when working in a group all members of the group were more actively involved and engaged with the learning task than when there was only one device per group. This also suggests that the students were learning more than the content in the one-to-one group-learning environment, but they were also learning how to work as an effective member of a group.

Carr (2012) conducted a research study that compared pre and post-tests of two groups of fifth-grade students in math classes. One group of math students learned with the supplement of an iPad, while the control group did not. Carr concluded, "experiences with iPads were not meaningful enough to significantly influence students' mathematics achievement" (p. 278). Carr went on to state that the findings of this study were similar to other one-to-one mobile learning like the iPad.

In a meta-analysis of six major one-to-one initiatives in the United States Argueta, Huff, Tingen, and Corn (2011) stated that students in the MLTI project reported an increase in the amount of time they spent on school work both in and out of school. These same students also reported that the technology rich projects took more time and were more challenging than traditional school projects, but the students said they were more fun and engaging.

Bebell and Kay (2010) found that learning in a one-to-one setting positively impacted all types of learners. Lowther et al. (2012) supported these findings concluding that students reported being more engaged in a one-to-one learning environment. Lin and Shao (2012) also conducted research that found students engaged with group projects in a one-to-one device learning environment were more effecivet as a group than students with one device per group. All three of these research studies concluded positive results for one-to-one learning environments and were all classrooms with laptop devices. Carr (2012) conducted research that found that iPad devices did not effectively enhance student engagement or learning.

Impacts to Students

The goal of any one-to-one laptop program was to have a positive impact on students. Through several studies that included student interviews, student surveys, and directly observing how students use their one-to-one devices, Bebell and Kay (2010), Donovan et al. (2012), Donovan et al. (2008), Spires et al. (2011), and Lei (2010) have found that there are both positive and negative impacts to students who learn in a one-to-one environment.

There are a variety of positive impacts on students when they learn in a one-to-one device setting. Bebell and Kay (2010) found that when students learned in a one-to-one device environment their interest in learning was increased, as well as the quality of the work that the students produced. Donovan et al. (2012) found that one-to-one laptop programs promoted 21st century skills through the 24 hours a day, seven days a week access to laptops at the fingertips of the students. Corn (2013) also concluded that the use of a one-to-one device at school helped to develop 21st century skills. Donovan et al. (2008) found that students felt they are more organized because of the one-to-one laptops and that they are able to create more interesting products for assignments at school. Downes and Bishop (2012) found that students in one-to-one device learning environments felt that working outside of school was easier than without the one-to-one device. Lastly, Rosen and Beck-Hill (2012) observed that in a one-to-one device setting that there was a two-fold increase in student-teacher interactions.

Three research studies found that students felt a positive impact of motivation and engagement due to the one-to-one technologies. Bebell and Kay (2010) found that students were more motivated in school because of the laptops. Donovan et al. (2010) concluded that when students had access to one-to-one laptops, they had an increase in motivation to use the laptops. Downes and Bishop (2015) found that access to a one-to-one device allowed students to feel more engaged and that the work they were doing in their classes was more relevant to their own lives.

Not only were students more engaged and motivated to learn in a one-to-one device learning environment, they were also learning skills that would be useful to them

in the future. The research of Spektor-Levy and Granot-Gilat (2012) outlined nine skills that students who were part of a one-to-one device program demonstrated a significant difference with than students who were not part of a one-to-one device program. Those nine skills were: identifying information sources, organizing information in a table, writing that is clear and detailed, identifying reliable sources, identifying advantages and disadvantages, writing argumentative paragraph, selecting software that is suitable for the task, and processing and linking digital content and media. Zheng, Arada, Niiya, and Warschauer (2014) concluded from student surveys that there were seven positive outcomes for students who learned in a one-to-one device program. These seven positive outcomes were: more efficient and productive learning, a better tool for writing, easier access to information, students are more engaged with interacting with new media, working in a technological world, learning and sharing with peers, and more individualized and differentiated instruction. Gigliotti, Carrington, and Agostinho (2013) also found that higher order thinking was fostered in a one-to-one device classroom through student choice, classroom discussions lead by the teacher, and simply through the use of the one-to-one devices.

Although there are many positive impacts for the students who participated in one-to-one laptop programs, there were also some negative effects. Storz and Hoffman (2013) concluded from interviews with students who were part of a one-to-one device learning environment that there were more off-task behaviors because of the increased challenges of the teacher to monitor all of the devices. Donovan et al. (2010) found that when students do not have their laptop for class due to a variety of reasons including

repairs, forgotten at home, or loss due to discipline, it hindered their ability to feel included in the classroom setting. Another barrier to the successful implementation of a one-to-one program for students was whether the device could go home, or if it needed to remain at school. Spires et al. (2011) found that if the device could not go home, this may be perceived by the student as a large barrier to their ability to use the device and complete their schoolwork..

Just as the teachers discussed in research studies, technical issues with the devices could have an impact on their success of implementing the one-to-one devices smoothly and successfully. Donovan et al. (2008) found that students in interviews and surveys indicated that technical issues with the devices such as the machine freezing or it needing to be repaired hinder them greatly for successfully using the equipment in class.

Lei (2010) did find one impact to students that shifted from a negative characteristic to a positive in a four-year study. When the students first started in the one-to-one device program, they used the device to accomplish academic tasks, but they were also using them frequently for entertainment. As the students spent more time with the one-to-one devices and they began to mature, their focus on using them for entertainment shifted to using them more for academic purposes.

There are a variety of positive and negative impacts that students perceive when participating in a one-to-one laptop-learning environment. Improved standardized test scores, motivation, quality of work, promoting of 21st century skills, organization, and interest are some of the positive characteristics that they students identified. When the device was in need of repair, when technical issues existed, or when the device was not

available for class due to a variety of reasons, a student could be left out of the classroom activities. Lastly, some of the impacts to students could shift from negative to positive over time through maturing on the parts of the students.

Standardized Test Scores

Standardized tests are taken by students across the country and globe and are a traditional way of comparing student progress, growth, and knowledge. One of the factors that make them a good way to compare students is that they are the same test no matter what classroom, school district, state, or country. In the research area of one-to-one laptops many researchers have analyzed standardized tests and the results were inconclusive for many studies.

Bebell and Burraston (2014) found after analyzing standardized test data there was a minimal differences between technology rich schools and the state average on the standardized test. This research team suggested that additional research was necessary in order to make any conclusive conclusions. Hur and Oh (2012) found that Korean students who were part of a three-year one-to-one device classroom did not have significantly increased standardized test scores in the areas of English and science as compared to students who were not part of the one-to-one device-learning environment.

Fleischer (2012) concluded in his meta-analysis the variety in research study design as well as type of scores being analyzed, standardized tests versus grade point average, made being able to make comparisons of research results challenging. Although standardized test score performance was difficult to link directly to the use of one-to-one laptop use, some researchers had noticed trends in various studies when one-to-one

device programs were initiated. In Massachusetts, Bebell and Kay (2010) noticed that eighth grade student performance on the math Massachusetts Comprehensive Assessment System (MCAS) test increased by 5% each year of their study. Suhr et al. (2010) found that fourth grade students who specifically participated in a one-to-one device program showed no statistically significant growth. Fourth grade students in the same study who did not participate in the one-to-one device program showed an overall average a loss of one year of growth. According to Suhr et al. fourth grade was a time when standardized test performance was traditionally poor, so the growth of the students who were part of the one-to-one program was not stifled.

Lowther et al. (2012) conducted a study comparing a group of students who participated in a one-to-one laptop program to a control group of students who did not participate in a one-to-one laptop program. Although there were an endless number of variables between the two groups of students, the research team tried to control as many of them as they could. The research team found that when comparing the two groups of students, the area that showed the greatest difference was in standardized test performance. The students who participated in the one-to-one laptop program scored statistically significant higher on their standardized tests than the students who did not participate in the one-to-one laptop program.

Shapley et al. (2010) found in their study the greatest indicator of standardized test performance with students who are part of a one-to-one device program was if the device was taken home and how much it was used outside of school. Furthermore,

Shapley et al. also found that it did not matter how the device was used outside of school for this increase to occur. .

One research team gave a suggestion as to why finding conclusive results when looking at standardized test data of students who were part of a one-to-one device program. Zheng, Warschauer, and Farkas (2013) concluded that it may be challenging to see the impacts that one-to-one devices were making in the classroom due to the disconnect between the types of assignments and types of writing that students did with their one-to-one device and the types of questions that were asked on standardized tests.

Although it was difficult to link standardized test performance to only a single variable such as participation in a one-to-one laptop program, some studies have found that standardized test scores have increased. One study conducted by Shapley et al. (2010) was even able to extend their observation past simply test improvement and found that if the device use outside of the normal school day could be an indicator of standardized test performance.

Changes To Teaching

In order for a one-to-one laptop program to be successfully implemented one of the key elements that needed to be in place was the teacher. Spires et al. (2011) discussed the importance of the pedagogical style of the teachers needing to align to the inclusion of the one-to-one devices. Lei (2010) observed that the technical skills of the teacher needed to be at a level where they were comfortable with the activities with which they were going to lead students. Most importantly, Bebell and Kay (2012) and

Lei concluded that time needed to be given so that the necessary shifts that teachers needed to go through could occur.

Bebell and Kay (2010) noted that the teachers who were part of the one-to-one laptop program increased their technical skills with the laptop. Demeski (2009) extended this observation by noting that as the teachers became more comfortable with the devices they started to use the Internet to find and develop content. As teachers turned to the Internet for curriculum, they started to use their textbooks less. Demski noted that by using the Internet for curriculum, the teachers could find content to fit the individual needs of the curriculum rather than a textbook that covered most of the curriculum needs. Demski observed that by using the Internet, teachers began to create their own curriculum content. Through the one-to-one learning environment, teachers became comfortable with the laptops and felt comfortable exploring the Internet for material. Lei (2010) observed that as the technical skills of the teachers increased, they no longer needed technical support for simple troubleshooting tasks; instead they had more advanced technical questions and needs. This shift in the use of technical support showed growth in the types of ways that the teachers were incorporating the one-to-one devices in their daily teaching.

These increased technical skills with the one-to-one laptops did not happen immediately after implementation of a one-to-one program. Bebell and Kay (2012) observed that it could take multiple years after implementation for teachers to fully adjust to teaching with one-to-one laptops. Swallow (2015) found that in the second year of implementation of a one-to-one device program data showed that although teachers

thought they were fostering student creativity and involvement the student data did not support this. Lei (2010) concluded in a longitudinal four-year study that four years after the implementation of a one-to-one laptop program was when teachers began to perceive the benefits of the program.

Just because one-to-one devices were added to the learning environment does not mean that there would be a fundamental shift in how teachers taught. Blau, Peled, and Nusan (2014) observed teachers who were in their first year of implementing a one-to-one device program. It was observed that although the teachers had the students using their one-to-one devices it was still through whole-class instruction. If technology was included it was through what Blau et al. termed technical interactivity, which meant the teachers were using the technology and the students are observing.

If a shift in teaching was going to occur Spires et al. (2011) outlined the type of change that needed to occur, and the characteristics specific to it. According to Spires et al. a positive shift in the learning ecology of a one-to-one device learning classroom had four specific conditions for teaching and learning: access to information that is immediate and constant, the ability for learning to be personalized, intense, and relevant, students who are self-directed, self-monitoring, and are creative and curious, and lastly teachers who can facilitate, improve, consult, and mentor. Spires et al. suggested that this was a "type of ecology, which is dynamic rather than static, provides a range of learning contexts for students as technological affordances are leveraged for ongoing learning actions (p. 63). Neiss (2011) outlined five levels of developmental progression in TPACK: recognizing, accepting, adapting, exploring, and advancing. Neiss urged that

there was a need for a valid and reliable way to "identify teachers' growth and development through specific education expectations" (p. 313).

The role of the teacher shifts in a one-to-one device classroom. Mortensen (2011) observed that after the initial stages of implementing a one-to-one device program teachers could transition from being the 'sage on the stage' to a facilitator of student learning. This would be a shift away from what Blau et al. (2014) observed and more towards the higher levels of progress in TPACK that Niess (2011) outlined as well as the shift in the learning ecology that, Spires et al. (2011) outlined. Lee, Spires, Wiebe, Hollebrands and Young (2015) observed that highly effective teachers moved fluidly between the five conditions for highly effective teachers: content expert, facilitator, consultant, mentor, and improvisationist. They moved through these five different roles given the specific situation they were facing in their classroom at that moment.

Donovan and Green (2010) found that there were two factors that impacted the effectiveness of a teachers' transition to teaching in a one-to-one laptop environment: readiness and preparation. This meant that if a teacher did not feel ready or prepared for the implementation of a one-to-one device program in their classroom, then there could be negative experiences for the teacher. Donovan et al. (2008) found that when teachers were not prepared for the new teaching environment, they could feel overwhelmed with discipline issues that could arise from inappropriate device use on the part of the students. More detrimental than a feeling of being overwhelmed, was when the teachers did not use the one-to-one devices in a meaningful way. Weston and Bain (2010) suggested after observing classrooms with one-to-one device programs, that there needed

to be more of a focus on how the devices were being used in the classroom and determine not just if it was being used, but what specific types of activities were students engaged in.

Spires et al. (2011) noted that the pedagogy of the teacher was one of the most critical elements to the successful implementation of a one-to-one program. So, through a one-to-one device program, it was intended that the instructional methods of the teachers would either shift to match the desired pedagogy, or they were already aligned prior to the implementation. Donovan and Green (2008) noted that teachers believed that one-to-one device programs allowed for more enriching instruction and differentiation within the classroom. One of the key pedagogical shifts that teachers needed to make was from teachers and givers of knowledge to learning facilitators, coaches, mentors, and consultants. In their multi-year observation of teachers in a one-to-one laptop environment, Lowther et al. (2012) determined that 75.5% of them made the shift from teacher to learning facilitator. Spires et al. also observed the same shift of teachers to learning facilitators. Through interviews with teachers who were part of a one-to-one laptop program, Maninger and Holden (2009) heard teachers say that in their shift from teachers to learning facilitators they felt freed from being content experts.

When teachers participated in a one-to-one laptop program, their technical skills with laptops increased over time. Also, one of the keys to a successful implementation was for teachers to have pedagogical strategies that supported the integration of the one-to-one devices into their daily teaching. One of the most essential pedagogical shifts that teachers could make that allowed for the successful implementation of the devices was to

shift their role in the classroom from the teacher, or giver of knowledge, to a facilitator of learning. This shift in pedagogical view and increase in technical skills did not happen immediately after implementation; it took time.

Summary

The major themes of the literature review show that the pedagogical knowledge of teachers, the ways that professional development is offered, the topics of professional development, and the leadership of the initiative are essential elements to the overall effectiveness of the implementation of one-to-one laptops into the classroom. The ways that the devices are utilized can impact the program as well. One-to-one devices can improve student engagement in the classroom, and some studies have indicated that they can improve standardized test scores. With the shift to including one-to-one devices into the classroom, also comes a shift in how teachers teach. This shift needs to be supported through training on pedagogical styles that support one-to-one device inclusion, as well as time to do the work necessary to ensure the program is successful.

The current research outlined what needs to be in place in order to implement a one-to-one laptop program. The current research also can recommend best practices for the initial years after implementation. What the current research does not provide is a discussion on how to support a one-to-one laptop program multiple years and even a decade into the implementation. The current research also does not provide a dialogue on the impacts to students and schools when a one-to-one laptop program has been implemented after the initial stages. The present research study could fill this gap in the

research by providing answers from teachers who have been working with students in a one-to-one laptop classroom for an extended period of time.

Chapter 3: Research Method

Introduction

The primary purpose of this research was to determine (a) what teachers who taught both before and after the implementation of the large-scale long-term one-to-one laptop program believed were its benefits and challenges for both them and their students, (b) the shifts that they have made to their teaching, and (c) how teachers adopted and adapted to technologies in general. This chapter is divided into four main sections: research design and rational, the role of the researcher, methodology, and issues of trustworthiness.

Research Design and Rationale

This case study was designed to address the gap in the literature focusing on the believed challenges and benefits of teachers who have been part of the implementation of long-term one-to-one laptop programs. The specific research questions for this study were:

RQ1: What teaching advantages do veteran and established teachers believe exist when teaching with one-to-one laptops?

RQ2: What teaching challenges do veteran and established teachers believe exist when teaching with one-to-one laptops?

RQ3: What benefits do veteran and established teachers believe that their students gain from learning in a one-to-one laptop environment?

RQ4: What challenges do veteran and established teachers believe that their students have from learning in a one-to-one laptop environment?

RQ5: What benefits and challenges can be observed in the classroom setting of veteran teachers integrating one-to-one laptops into their teaching.

RQ6: What benefits and challenges can be observed in the classroom setting of established teachers integrating one-to-one laptops into their teaching?

My central concern when designing the six research questions was getting at the challenges and benefits that teachers believe both they and the students face in the one-to-one laptop program. In her study of the MLTI program, Fairman (2004) stated that early findings showed that there could be potential for change in the role of the teacher and student in the classroom with the introduction of the one-to-one devices in the classroom. Fairman conducted this research after the MLTI program had been implemented for a few years. The difference that my study had with other one-to-one laptop studies was that it was conducted after the program had been in statewide operation for over a decade. The teachers who participated in the study have had opportunities to attend training at the local and state levels on how to implement one-to-one laptops into the classroom setting, and have been able to adapt their implementation strategies over many years. My goal was to have a conversation with teachers that allowed them to reflect on how they have adopted and adapted to technologies in general.

To select the best qualitative research approach for my study I looked at the five qualitative research approaches as outlined by Creswell (2007): narrative, phenomenology, grounded theory, ethnography, and case study. In narrative research the primary focus is on one individual. Narrative research is best to answer questions related to the story of the experience of an individual (Creswell, 2007). Phenomenology focuses

primarily on building an understanding of participant experiences, and is used mostly to answer questions regarding a lived phenomenon (Creswell, 2007). Grounded theory research studies are used to develop a theory that is supported through data that is gathered in the field, and are typically used to create theory from the participant views (Creswell, 2007). Of these first three types of qualitative research approaches described by Creswell, I determined that none were a good fit for my research questions because my goal was not to tell the story of an individual teacher and his or her journey with one-to-one laptops, to build an understanding of a lived phenomena, or to develop theory from participant views.

The final two approaches that Creswell (2007) described were better fits for my research questions. In ethnographic studies, researchers focus on a culture-sharing group and then describe and interpret the elements that the group shares (Creswell, 2007). The fifth and final qualitative approach that Creswell described is a case study. The primary focus of a case study is to develop "an in-depth description and analysis of a case or multiple case" (Creswell, 2007, p. 78). In both ethnographic and case studies there is a description of a phenomena, but the key difference is that ethnographic studies investigate the phenomena whereas a case study analyzes and explores the phenomena. An ethnographic study ultimately shows how the culture-sharing group functions, whereas a case study serves as an in-depth analysis of one or more cases (Creswell, 2007). Since the research questions were not aimed at understanding how veteran and established teachers work within a long-term one-to-one laptop program, an ethnographic study was not the best fit.

I designed the research questions in this study to understand in-depth how teachers were able to implement one-to-one laptops effectively into their classrooms, and what they understood to be the benefits and challenges of the laptop program for themselves and students. The case study approach allowed me to answer the research questions based on an in-depth analysis of the case. The case for this study was veteran and established teachers in one school district in Maine who taught grades 6-12, which were the grades that were supported through the MLTI program. Since I sought to gain knowledge about the believed challenges and benefits of a one-to-one device program, the only way to gain in-depth answers to the research questions was through in-depth interviews and classroom observations. Each participant was interviewed in a one-on-one interview, followed up by a classroom observation. The case study approach allowed for a deep analysis of the targeted type of classroom teacher.

Role of the Researcher

My role as researcher was to gather and interpret the data for this study. I interviewed and observed the participants to gather data regarding their experiences over the past decade with one-to-one devices in their classrooms. Yin (2009) noted that being able to ask the right questions, listening well, and remaining unbiased are three of the main characteristics of an effective case study researcher. In order to follow Yin's recommendation for asking the right questions, I asked each participant the same set of questions, transcribed the answers, and analyzed them using a coding strategy. In order to be a good listener, Yin (2009) urged that the researcher must let go of his or her own thoughts and ideas on the topic being explored. This means that during the interviews I

made sure to ask each participant the same questions and follow-up questions if there was confusion with a response or if the response did not answer the question directly.

Lastly, Yin (2009) suggested that in order to be unbiased from preconceived notions, the researcher needs to be mindful of information that contradicts itself. This means that I designed the interview questions to allow participants to respond in either a positive or negative way. That is, the questions were not designed for a specific type of response. The last role of the researcher that Yin (2009) outlined, being unbiased from preconceived notions, was a challenge given my background prior to conducting this research. I was an established classroom teacher who taught with one-to-one devices and have been doing so my entire teaching career. This means that I had gathered my own observations of the successes and challenges from working in a one-to-one laptop classroom. I was aware of how my personal experiences could lead to a bias during the study, but as Maxwell (2013) has noted, "It is impossible to deal with these issues by eliminating the researcher's theories, beliefs, and perceptual lens" (p. 124). This unique perspective allowed me to have more in-depth conversations with the participants since I was familiar with how the large-scale implementations of the one-to-one devices have taken place. In order to reduce potential bias, all interviews were recorded and transcribed. Additionally, each participant was asked the same series of questions. By asking the same questions in the same order, I was able to bracket my background in the field and keep from steering the interview in a potentially biased direction. Lastly, the interviews with the veteran teachers were triangulated with the interviews with the established teachers as well as classroom observations.

I received authorization from the school district to conduct the study, and no participants were contacted prior to this authorization. None of the participants were from the school that I work in, but they were from within the same school district. Since I was not in a supervisory position, there was no concern for power relationship bias. An Institutional Review Board (IRB) application was filed for this case study and approved by Walden University, approval #08-13-15-0053234.

All teachers within the school district were contacted via email to ask if they were interested in participating. When a significant number of people did not respond to the first email, I individually contacted teachers within the targeted school district who potentially met the participation criteria. Those who were interested replied to the email. I then sent a second email to those interested in participating that included a link to a short survey to ensure that they met the research criteria. The criteria for participation are explained in more depth in the methodology section of this chapter.

Methodology

Participation Selection Logic

The population of participants was classroom teachers who have participated in the one-to-one device program MLTI in western Maine. The veteran teacher participants were classroom teachers who taught in the classroom before and after the implementation of the one-to-one laptop program. The established teacher participants were classroom teachers who had taught only in a one-to-one laptop setting for at least 5 years.

The one large case for this study was teachers who taught within the MLTI one-to-one device program. This one large case could be further divided into two sub-cases.

One sub-case for this study was the four veteran teachers; the second sub-case was the four established teachers. For this study, a case was defined as a group of teachers from the same school district or area of the state that met a set of criteria associated with the number of years that they had been teaching, when in their career they began to teach with one-to-one devices, and if they were part of the MLTI program.

Patton (2002) claimed that the "the purpose of sampling is to select information-rich cases whose study will illuminate the questions under study" (p. 46). The goal of sampling is to yield saturation. With qualitative data, saturation "often signal[s] completion of the study when there is a judgment of diminishing returns and little need for more sampling. This is the point where new data and their sorting only confirm the categories, themes, and conclusions already reached" (Suter, 2011, p. 350). By interviewing at least four of each type of teacher, my goal was for saturation to occur so that themes, trends, and patterns could be established and replicated. Also, since this was a case study using an in-depth interview and a classroom observation for each of the eight participants, it was not possible with the time and resources available to have more participants.

Each veteran teacher was selected based on the criteria that they had taught in a classroom before and after the implementation of the one-to-one laptop program. Each established teachers was selected based on the criteria that they had been teaching for at least 5 years only in a one-to-one laptop classroom. All interested participants took a survey to determine if they met the criteria of the study for either a veteran or established

teacher. See Appendix A for the survey and Appendix B for the participation criteria survey.

In order to recruit participants for the study, I sent an email through the school district email system that outlined the study and the need for participants (see Appendix A. The email included the criteria for participation in the study, a brief overview of the goals of the study, and an estimated time commitment for participation. The survey was created on Google Drive and shared with the participants via a link in the email. The goal of the survey was to determine if the person met the criteria to participate in the study.

Instrumentation

The instrumentation for this case study was a survey filled out by each participant to determine if they met the criteria for participation in the study, one in-depth interview, and a one hour classroom observation of each participant. I designed the questions for the interview, and the interview protocol was followed for each interview, and all interviews were audio taped. See appendix C for the interview questions, and appendix D for the interview protocol.

The interview questions and protocol were researcher-developed instruments; to ensure that they collected sufficient data to answer the research questions. For each set of questions, possible follow-up questions as well as probes had been developed to ensure the depth of responses from the participants. Also, all questions had been designed to be open-ended type responses to ensure that in-depth responses are gathered and not simple yes or no answers. By having follow-up questions and probes along with the interview

questions, this ensured that each question gathered an in-depth response to answer the six research questions. Since these interview questions were designed specifically for this research study and the focus of the research questions, it was not possible to determine the validity and reliability of research questions or the protocol.

In order to allow for triangulation of data, three sets of data were utilized. The first data points were the veteran teachers, the second data points were the established teachers, and the third data point were the classroom observations. Through the interview questions and the classroom observation there was a sufficient amount of data collected in order to be able to answer the research questions. The interview questions were designed to address each of the research questions individually; the classroom observations were to support what teachers spoke about during the interview.

Procedures for Recruitment, Participations, and Data Collection

The participants for the case study were recruited through an invitation to participate that was sent via email to all teachers within the targeted school district. A significant number of people did not responded initially to the email that meet the participant requirements. I individually contacted teachers within the targeted school district that potentially meet the participation criteria. All participants volunteered to participate.

For each of the research questions, interview questions were asked of each participant in the case study. Each interview was audio recorded and transcribed after the interview. Each interview lasted until all questions in the interview protocol had been asked and answered in-depth by the case study participant. The case study participants

exited the study upon completion of the interview and classroom observation after an explanation of how their data would be used for the analysis portion of this study. A copy of the analysis was provided to them upon completion of the research.

The veteran and established teacher data was gathered during one interview session that was audio recorded as well as one classroom observation. I collected all of the data. The interview session did not last any longer than an hour. The interview was be audio recorded and then transcribed.

The classroom observation lasted for a one-hour class period. For each classroom observation field notes were taken. Spradley (1980) suggested in a research study the focus must first be identified for all observations. For the classroom observations the observational focus was two-fold: the function of the device, or how the students used the one-to-one devices, and the ways that students utilized the one-to-one tools for learning.

Data Analysis Plan

The data from the interviews and observations were analyzed utilizing the first cycle and second cycle coding methods as outlined by Miles, Huberman, and Saldana (2014). The codes were simply short phrases that I used to categorize and remind myself to reflect deeper on that data's meaning (Miles et al., 2014). The first cycle codes were tags that were assigned to the interview responses, or data chunks. In order to assign the first cycle code the transcribed interview responses were read through, reading all of the responses to one question. During the reading, common themes, patterns, or words were looked for. When a theme, pattern, or common word arose, a tag was created noting the code. Once all of the first cycle codes were done, I transitioned to the second cycle codes.

The second cycle coding process started with the first cycle codes being read looking for and analyzing for more global overall patterns and themes (Miles et al., 2014).

The type of codes used in the first cycle and second cycle were descriptive coding methods. The reason why they were descriptive codes had to do with the nature of the interview questions and the research questions themselves. The entire focus of the research questions was to get teachers to describe their views and practices with the implementation of one-to-one devices over the decade that they have been in place. Since the research questions were focused on descriptions, it seemed fitting that most of the first and second cycle codes focused on descriptions. If a discrepant case was discovered, it was compared through the same patterns and themes that emerge to determine how the case was different.

Issues of Trustworthiness

In order to ensure the internal validity of the case study, the data was triangulated looking at the responses from the veteran teachers, and the responses from the established teachers, and the classroom observations. Patton (2002) suggested that the goal of triangulation of data was to look closely at the information gathered through different strategies and at different times to ensure consistency. The three points of data derived at different times and through different strategies meant that triangulation was the established teacher interviews, the veteran teacher interviews, and the classroom observations. Paton (2002) stated one type of triangulation of data could be looking at the thoughts of people with different points of view to compare their view of a particular situation. Each of the participant groups had different points of view and experiences in

their classroom. One group, the veteran teachers, could compare teaching in a one-to-one laptop classroom, while the second group, the established teachers, could only refer to their time teaching in just a one-to-one laptop classroom.

To ensure transferability the participant selection was based on clearly determined criteria prior to the start of the research. This criterion was outlined separately for both the veteran and established teachers, and a survey was given to each interested participant to determine if they met the requirements to participate in the study. Each veteran teacher was selected based on the criteria that they had taught in a classroom before and after the implementation of the one-to-one laptop program. Each established teacher was selected based on the criteria that they had been teaching for at least five years only in a one-to-one laptop classroom. See appendix A for the survey and appendix B for the participation criteria survey.

To ensure dependability of the data gathered I transcribed the audio recordings for each interview within a few days of conducting the interview. To ensure accuracy of the transcriptions 10% of the transcripts were checked by an outside source. Secondly, dependability with the conclusions of the study itself was ensured through the triangulation of the data.

Confirmability, or the ability to ensure that the results of the study were from the participants and not from the researcher was important to the overall trustworthiness of the study. Since I, the sole researcher, was also an established teacher in a one-to-one MLTI classroom my experiences had shaped the design of this research study. My job as the researcher was to step back as a teacher and step in as a researcher to analyze through

an unbiased lens. Through the use of triangulation of the two sets of interview data and the classroom observations this reduced my bias and increase the cofirmability.

The external validity of this case study was limited by the sample set. Due to the nature of this study and the specific requirements of the participants, it was challenging to find participants in other school districts.

Ethical Procedures

Due to the nature of the study, the data was confidential. All confidential data for this research study was be kept electronically and backed up on an external hard drive for five years. After five years the hard drive was destroyed. The data on the hard drive was password protected and only the researcher knew the password. All participants in the case study participated voluntarily, signed an informed consent form, were debriefed about how the results of the study would be used, and were sent a copy of the report upon completion. An Institutional Review Board (IRB) application was filed for this case study and approved by Walden University, approval #08-13-15-0053234. If a participant chose to withdraw from the study early, the recruitment process would have begun again to find a replacement. Since this research study took place in my own work environment, I signed a confidentiality form with each case study participant to ensure that the contents of the interview and the identity of the participant remained confidential. The school district where the case study took place was informed about the research, and permission to conduct the research was gathered from the superintendent.

Summary

This case study focused on six research questions that were answered through interviews and classroom observations with four veteran teachers and four established teachers. Participants in the study were voluntary, and answered a series of open-ended questions that were designed around the six research questions. All interviews were audio recorded and later analyzed utilizing first and second cycle codes, looking for themes and patterns centered on the six research questions. The responses from each set of interviews were triangulated with the classroom observations.

Chapter 4: Results

Introduction

The primary purpose of this research was to determine (a) what teachers who taught both before and after the implementation of the large-scale long-term one-to-one laptop program believed were its benefits and challenges for both them and their students, (b) the shifts that they have made to their teaching, and (c) how teachers adopted and adapted to technologies in general. I designed the six research questions for this study to focus on (a) perceived teaching advantages and challenges with one-to-one devices for veteran and established teachers, (b) the participants' perceptions of the benefits and challenges of the students learning with one-to-one devices, and (c) the observed benefits and challenges of veteran and established teachers in a one-to-one device classroom. This chapter is divided into four main sections: setting, data collection, data analysis, and the results of the study.

Setting

The case for this research study was one school district in rural Maine that has participated in the MLTI program since it began in 2002. The participants in this study, four veteran teachers and four established teachers, were all from this one school district. The school district was comprised of three regional school districts that consolidated in 2009 to form a Regional School Union (RSU). The RSU has two high schools, two middle schools, one junior/senior high school, and four elementary schools. Each of the three school districts had implemented the MLTI program at the middle school level in 2002 prior to becoming an RSU. In 2009, MLTI offered to extend the program to the

high school level, but each school district could choose if they wanted to opt-in or not. Each of the three high schools in the RSU chose to opt into the MLTI program at different times. All of the middle, high, and junior/senior high schools in the RSU had at least one participant in the study.

Demographics

All eight of the participants in the research study met the criteria for being either a veteran or an established teacher from the same school district in rural Maine. The criteria for veteran teachers were that they had to have taught both before and after the implementation of the one-to-one laptop program. The criteria for the established teachers were that they had to have taught for at least 5 years exclusively in a one-to-one device setting.

Three of the veteran teachers were high school teachers and one was a middle school teacher. Three of the established teachers were middle school teachers and one was a high school teacher. Four of the participants were math teachers, two were social studies teachers, and two were elective teachers. The participants were from three different high schools and two different middle schools within the same school district. More specific demographic data about each participant cannot be supplied without compromising the participants' anonymity. In this small-group setting, sharing specifics such as age, gender, years teaching experience, or more specific teaching assignment would allow members of the school community to easily identify individuals, even without stating their names. No additional people who met the criteria expressed interest in participating in the study.

Because the three high schools that participated in the study were not all part of the same school district during the implementation of the MLTI program, each high school had been actively part of the MLTI program for a different number of years. Both of the middle schools involved in the research study joined the MLTI program in 2002. All of the participants have had opportunities to attend district-organized professional development on technology inclusion in the classroom, as well as state-organized professional development opportunities offered by either MLTI or other state organizations.

Data Collection

I interviewed each of the eight participants in the study using the same set of interview questions, and I observed each in their classroom for one hour. Each interview lasted a different amount of time because of the length of responses that each individual participant gave. The interviews were audio recorded and transcribed later. I took notes during the observations using the observation protocol (see appendix E).

For each participant, I conducted the interview before the classroom observation. For seven of the eight participants, the interview was conducted in their classroom, and for one participant, the interview was conducted in my classroom. All observations were conducted during the school day, and the participants were observed teaching one of their regularly scheduled classes. The interviews were audio recorded and later transcribed manually. All participants were asked the same series of questions, in the same order (see Appendix C). I took notes in the margins of the research questions, and kept track of which questions had been asked and what to ask next.

Once the interviews were conducted, I observed each participant in their classroom for one hour. The participants were encouraged not to plan anything special or different for the day of their observation. I organized the observation data by using the note taking aid and a series of six questions:

1. How is the teacher using technology in the classroom?
2. Is the utilization of TPACK by the teacher apparent with the teacher use of technology?
3. How are the students using technology?
4. Are all the students using the technology the same way?
5. Are their different types of technology tools being utilized?
6. What levels of SAMR are the students engaging in with their technology use?

During the observation, I used six questions to focus on collecting data about technology use by the teacher and by the students. The six questions were used to focus the observation and to ensure that the research questions would be answered with the data gathered through the observation. There were no variations in the data collection from what was outlined in Chapter 3, nor were their any unusual circumstances encountered during the data collection process.

Data Analysis

Once each interview was conducted, I transcribed each interview. Of the total transcribed interviews, 10% of the total recorded time was then checked by an outside source. The outside source checked each interview randomly for a total 16 minutes of recorded time.

Coding qualitative data means that the raw data needs to be moved inductively from coded units to a larger representation of the categories and themes. To do this, I read through the original transcripts and observation notes and began to pull out the answers to the specific questions that were being asked. For both the veteran and established teachers, I organized responses to each individual question asked during the interview stage together. I then repeated this organization process for the observation criteria. At the end of this process, I had each question or observation criteria and all of the responses organized for both the veteran and established teachers. These organized lists of responses represented the first cycle of coding (see Miles, Huberman, & Saldana, 2014). I then read through the first cycle of coding, looking for common themes and categories that arose. This second list of common themes and categories represented the second cycle of coding (see Miles, Huberman, & Saldana, 2014). I then compared the second cycle codes for both the interviews and the observations.

Interview Themes

Several themes emerged from the second cycle coding of the interview data about change, TPCK and SAMR utilization, teaching advantages and challenges, student benefits and challenges, and student learning. One primary topic that was brought up several times by almost all of the participants was that 2 years before the data was collected for this research study, there was a change in the device that the students were issued by MLTI. From the beginning of the MLTI program, the students and teachers had always been issued an Apple laptop. Two years before I gathered the data for this study, each school district was given the option of choosing from four different device

options. Two of the options were laptops, and the other two were tablets. This meant that all of the participants in the MLTI program no longer were using the same device or platform. The school district that participated in this research study opted for the tablet solution that included one iPad for each student and a MacBook Air and iPad mini for each teacher. Although all classrooms were still one-to-one, the change from laptop to tablet required a shift in how both the teachers and students interacted with the device. And required them to learn how to use this different device.

Change. When asked how their inclusion of technology has changed over time, the established teachers spoke about the concept of *more*. There are more tools to select from, and more work was done digitally. Conversely, the veteran teachers discussed the specifics of what had changed in their teaching. The veteran teachers discussed how their specific assignments and overall workflow of their classes have changed, as well as the overall workflow of their classes. The veteran teachers also spoke more about the change from the laptop device to the iPad tablet device. One veteran teacher discussed the difference between the laptop and the iPad device for the students, noting that "it is a matter of adapting to the technology that we have, it's not that it is good or bad, it is just used differently." All of the teachers who participated in the study—both the veteran and established teachers—said that the transition to teaching with one-to-one devices was an easy one.

TPCK and SAMR utilization. When asked about the two theories that ground the MLTI program, TPCK and SAMR, three out of four of the established teachers were not familiar with them, while one out of four of the veteran teachers were familiar enough

to answer the follow-up questions about TPCK and SAMR. One of the veteran teachers had a strong opinion that TPCK and SAMR models of technology inclusion were "wildly overrated" and went onto explain, "I don't consider them even a thing, because they are a natural expression of good teaching."

Teaching advantages and challenges. For the veteran teachers, equity was a theme that emerged from the responses about the teaching advantages. The theme of equity included that all students have equal access to a device and thus to information. One veteran teacher summarized the value of equity when answering the question about teaching advantages associated with one-to-one devices by saying "equity is a gigantic one. When every kid has a laptop and every kid has access to the Internet it levels that playing field. I think that is highly significant and has been a great success."

For both the veteran and established teachers, the theme of engagement also came up during their response to teaching advantages. Both groups of teachers felt as though their students were more engaged. One veteran teacher stated that "it [the one-to-one devices] really engages kids that might not otherwise been engaged."

On the topic of teaching challenges the veteran and established teachers spoke about different challenges. The established teachers discussed that time, technology glitches, and not all students taking their devices home were challenges for them. One established teacher summarized the glitches by saying "technology it's not always seamless. There can be glitches all the time." Later after going into depth about one recent experience troubleshooting a technical glitch this same established teacher stated, "sometimes that can be frustrating, but the benefits I feel far outweigh the obstacles." As

for the challenge of time an established teacher state “the challenges for me are time to prepare with the technology.” This established teacher went onto discuss that implementing a technology system that you utilize everyday with students and teach them how to utilize this system all year long could be time consuming. They went onto summarize that once this large-scale system was in place though, and the initially time was invested, the entire system would most likely save the teacher and students time. Lastly, an established teacher stated “I do find that when kids aren’t allowed to bring their laptops home, or the parents don’t want them at home, or they don’t have Internet then it does more things more difficult.”

The veteran teachers discussed the misuse of the technology by the students with the current device, the iPad versus the laptop as teaching challenges. One veteran teacher on the topic of the iPad versus the laptop stated that their “biggest current challenge is the nature of the current device.” This veteran teacher went on to say that they have more students who hand write assignments because of the technical challenges of typing and with turning in work with the iPad. Also the nature of the device tends to lead to more off task behaviors with students.

One topic that both the veteran and established teachers echoed was the power of distraction that the one-to-one devices, no matter if they were laptops or iPads, could have with students. One veteran teacher summarized this sentiment when they said that “getting them to access the thing that you want them to access right now instead of all of the other shiny objects that they would really like to be accessing.”

Student benefits and challenges. Both the veteran and established teachers discussed that two of the benefits for students who learn in an environment with one-to-one devices was access and creation. For the participants in this study access meant access to more materials and knowledge through the use of the one-to-one devices. The participants discussed that the students had access to not only the teacher in their classroom, but they also had access to the entire Internet that was full of people teaching and explaining concepts. One established teacher explained on the topic of student access that "they're not restricted to just my teaching and just my teaching alone, because not all students learn well from my style of teaching, so it gives them another style, or more styles, and more perspectives." Both groups of teachers also discussed how the students had greater access to a variety of final products that they could create to demonstrate their understanding of a topic for a standard.

On the topic of student challenges both the veteran and established teachers discussed how the one-to-one device could be a distraction for the students. Both groups of teachers discussed how each student needed to learn to manage what they wanted to do versus what they had to do. One established teacher described on the topic of distraction, she said "I think it gives them access to more of everything, not just more of what we want them to access." Another topic that both the veteran and established teachers discussed was the responsibility of the device. Not all students were good caretakers for their device, which lead to it being broken, not charged, or not brought to school. Along with caretaking the teachers also discussed the challenge that not all students could take their device home, either by choice or because of discipline, and not all students had

Internet access at home. This lack of being able to take the device home hindered the student's ability to get work accomplished outside of the school day.

Student learning. The last question that all of the participants were asked in the interview was about student learning. All of the participants, both the veteran and established teachers felt that the students learned more with the one-to-one devices than without. One established teacher elaborated on this by saying that "because they" [the students] are able to access anything that they need to "whether it is a lesson that I have taught and recorded and they can watch, or they are looking up other sources to teach that same thing weather it is through Khan academy or Learn Zillion, or YouTube."

At the end of the interview one veteran teacher said, "as far as the technology I would hate to go back. I can't even imagine. I can't imagine." This was after reflecting on the challenges including distraction by the students, glitches with the technology, and dealing with the challenge of shifting the type of device.

Observation Themes

After all of the classroom observations were completed I looked for common themes by reading through the all of the observations. Once the first cycle of common themes was extracted these themes were then further sifted in a second cycle of coding. Several themes emerged from the second cycle coding of the observation data about teacher technology use, TPCK and SAMR implementation, and student technology use.

Teacher technology use. There were a variety of ways that the teachers were directly observed using technology in their classroom. The most common way teachers utilized their teaching technology during the observations was through the use of the

projector and possibly with an Apple TV. Both the veteran and established teachers were observed using their laptop connected to a projector, either by a cord or through an Apple TV to share their screen with students. One veteran teacher and two established teachers were observed using their teacher device with the use of a projector, or a projector with an Apple TV to share their screen in some way during the one-hour observation. Both groups were also observed using their laptop to take attendance at the start of class.

Beyond the use of a projector and taking attendance the ways that the teachers used technology varied. One of the veteran teachers had created a Wiki page with a QR code that the students were using on the day of the observation. One veteran and one established teacher were not observed using any technology on the day of the observation, but through the student activities it was apparent that they had both used technology to set up the activities that happened in the classroom. One established teacher was observed using a document camera to share answers to homework questions at the start of class. None of the teachers were observed using their MLTI issued iPad mini.

TPCK and SAMR implementation. In almost all of the observations the utilization of TPCK was apparent. Although not all of the classrooms incorporated technology use on the day of the observation, it was still clear that the lessons had be developed in a way to think about technology, pedagogy, and content and how all three of these areas combine to make one effective learning experience. One classroom had only the teacher using technology by projecting a decision-making matrix. Some classrooms had both the teacher and the students using technology such as the classroom

where the students participated in a Kahoot activity. Lastly, some classrooms had only the students using technology, such as the classroom where the students were using a program to get immediate feedback on their in-class practice work. In all three of these different technology use arrangements the teacher had made a clear decision prior to starting their lesson how, if, and when technology was going to be integrated to best support learning. Although both the veteran and established teachers admitted to not really knowing about TPCK during the interview portion of the study, the way they planned the inclusion of technology demonstrated their understanding of the various ways technology can be included and how it can be more appropriately incorporated.

The one classroom where a plan for technology use was not apparent was in an established teacher's classroom. At the very end of class the students reviewed a list of tasks on a website they had done in order to prepare for an upcoming assessment. In all of the other classrooms the use of technology by both the students and the teachers seemed planned, organized, and thought out with a specific purpose in mind to enhance the student experience that day.

The established teachers were split in their level of rigor when it came to the students' use of technology and the SAMR scale. Two of the established teachers observed had students engaged in substitution or augmentation types of technology actives, while two of the established teachers had students engaged in modification or redefinition types of technology activities. One of the veteran teachers was observed having the students engaged in the substitution or augmentation types of technology activities, while three of the veteran teachers had their students engaged at the

modification or redefinition level. Combined this means that three teachers were observed having the students engaged at the substitution or augmentation level, while five teachers were observed at the modification or redefinition level. Of those five teachers having their students engaged at the modification or redefinition level three were having their students use a website that gave them immediate feedback on their response to practice questions, one was having the students create and edit movies, and the last teacher was having their students research current events while having a class conversation.

Student technology use. In all but one of the classrooms observed students were using their iPads for the majority of class in a variety of ways. In half of the classrooms on the day of the observation students were using their iPad to connect to the Internet to access a tool that would give them immediate feedback on their answer to a question as well as provide a report to the teacher on each individual student and their progress. In two veteran teachers classrooms the students were using their iPad to connect to the Internet to conduct research. In one veteran teachers classroom the students were using their iPads along with laptop computers to create original videos. Lastly, in one of the established teachers classrooms the students used their iPads to access a website that was used to create a playlist of assignments with resources. In only one classroom did the researcher observe students doing off task behavior such as social media and playing games when they were supposed to be doing a different task on their iPad.

In 7 out of the 8 of the classrooms observed all of the students were doing the same types of tasks on their iPads at the same time. In one classroom, the class where

students were creating original videos, the student doing different tasks on their iPads. This variation in what the students were doing on the iPads in this one classroom was due to the fact that students were at different points in the video production process.

Evidence of Trustworthiness

To ensure the credibility of the research conducted for this study the results from both the veteran and established teachers interviews were triangulated with the results from both the veteran and established teachers observations. By looking at how each of these sets of data, which were each gathered in different ways, common themes and patterns could arise.

To ensure transferability the participants were each selected based on if they matched a set of criteria established prior to the research being conducted. The veteran teachers who were selected for participation in the study had all taught both before and after the implementation of the MLTI program in their school. The established teachers had been teaching for at least five years, and had only ever taught in a one-to-one classroom setting. By ensuring that all of the participants met this same baseline of criteria, the results from the study could possibly be transferred to other schools that were part of the MLTI program.

To ensure dependability I followed the research plan as outlined in chapter three. The interviews were transcribed and then 10% of the transcripts were checked by an outside source. The second strategy for dependability was the triangulation of the data.

Confirmability of the results of the study was ensured by only having one person, me looking at the transcripts from the interviews and the notes from the observations to

draw conclusions from the study about. The data was triangulated to ensure that the data could be confirmed and not influenced by the opinions and views of the researcher.

Results

Research Question 1

The first research question for this study was what teaching advantages do veteran and established teachers believe exists when teaching with one-to-one laptops? This question could directly be answered through the interviews conducted with the veteran and established teachers. On the topic of advantages the veteran teachers discussed the topic of equity while the established teachers talked more about things that students could do because of the technology. Equity, in the eyes of the veteran teachers meant all students had access to a device that was loaded with the same software, and could allow them all to accomplish the same tasks. One veteran teacher summarized this advantage of equity as "when every kid has a laptop and every kid has access to the Internet it levels that playing field. I think that is highly significant and has been a great success."

In the area of advantages the established teachers talked about all of the tasks that students could do because of the one-to-one device. Some of those tasks were that they could access assignments online, materials online, instant feedback, more easily communicate between teacher and student, allow for easy differentiation of teaching, as well as access a variety of people teaching on a particular topic. One established teacher summarized this idea of more varied tasks that students could do by saying "assignments can be broadened because it isn't just what comes out of your mouth." The varieties of student tasks were also observed during the classroom observation phase of the research

study. The established teachers were observed having the students use their devices to use the Internet for research, practice problems, receive instant feedback, as well as use a teacher created list to review for an assessment. The veteran teachers were observed having the students use their devices for viewing and creating video projects, research on the Internet, as well as receive immediate feedback on practice problems. Both the veteran and established teachers were having the students use their devices for Internet research and doing practice problems with a website that allowed the student to receive immediate feedback.

Both the veteran and established teachers touched on the idea that one of the advantages of the one-to-one device program was that students were more engaged. This advantage was observed in the classroom where most of the students were engaged and remained on-task with their one-to-one device to accomplish the assignment that the teacher had given. In conclusion on the question about teaching advantages one established teacher said, "sometimes it can be frustrating, but the benefits I feel far outweigh the obstacles."

Research Question 2

The second research question for this study was what teaching challenges do veteran and established teachers believe exists when teaching with one-to-one laptops? The veteran and established teachers did not respond to this question in overlapping themes. The established teachers discussed time, glitches, and not all students being able to take their device home. The veteran teachers discussed the current device and the misuse of the device.

The established teachers outlined three main challenges that they faced with the one-to-one devices: time, technology glitches, and not all students being able to take their devices home. For the established teachers they felt as though they did not have enough time to look through the ever-growing resources so they could then prepare or create lessons for students. One established teacher stated, "the challenges for me are time to prepare with the technology."

The established teachers also discussed that technical glitches arose on a regular basis when they are using the one-to-one devices with students and that they needed to figure out how to trouble-shoot these technical glitches on the spot. One established teacher summarized the challenges with glitches when they said, "technology it's not always seamless. There can be glitches all the time." One of the established teachers summarized the glitches challenges, as "it's just that sometimes you have to jump through a lot of hoops to get to what you want. Sometimes you can't always predict how that is going to go." The technical glitches were also directly observed in the classroom with one veteran teacher who had to adapt their entire lesson for the day due to an online tool being offline for the day that the students were going to access for the majority of the lesson.

The third major challenge that the established teachers discussed was that not all students could take their devices home. They couldn't take them home either for discipline reasons, or because their family chose for the student not to take it home, or because the family cannot afford to pay the free to be able for the device to go home. Because not all devices could go home this meant that teachers had to make alternate

plans for those students so they could do their work outside of class. One established teacher described the additional work as "I have to go out and make copies, I have to do this, I have to do that. And try to get all the information for them that everyone has right on their iPad."

The veteran teachers talked about the distraction and misuse of the device, as well as the current device as their biggest challenges with the one-to-one program. "Getting them to access the thing that you want them to access right now instead of all of the other shiny objects that they would really like to be accessing instead" was how one veteran teacher described the challenge of in class distraction and misuse of the one-to-one devices. The power of distraction on the part of the students was observed in one veteran teacher's classroom. The students were having a whole class conversation guided by the teacher, but some students were playing games on their iPads and were thus not directly involved in the class conversation. The teacher acknowledged the students who were off task and tried to refocus their attention on the class conversation.

The second challenge that the veteran teachers discussed in depth was the challenge of the current device. There was a shift three years ago from the one-to-one device being a laptop to it now being an iPad. The veteran teachers discussed how the iPad was not really designed to do in-depth documents that are required at the high school level, the perception by the students that the iPad was a toy and not a productivity tool, and lastly the challenge in the workflow with the iPad versus the laptop. One veteran teacher summarized this lack of robust student work with the iPad when they said, "there were lots of really awesome lessons that I would do. Kids would take stuff,

and they would split stuff apart, and they would put it together. And then when they introduced the iPad you couldn't do it anymore. It was completely busted. So it was frustrating design materials that you know that are really engaging, and are really good, and have lots of success, then have something come in and blow it up." The fact that the one-to-one device was now an iPad meant that this veteran teacher could not use the same engaging and rigorous teaching lessons as they once had with the laptop.

Research Question 3

The third research question for this study was what benefits do veteran and established teachers believe their students gain from learning in a one-to-one laptop environment? Both the veteran and established teachers discussed that students had access to more information with the one-to-one devices than they do without them. This was observed in both the veteran and established teacher classrooms when students used their devices to conduct research on the Internet. One veteran teacher even conducted a current events conversation that was enhanced by the students using the Internet to read current online newspapers while the conversation was taking place.

Both groups of teachers also discussed the enhanced variety in ways and products that students could create in order to demonstrate their new learning on a given topic. The variety of student projects was observed in one veteran teacher's classroom where the students were creating videos to demonstrate their understanding to cinematographic techniques. This was echoed again in an established teacher's classroom by having the students demonstrate their cumulative knowledge on a given topic through the use of game style immediate response system Kahoot.

The veteran teachers also discussed the opportunity for collaboration that the devices allowed for. Collaboration was observed in the veteran teacher's classroom when students were working together to create one final group video product.

The established teachers touched upon the fact that the students were not only learning the content that the teacher was teaching, but also how to use technology. This could be observed in all of the classrooms with the general technical ease that the students were able to accomplish all of the educational tasks that the teachers asked them to complete with the use of their one-to-one device. While some students were observed being challenged with the task the teacher asked them to complete academically, no students were observed struggling with getting their device to technically complete the task that was asked of them.

Research Question 4

The fourth research question for this study was what challenges do veteran and established teachers believe their students have from learning in a one-to-one laptop environment? Both the veteran and established teachers resoundingly discussed the perceived challenge for the student was to learn how to manage the potential impulse for distraction that the one-to-one device brings. The students needed to learn to manage a balance between what they needed to do with the device versus what they may wanted to do with the device. One established teacher summarized this struggle as "I think it gives them access to more of everything, not just more of what we want them to access." This balance to manage impulses was observed in one veteran teacher's classroom where students were using their device for off task behavior during a whole class conversation.

Both the veteran and established teachers also discussed another student challenge that not all of the students are good caretakers of their device. The students did not always take on the responsibility of charging the device, remembering to bring it to school, as well as sometimes they broke the device. Poorly cared for devices were not directly observed in any of the classrooms during the observation portion of this research study. There were however many high school students who had brought in their own device, typically laptops, to complete the assignments that the teacher had assigned. This use of a non-MLTI device may have been due to a poorly cared for MLTI device, or it could have been because the laptop was a better suited tool to complete the task than the MLTI issued iPad.

The veteran teachers also touched upon the challenges that a student could have if they are not able to bring their devices home, or they do not have access to the Internet at home. When a student could not take their device home, or they did not have access to the Internet this meant that staying on top of their schoolwork could be a challenge, and they needed to work with their teachers to ensure that they had the materials in a non-digital format to be able to get their work done.

Research Questions 5 and 6

The fifth research question for this study was what benefits and challenges can be observed in the classroom setting of veteran teachers integrating one-to-one laptops into their teaching? The sixth research question for this study was what benefits and challenges can be observed in the classroom setting of established teachers integrating one-to-one laptops into their teaching? The challenges of technical glitches, and off task

behaviors were all observed during the observation phase of the research study. The technical glitches were most dramatically observed in one veteran teacher's classroom when her entire plan for one class needed to change moments before the start of class because delay in updating a website database and the fact that the students could not interact with the updated material until the following day. This glitch meant that the teacher needed to make adjustments to the day's lesson moments before the students came into class. The challenges of off-task behavior were also observed in one classroom where students were playing games on their device when they should have been actively involved in a whole class conversation giving a critique to a group project.

The benefits of engagement, equity, and access to online materials, assignments and information, as well as instant feedback on student answers were all observed in both the veteran and established teachers classrooms. The benefits of instant feedback were observed in one veteran and two established teacher's classrooms. Students were observed practicing a problem, entering their answer on a website with their iPad, and then receiving instant feedback if their answer was correct or not. The benefit of access and engagement were highlighted in one veteran teacher's classroom where students were having a conversation about current events while researching and reading current events online. The conversation was dynamic to what the students' were reading as well as their interests. All the students in this class were observed actively sharing, researching, and questioning throughout the hour-long observation.

In all of the classrooms that were observed the students were engaged in the activities that they teacher had planned for them that day. The students were observed

accessing online materials and assignments. They were also observed using a variety of tools that gave both the student and the teacher instant feedback on the students' answers to questions. The advantages of equity as discussed by the veteran teachers were also observed. All of the students in each class observed had access to the same iPad device loaded with the same software and access to the Internet. This allowed all of the students to accomplish the same tasks required of the teacher that day. Some high school students were observed with their own personal laptops as well, but they were still able to complete the assignments required by the teacher.

Summary

During the interview portion of this research study the veteran and established teachers sometimes had an overlap in their responses to the interview questions, and other times they did not have answers that overlapped. For research question one and two the topics that the veteran teachers brought up did not overlap with the established teachers. For the rest of the four research questions aspects of the answers between these two groups did and did not overlap.

For research question one the veteran teachers discussed the topic of equity while the established teachers talked more about things that students could do because of the technology. Equity, in the eyes of the veteran teachers meant all students had access to a device that was loaded with the same tools, and could allow them all to accomplish the same tasks.

For research question two the veteran and establish teacher again did not overlap in their answers about teaching challenges. The veteran and established teachers did not

respond to this question in overlapping themes. The established teachers discussed time, glitches, and not all students being able to take their device home. The veteran teachers discussed the current device and the misuse of the device.

For research question three both the veteran and established teachers discussed student benefits as access to information and materials, as well as variety in the type of work that students can do. The established teachers also touched upon the fact that students were learning how to use technology as a benefit while the veteran teachers discussed the ability for collaboration to take place as a benefit.

With research question four about student challenges both groups of teachers discussed the challenge for students to learn how to manage the impulse for distraction that the one-to-one device has while they are doing classwork. The veteran teachers also discussed the challenge of the students not being able to take the device home or not have access to the Internet at home.

For research questions five and six the challenges of technical glitches, and off task behaviors were all observed during the observation phase of the research study. The benefits of engagement, equity, and access to online materials, assignments and information, as well as instant feedback on student answers were all observed in both the veteran and established teachers classrooms.

Chapter five will conclude this research dissertation by interpreting the findings, discus the limitations and implications of the study, provide recommendations for future research, as well as discuss the implications for social change.

Chapter 5: Discussion, Conclusions, and Recommendation

Introduction

The primary purpose of this research was to determine what teachers who taught both before and after the implementation of the large-scale long-term one-to-one laptop program believed were the benefits and challenges for their students, the shifts that they had to make to their teaching, and how the teachers adopted and adapted to technologies in general. The key findings of this research show that students who learn in a one-to-one device setting are more engaged, have access to more information, can work collaboratively, and can create a larger variety of products to demonstrate new learning, all while trying to manage the impulse of off task behavior and not always being good care takers of their device.

Interpretation of Findings

Research Question 1

Research Question 1 focused on the perceived teaching advantages of the one-to-one device program. The veteran and established teachers reported that teaching advantages included equity for the students, increased variety in the types of products that the students could create, and engagement on the part of the student. Lin (2012) concluded that students who were in a one-to-one device learning environment were more engaged in group work, which resulted in more effective groups than student groups that had only one device per group. In his meta-analysis, Fleisher (2012) also suggested that students might be more engaged in classrooms that have one-to-one devices because the work shifts to be more learner-centered.

Research Question 2

Research Question 2 focused on teaching challenges. One often-documented challenge in the current research on one-to-one device programs is buy-in from teachers and the necessary shift in their pedagogical views. Spires et al. (2011) suggested that the most critical element in the successful implementation of a one-to-one program was the pedagogical view of the teacher. Bebell and Kay (2010) found that the attitudes and beliefs of the teachers are critical elements in the success of t a one-to-one program. Shapley, Sheehan, Maloney, and Caranikas-Walker (2010) concluded that without teacher buy-in or support, a one-to-one program will not be successful. During my interviews with the teachers, the language and attitudes that the teachers had about the one-to-one deices were positive. It can be generally concluded that they felt as though the devices were a positive addition to the classroom. All of the teachers had embraced the inclusion of the one-to-one devices, and several of the participants said at the conclusion of their interview that they could not imagine going back to teaching without the one-to-one devices. These statements and observations align with Shapley, Sheehan, Maloney, and Caranikas-Walker (2010) conclusions about buy-in, and Bebell and Kay's (2010) comments regarding attitudes and beliefs were confirmed through both my observations of and conversations with the participants.

Research Question 3

Research Question 3 addressed the perceived benefits of the one-to-one program to student engagement. Bebell and Kay (2010) concluded that student engagement improved for students who were part of one-to-one laptop programs. Findings from

Fleisher (2012) indicate that this could be because more of the student work in one-to-one learning environments tends to be more learner-centered which creates a sense of motivation and engagement for the student. The findings from Bebell and Kay (2010) and Fleisher (2012) were confirmed both through interviews with teacher participants in this study as well as through classroom observations of the researcher that students who learn in a one-to-one device setting are more engaged with the learning activities that they are participating in.

Research Question 4

Research Question 4 focused on perceived student challenges. Spires et al. (2011) found that if the laptops cannot be taken home, students may perceived this restriction as a large barrier to their ability to use the laptop. At different points in the interviews, both the veteran and established teachers discussed the challenges resultant from this barrier. The established teachers discussed how this was a challenge to them because they needed to either create an alternative assignment for the student who could not take their device home, or they needed to find an alternative time for the student to complete the work. The veteran teachers discussed the inability for a student to take a device home during the questions about student challenges.

Conceptual Framework

The conceptual framework for this research study included the SAMR model designed by Puentedura, and the TPACK model designed by Koehler and Mishra. These models are the two technology integration theoretical frameworks that MLTI uses for its state-wide one-to-one laptop integration. According to MLTI (2010), “taken together, the

two models help teachers by showing them both how to incorporate the best of their past practice into the new domain, and how to accomplish significant changes in their classroom."

During the interview portion of the study, I asked the participants how familiar they were with these two models of technology integration. Two of the veteran participants were very familiar, and two were moderately familiar—one veteran and one established teacher. Two of the participants, one veteran and one established, were not familiar at all with these two educational technology theories, and one participant was familiar with TPCK but not with SAMR. This lack of a solid understanding of either TPCK or SAMR indicates that when making decisions about how to incorporate technology into their daily teaching, the teachers, both veteran and established, may not have a pedagogically sound way to make decisions about technology inclusion. Spires et al. (2011) suggested that the most critical element in the successful implementation of a one-to-one program was the pedagogical view of the teacher. Although the teachers have a positive pedagogical view of the inclusion of one-to-one devices in their teaching, it can be concluded that the majority of teachers in this research study do not have the theoretical pedagogically knowledge about how to effectively integrate technology into their teaching.

Research Questions 5 and 6

The lack of understanding about SAMR was evident with the types of activities that I observed the students engaging in. I observed three of the eight teachers having their students engaged in the lower substitution or augmentation types of activities.

Although more teachers were observed having their students engage in technology inclusion activities in the upper half of SAMR, engagement could have been further enhanced. Indeed, Puentedura (2008) summarized that at the redefinition level of technology inclusion, students can gain two letter grades better than if they worked only at the substitution level. I observed one veteran teacher, a veteran teacher having their students engaged at the redefinition level. Lastly, I observed one established teacher integrating at the substitution level, one at the augmentation level, and two at the modification level. I observed no veteran teachers working at the substitution level, one at the augmentation level, two at the modification level, and one at the redefinition level. This indicates that the veteran teachers were observed using the technology at more rigorous levels of SAMR than the established teachers.

Limitations of the Study

One of the main limitations of this study is that I looked closely looked at only one case, a school district in rural Maine. The transferability of the conclusions of this study is limited due to the unique experiences, training, and students within this one school district. Other researchers could conduct this same study in districts in other regions throughout the state of Maine that have also participated in MLTI since its development. The results from such studies could be compared to the results of this case study to look for overlap and variance.

A second limitation of this study common to case studies is researcher bias. Yin (2009) cautioned that there could be increased levels of bias in case studies because the researcher must fully understand the issue being studied before conducting the research.

In order to be able to conduct case studies effectively, researchers need to have an in-depth understanding of the phenomena that they are studying. For this case study, I had a first-hand in-depth knowledge of the phenomena being studied because I am an established teacher. This means that I came to the study with my own feelings and opinions about one-to-one learning environments. Such in-depth understanding can lead to increased bias. Yin suggested that a researcher could avoid this bias by asking good questions and being a keen listener. This is why all interviews followed the same protocol that I outlined prior to the start of the interviews, as why I used an observation protocol. Following these protocols in the same way for each interview and observation, and then utilizing the first and second cycle coding methods helped me reduce possible researcher bias.

Recommendations

Given that Spires et al. (2011) suggested that the most critical element in the successful implementation of a one-to-one program was the pedagogical view of the teacher. From this research study it is concluded that both the veteran and established teachers positively embraced the inclusion of the one-to-one devices, yet one quarter of them understood TPCK and SAMR well, one quarter were familiar with the two technology inclusion theories, and one half of the participants were not familiar at all with the two theories. This means that the teachers think that the one-to-one devices are good for teaching but do not have a theoretical understanding of how best to include them into their daily routines.

Although teachers were observed having students engaged in activities in the classroom that involved the use of the one-to-one devices the level at which these activities were on the SAMR scale were low. Often they were substitution or augmentation. This means that the one-to-one devices are being included into the lessons, and may effectively utilize TPCK, but they are not as rigorous as they could be on the SAMR scale.

Recommendations for further researcher include providing training and support to teachers in the areas of understanding TPCK and SAMR for the selection and inclusion of technology into their teaching. This training could specifically focus on how to enhance technology activates that teachers have already implement, but increase their rigor on the SAMR scale. A research study could be designed that interviews and observes a group of teachers before and after training and support in understanding how to utilize TPCK and SMAR to make decisions about technology inclusion.

Implications

The implications for positive social change from this research study are at the organizational level, specifically the state of Maine and the MLTI program. Given the conclusions that can be made from this research and the recommendations for further research, the MLTI program is successful and has similar advantages and challenges both for teachers and students when compared with current research on the inclusion of one-to-one devices in the classroom. This implies that one-to-one devices engage students more in learning, allow for students to complete educational tasks in ways unique to having the one-to-one devices, and that overall the advantages outweigh the challenges.

Initially in chapter one the current gap in the research was outlined as a lack of understanding the benefits and challenges of teachers and students participating in a long-term on-to-one laptop program. After more than a decade of having one-to-one devices in their classrooms, the participants in this research study paralleled the same benefits and challenges for both teachers and students as other current research finds. This means that although currently research typically looked at one-to-one programs after a few years of implementation the same patterns and trends still appeared after a decade of implementation.

Conclusion

The purpose of this case study was to determine the perceived benefits and challenges of veteran and established teachers when implementing one-to-one device programs who were part of the large scale, long-term one-to-one device programs. It can be concluded that the teachers, both veteran and established embraced the inclusion of the one-to-one devices into their teaching. This can be supported through both the interviews and the classroom observations. Both the veteran and established teachers who were part of this research study were heard during in-depth conversations and were witnessed during classroom observations trying to implement the devices in the most effective and meaningful ways that they could, yet they lacked the pedagogical training and background knowledge in both SAMR and TPCK.

In order to possibly enhance the classroom experiences of students who are part of large-scale one-to-one device programs the pedagogical knowledge in the areas of technology inclusion needs to be addressed. More support and training focused in the

areas of TPCK and SAMR could enhance the teaching and learning for teachers and students in this unique state-wide one-to-one device program.

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Appendix A

Criteria For Participation Survey

Thank you for considering being part of this research study. The following survey is designed to determine if you meet the criteria for participation in the study.

Name:

Email address:

Phone number:

School district employed by:

School teaching in:

Teaching position:

Number of years teaching:

Number of years teaching with one-to-one laptops (MLTI):

Number of years teaching prior to the implementation of MLTI:

*MLTI was implemented in 7th grade in 2002, 8th grade in 2003, high school in 2009

Have all of your years of teaching been in a one-to-one classroom:

Appendix B

Recruitment Email

As part of my dissertation I am conducting a case study aimed at learning more about the believed successes and challenges of large-scale one-to-one laptops programs such as MLTI. I am in the process of gathering people who would be willing to be interviewed for the case study. The interview should not take any longer than two hours. In order to be eligible to participate in the case study you need to be teaching in a one-to-one laptop program and either have taught in that setting both before and after the implementation of the MLTI program, or have only taught in a one-to-one laptop setting. If you are interested in being part of the case study please fill out the survey through the link below to determine if you meet the participation criteria and return it to me. Please be aware that not all people who complete the survey will necessarily participate in the study. Lastly, the informed consent document is attached for you to look at so that you understand the details of the study. It is not necessary at this point in time to sign or return the informed consent document.

Link to survey: http://goo.gl/4r4NdF

Thank you,

Sarah Irish

Appendix C

Interview Questions

1) What grade/grades do you teach?

2) How long have you been teaching in the one-to-one device setting?

3) How often have you taught without one-to-one devices?

4) How has your inclusion of technology changed over the years?

5) How do you view the laptops in your classroom, are they supplemental or vital?

6) How familiar are you with TPACK and the SAMR models of technology inclusion in the classroom?

6A) If yes, then how to you use them design instruction including the use of the one-to-one laptops?

6B) At what level of SAMR do you feel that most of the activities that the students engage in are at?

If the participant is not familiar with TPACK and SAMR the research will explain to two models, omit asking question 6A and 6B, and then ask:

7) How do you determine what types of technology activities to have the students engage in?

8) How long did it take you to get used to/comfortable with teaching in a one-to-one learning environment?

9) How have the types of assignments that you create changed with the introduction of one-to-one technologies?

10) What teaching advantages do you perceive exist when teaching with one-to-one laptops?

11) What teaching challenges do you perceive exist when teaching with one-to-one devices?

12) What do you think that your students are able to do or not do with the one-to-one devices?

13) What impact do you think this has had on whether students can learn more or less with one-to-one devices? Please give examples.

14) What benefits do you perceive that their students gain from learning in a one-to-one laptop environment?

15) What challenges do you perceive that their students have from learning in a one-to-one laptop environment?

Appendix D

Interview Protocol

Date:

Participant:

Introduction:

To facilitate the note-taking process for this research study I would like to audio record our conversation today, is that all right with you? For your information only researchers such as myself, and my dissertation committee will have access to recordings from today. They will be destroyed once they are no longer needed. There is a form here for you to sign that outlines your consent to participate in the study. Please take you time to read it over and ask any questions that you have. (Collect signed consent)

The goal of today's interview is to last no more than an hour and a half. During this time I have several questions to ask you about your teaching and use of the one-to-one laptops in your classroom. The focus of this research project is teacher's perceptions of the one-to-one laptops in their classrooms after a decade of the MLTI program. Your participation is greatly appreciated.

Part 1: Participant background

What grade/grades do you teach?

How long have you been teaching in the one-to-one device setting?

Have you ever taught without one-to-one devices?

How has your inclusion of technology changed over the years?

Part 2: Knowledge and use of TPACK and SAMR

Are you familiar with TPACK and the SAMR models of technology inclusion in the classroom?

If yes, then how to you use them design instruction including the use of the one-to-one laptops?

At what level of SAMR do you feel that most of the activities that the students engage in are at?

If no, research will explain to two models and then ask:

How do you determine what types of technology activities to have the students engage in?

Part 3: Teaching benefits and challenges

How long did it take you to get used to/comfortable with teaching in a one-to-one learning environment?

How have the types of assignments that you create changed with the introduction of one-to-one technologies?

What teaching advantages do you perceive exist when teaching with one-to-one laptops?

What teaching challenges do you perceive exist when teaching with one-to-one devices?

Part 4: Student benefits and challenges

Do you think that your students are able to learn more or less with one-to-one devices? Please give examples.

What benefits do you perceive that their students gain from learning in a one-to-one laptop environment?

What challenges do you perceive that their students have from learning in a one-to-one laptop environment?

Appendix E

Observation Protocol

1. How is the teacher using technology in the classroom?
2. Is the utilization of TPACK by the teacher apparent with the teacher use of technology?
3. How are the students using technology?
4. Are all the students using the technology the same way?
5. Are their different types of technology tools being utilized?
6. What levels of SAMR are the students engaging in with their technology use?