Flying blind with badly behaving technology: A case study of integrating 1:1 computers in middle school

by

Gary Richmond

B.S., The University of Kansas, 2006
M.S., The University of Kansas, 2007

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF EDUCATION

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Abstract

Information and communication technology is becoming more affordable and available to schools. In response to the emerging need to produce students with academic skills appropriate for 21st-century learners, many schools are investing large sums of money into this technology in an effort to create learning environments where students have a 1:1 ratio with access to tools such as laptops, tablets, or other types of portable devices. While there is evidence demonstrating that 1:1 student device adoptions can influence instruction and student learning, there is an ever-present, evolving need for scholarship concerning the experiences of teachers participating in such initiatives. The premise of this study is that teachers can provide valuable understanding concerning 1:1 computer adoptions, as they are one of the primary instruments in its success.

The purpose of this study was to explore how two middle school teachers in a Midwestern city described the effects of ubiquitous computer access for students on their instructional practices and overall student learning as they participated in a district-wide 1:1 computer initiative. Participants for this qualitative case study were selected through purposeful- and criterion-based sampling. The participants were chosen from a pool of classroom teachers participating in the early phase of their district's 1:1 initiative. Additionally, the participants' eagerness to participate in the study as well as their comfort level with technology played a role in selection. Symbolic interactionism provided the lens through which to analyze the participants' meaning making and the framework of TPACK afforded the substantive lens for discussing their experiences.

Many of the individual aspects of the findings of this study are not new or particularly insightful by themselves and largely confirm existing findings in the scholarship. However, the significance of this study lies not in the corroboration of existing scholarship, but instead in

illustration of the anatomy of change. In the end, this study investigating ICT integration wasn't about technology at all. It was about the experience of transition.

This study, with rich detail and context, shows the anatomy of transition for the two participants' pedagogical practices and beliefs from the start of the process to the end. It provides insight into how things come to be and the way in which they come to be. It provides insight into how and why participants moved back and forth across the TPACK domains as they assimilated their fundamental beliefs with their lived experiences.

The outcomes of this research suggest avenues for policy makers, administrators, teachers, and professional development organizers to increase the influence of 1:1 initiatives. It is necessary for all involved stakeholders to understand the importance of professional development in affecting technology-related change and to include training in any 1:1 adoption plan. It is equally important for teachers to understand that they will need to leverage formal and informal avenues of professional development to further their professional learning. Professional development organizers need to be cognizant of the needs of the staff and provide targeted, content-specific training in a timely manner. Last, district and building leaders should be aware of their organizational culture and the underlying goals for their 1:1 initiative and keep these in mind as they lead their staff through the change process.

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Approved by:

Co-Major Professor
Dr. Kakali Bhattacharya

Approved by:

Co-Major Professor
Dr. David C. Thompson

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Dedication

This dissertation is dedicated to my wife, Amanda. You have been there from start to finish, never wavering in your support. Thank you for all the evenings where you had to entertain yourself. But, most importantly, thank you for tolerating my procrastinating with only the occasional judgement.

This scholarly work is also dedicated to my friend Derek. You are a large part of the reason I started this journey in the first place. If it wasn't for your overoptimistic encouragement I likely would have stopped with a master's degree and been done years ago. I'm sorry that you never got to see me finish.

Chapter 1 - Introduction

Information and communication technology (ICT) is becoming more affordable and available to schools (Penuel, 2006). In response to the emerging need to produce students with academic skills appropriate for 21st-century learners, many schools are investing large sums of money into this technology in an effort to create learning environments where students have a one-to-one ratio with access to tools such as laptops, tablets, or other types of portable devices (ISTE, 2016; Partnership for 21st Century Schools 2009). The prevalence of computers in the classroom is made evident in the 2010 report from the National Center for Education Statistics, which states that 99% of teachers had at least one computer in their classroom and 95% had daily access to the Internet (Gray, Thomas, & Lewis, 2010). Only seven years later access to ICT technology in schools would increase to the point that over 50% of teachers were reporting one-to-one (1:1) student device access in their classrooms (EdTech Staff, 2017).

Despite the access to at least minimal levels of ICT in most schools, research has shown that these resources are often being underutilized (Cuban, 2009; Grimes & Warschauer, 2008; Zhao & Frank, 2003). For example, only 40% of classroom teachers reported using a computer often during instruction out of the 99% that had reported daily access to the Internet (Gray et al., 2010). This lack of adoption could be due to any number of reasons. One such component possibly influencing the use of information and communication technology is the classroom teacher's awareness of how to successfully integrate it into their instruction (Moore-Hayes, 2011). Recognizing this connection, Levin and Wadmany (2006) note, "Without teachers' skilled pedagogical application of education technology, technology in and of itself cannot provide innovative school practice and educational change" (p. 158). With careful attention to the ways

information and communication technology can support content and pedagogy, teachers could be better equipped to meet the various learning needs of their students.

Given the support for the idea that teachers' awareness and pedagogical beliefs influence technology integration, there is a need to examine teachers who are in the process of attempting to adopt ICT in a meaningful way. According to Ertmer and Ottenbreit-Leftwich (2010), meaningful instruction in this context can be defined as those instructional tasks "that enable students to construct deep and connected knowledge, which can be applied to real situations" (p. 257). One way to examine how teachers are adjusting their pedagogy is through having conversations about their fears and anxieties, successes, and plans. Although research exists on effective teacher planning (Joyce & Showers, 1982; Nelson, Christopher, & Mims, 2009; Shulman, 2004), technology in the classroom (Barron, Harmes, & Kemker, 2006; Cuban, 2009; Grimes & Warschauer, 2008; Levin & Wadmany, 2006), and the educational change process (Ertmer & Ottenbreit-Leftwich, 2010; Fullan, 2001, 2007; Gardner, 2006), there is scant research that provides rich descriptions of the human element of the process of transitioning to meaningful ICT integration, especially in a 1:1 environment. Therefore, the purpose of this case study was to develop a deep understanding of the thoughts and perceptions driving the decision-making process of teachers while adjusting their practice to incorporate ICT and how their understanding, willingness to embrace change, and existing pedagogical beliefs affect this process.

Background Information

Technology has influenced the economic, social, and cultural shifts of the 21st century, and it has also begun to influence the educational system in the United States and around the globe. According to a report published by the U.S. Department of Education, of all public

schools in the fall of 2008, 97% had one or more instructional computers located in classrooms and 58% had laptops carts (Gray et al., 2010) Researchers, such as those involved with the seminal Apple Classrooms of Tomorrow, have conducted in-depth research on classroom technology integration, most significantly studying classrooms that provide one computer for each student. According to Costa (2012),

> Currently, what passes for basic skills must be redefined in the context of what is needed for successful participation in an information-saturated and hyper-adaptive digital world. Certainly, some skills are timeless in their necessity, but anyone who believes that the skills required for the 19th and 20th centuries will be adequate in 2025 or beyond needs to think carefully about what has recently unfolded in the world around us. (p. 4)

The job market, once dominated by agriculture and manufacturing sectors, has changed to require professional and technical skills due to globalization, the decrease in the number of domestic manufacturing jobs, and the increase in technology (Rotherham & Willingham, 2010).

In addition to responding to the evolving job market, continuing advancements in technology, and changing federal and state mandates have also affected education over the past several decades, causing educators to contemplate how technology can best be used to influence the teaching and learning environment (ISTE, 2016). Technology integration in education is also increasing due to growing student disengagement and declining student achievement scores. However, Prensky (2010) specifies that the issue of student disengagement isn't simply a refusal to learn: "There is a huge paradox for educators: the place where the biggest educational changes have come is not our schools; it is everywhere else. The same young people we see bored and resistant in school are often hard at work learning informally" (p. 1). There is a multitude of technologies available for students to pursue their interests outside of school, such as television,

cell phones, video games, and the Internet, that may or may not be available to them during the traditional school day.

Twenty-first century students are disengaged because the school environment, often void of familiar technology, does not mimic the environment that exists for students outside of the classroom (Metiri Group, 2006). According to Green and Hannon (2007), "Children are establishing a relationship to knowledge gathering which is alien to their parents and teachers" (p. 38). Many young people are now deeply and permanently reliant on computer technology, connected to their peers and the world at large in ways no generation has ever been before (Prensky, 2010). Increasingly, what students want is available in their pocket and on demand. Therefore, in order to adequately prepare students with the skills necessary for the 21st century, schools have begun to implement 1:1 computing programs that provide each student with personal access to some kind of computing device. The perceived benefit is that these devices provide for immediate access to information and unsurpassed opportunities for communication and collaboration (Luo, 2011; Penuel, 2006).

The expansion of individual computers as tools for learning in the classroom is predicated on the idea that since students are exposed to technology since birth, they naturally expect to learn by using such technology. In order to prepare students for a technologically rich environment that is constantly changing and adapting, Costa (2012) posits the following argument:

> Educators must be able to replicate or introduce students to learning experiences that prepare them for it. To be fluent with problem solving and adaptability, to be digitally literate adults, learners must practice and use these skills consistently over time. (p. 13)

One-to-one computing can help close the digital divide and equip students with the skills necessary for success in the 21st-century workplace (Metiri Group, 2006). Costa (2012) illustrates the dire importance of schools' embrace of 21st-century skills: "Without 1:1 access to the tools that form the foundation of 21st-century learning and work, students cannot be properly prepared for life in this environment. Facing this is no less than a matter of survival for public schools" (p. 15). Today's youth must continuously choose from among a plethora of expertly produced demands on their attention—music, movies, commercials, TV, video games, Internet, and more. They have learned to focus only on what interests them as individuals (Prensky, 2010). In an increasingly populated and crowded world, personalization and individualization have become, for today's students, a necessity.

Rationale

Due to the advancement of technology in society and the increasing number of school systems implementing 1:1 computing, much research has been done to study its effects on professional development, the role of the teacher and student, and the effect on student achievement (Allan, Erickson, Brookhouse, & Johnson, 2010; Cuban, 2009; Prensky, 2001). Work remains to be done on how to best match the learning styles of modern students with teacher pedagogy. Professional development that is based on scholarship is necessary for achieving this goal.

There is a growing dichotomy between students' school experiences and other aspects of their lives. Because contemporary students have grown up using various technologies outside of school, they have become disengaged with the traditional school environment that either lacks or may even forbid technology (Cuban, 2009; Metiri Group, 2006; Prensky, 2010). Costa (2012) explains the significance of needing to address this dichotomy: "As long as schools remain

primarily paper and textbook based, the gulf between the appropriateness of the preparation system we provide and the learning and work environment that our students enter continues to grow" (p. 15).

Another reason to create technology-literate students is to match the demands of employment. An example of one such consideration is that employers today value skills such as creativity, communication, presentation expertise, and team building (Green & Hannon, 2007). As such, educational practices will need to shift towards a student-centered approach to facilitate these desired traits.

As demonstrated above, the educational status quo in regard to educational technology integration is in flux. The classroom practices of 20th-century teachers are no longer entirely sufficient to meet the needs of contemporary learners (Kereluik, Mishra, Fahnoe, & Terry, 2013). It seems that there is a significant gap in how 21st-century students learn and how teachers teach. Bridging this gap calls for continuous adaptability and appropriate support for teachers. Thus, the need to understand a teacher's perspective of teaching in a 1:1 environment and its influence on pedagogy is critical in developing effective teaching and learning practices.

Research Purpose and Questions

The purpose of this study was to explore how two middle school teachers in a Midwestern city described the effects of ubiquitous computer access for students on their instructional practices and overall student learning as they participated in a district-wide 1:1 computer initiative.

Research Questions

1. What were the participants' experiences during the early phases of a 1:1 computer initiative?

2. What were the participants' perceptions of the effect that transitioning to a 1:1 computer environment has on their pedagogical practices?

3. What were the participant's perceptions of the effect of a 1:1 computer environment on overall student learning?

Methodology

Qualitative research is often conducted to answer "the whys and hows of human behavior, opinion, and experience—information that is difficult to obtain through more quantitatively-orientated methods of data collection" (Denzin & Lincoln, 2005, p. 1). Therefore, a qualitative research design is appropriate for this study in order to explore and understand people's behaviors, opinions, and experiences as indicated by their words and actions, as well as by the meaning that language and behavior carry. To understand how the interpretation of situations gives rise to the decision to persist in the teaching profession, the participants' words and their meaning-making processes, in addition to other sources of information need to be documented and interpreted.

A case study research design was an appropriate form of methodology for this study. Yin (2009) defines a case study as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (p. 13). Additionally, Merriam (1988) describes a qualitative case study as "an intensive, holistic description and analysis of a single instance, phenomenon, or social unit" (p. 21). However, it would be unrealistic to assume that any case study could be holistic on its own because all forms of data collection are limited by access to the participants, and the researcher's time and resources. Case studies are frequently utilized in education in order to gain a

comprehensive, in-depth understanding of a specific situation and to identify the meanings for those involved in the situation, especially when compared to positivist forms of inquiry. Case studies are differentiated from other types of qualitative research in that they contain intensive descriptions and analyses of a single unit of a bounded system, such as an individual, program, event, group, intervention, or community (Stryker, 1976). The case study approach to qualitative research represents a specific way of collecting, organizing, and analyzing data and the result of the analysis process (Patton, 2001). Understandings gathered from case studies can often "directly influence policy, practice, and future research" (Merriam, 2009, p. 19).

For the purpose of this study, the case was bounded by a single school's implementation of a 1:1 computer initiative and investigated through the lens of the classroom teachers as they participated in the adoption. Data collection was conducted over the course of 35 weeks. Collection methods included semi-structured interviews, object-elicited interviews, journal reflections, participant observation, document analysis, peer debriefing, and member checks for a total of 281 pages of data. (See Chapter Three for more details.)

Methodological Framework

The methodological framework within which this study was grounded is symbolic interactionism. According to Schwandt (2007), this social psychological and sociological theory "has its roots in American pragmatism" (p. 283). Symbolic interactionism traces its origins to the pragmatic philosophies of Charles Sanders Peirce, John Dewey, William James, and George Herbert Mead, which laid the groundwork for what would later be developed into the framework of symbolic interactionism (Crotty, 1998, pp. 73-75).

Crotty (1998) credits the psychologist and philosopher George Herbert Mead with the framework's inception. Herbert Blumer, who studied with Mead at the University of Chicago, would later be responsible for coining the term in 1938 and also for formulating the most prominent version of the theory. According to Schwandt (2007), the Blumer-Mead version of symbolic interactionism rests on three premises:

> First, humans act toward the objects and people in their environment based on the meanings these objects and people have for them. Second, these meanings derive from the social interaction (communication, broadly understood) between and among individuals. Communication is symbolic because we communicate through language and other symbols and in communicating create significant symbols. Third, meanings are established and modified through an interpretive process undertaken by the individual actor. (people. 283-284)

Symbolic interaction focuses on the subjective aspects of social life, rather than on objective, macro-level aspects of social systems. Subjective meanings are given primacy because it is believed that people behave based on what they believe and not just on what is objectively true. A primary belief of this framework is that humans are practical actors who must continually adjust their thoughts and behavior to the actions of other actors. A researcher using the lens of symbolic interactionism sees humans as active, creative participants who construct their social world, and not as passive, conforming objects of that world (Blumer, 1986).

Researchers using symbolic interactionism seek to answer how people create meaning, how they present and construct their identity, and how they define situations with others. One of the perspective's central ideas is that people act as they do because of how they define the present situation and that through their interactions, individuals create the symbolic structures

that make life meaningful. The reconstruction of such viewpoints becomes the instrument for analyzing the participant's world (Blumer, 1969). In fact, the reconstruction of the participant's viewpoint is the "fundamental methodological principle of symbolic interactionism: researchers have to see the world from the angle of the subjects they study" (Stryker as cited in Flick, 2009, p. 58).

Symbolic interactionism is appropriate for this study because of its focus on the participants' meaning-making of their experiences as educators. Within this framework, the focus is on the subjective experience of an individual as the basis for understanding and studying society, or a system of society, such as the education system. Teachers, as people, interact socially and adjust their behavior and beliefs in response to the actions of one another. This meaning is dependent upon interactions between all the actors and the socially constructed realities of their environment. Thus, individual interpretations of the symbol, which in this case is the way in which the teacher constructs their[1] professional identity, are required in order to approach understanding.

In agreement with Blumer's (1969) interpretation of symbolic interactionism, it is teachers' individual understanding of their professional identity that determines how they engage with the greater school culture. The central role of teachers' sense of identity in understanding their actions is clear:

> The teacher as a person is held by many within the profession and outside it to be at the center of not only the classroom but also the educational process. By implication,

[1] Their is the gender non-binary inclusive pronoun.

> therefore, it matters to teachers themselves, as well as to their pupils, who and what they are. Their self-image is more important to them as practitioners than is the case in occupations where the person can easily be separated from the craft. (Nias as cited in Kelchtermans, 2005, p. 100)

Kelchtermans (2005) emphasizes that "the ways in which teachers achieve, maintain, and develop their identity, their sense of self, in and through a career, are of vital significance in understanding the actions and commitments of teachers in their work" (p. 1000). The role of teachers' sense of identity and its effect on their actions and commitments in regard to adapting their pedagogy in response to ubiquitous technology access is the basis for this study.

Symbolic interactionism allowed for various broad questions to be posed in this research study. The first research question asked how participants would describe their experiences of teaching. This is appropriate because symbolic interactionism, by definition, is centered on the meaning-making process and the social interactions involved therein. Additionally, using symbolic interactionism as a lens allowed for exploring how teachers make meaning of, interact with, and are shaped by the educational environment in which they function and by the resources to which they have access. As a result, the experiences educators described as playing a role in their decision to persist as classroom teachers were ultimately dependent upon their personal interpretations and meaning-making processes.

Substantive Framework - TPACK

The framework of Technological Pedagogical and Content Knowledge (TPACK) informed this study. The TPACK framework (Harris, Mishra, & Koehler, 2009) emphasizes the relationship between technological knowledge and a comprehensive pedagogical and content area knowledge (Koehler & Mishra, 2009). TPACK is a conceptual tool that can assist teachers,

administrators, and researchers in planning and evaluating technology integration. Building on Shulman's (1987) Pedagogical Content Knowledge (PCK) framework, TPACK adds technological understand to the existing consideration of pedagogy, content, and knowledge. When applied, TPACK requires the user to pay "equal attention to technology, pedagogy, and content as they work together to contribute to student learning" (Wetzel & Marshall, 2011, p. 74). Essentially, TPACK provides for a separate, specific emphasis on technological best practice in addition to the more traditional focus of a teacher's content knowledge and pedagogical knowledge.

TPACK is designed as a framework to help recognize the knowledge and skill necessary for successful technology integration. Harris et al. (2009) suggest using the TPACK framework as a way to design effective technology integration. This framework provided a lens through which I could consider the participants' evolution as they progressed through the 1:1 technology adoption.

Limitations

Despite a researcher's due diligence and grounding of a study in scholarly literature, no study is without its limitations. Thus, one limitation of this study is its scope. This study only focused on the technology integration experiences of two in-service teachers. Missing from this study are the stories of the administrators whose leadership might influence the way the teachers integrate technology into their pedagogy, as well as the stories of their students. While these perspectives would undoubtedly add insight, they were purposefully excluded in order to narrow the scope of the case so as to make the study more feasible based on a realistic understanding of the researcher's resources and time required to conduct in-depth inquiry.

Additional limitations include my novice researcher skills. While lacking extensive research experience in these matters, I did have the knowledge gained from conducting the pilot study, as well as the careful planning of this study, on which to draw. Throughout this study, I needed to be mindful in presenting co-constructed findings which share an understanding as interpreted truth rather than a fixed or absolute truth.

Time is a finite resource, and available time—both mine and the participants'—further limited the study. I made the most of the available time through planned pre-scheduling of the interviews and interactions as outlined in the data collection section of Chapter Three (see Appendix A). By respecting the participants' time, I maximized our interactions.

Possibilities of the Study

This study was an opportunity to share the stories of teachers as they adjusted to the changing technological environment of their profession. Scholars have already developed links between educational technology integration and student achievement (Haydel & Roeser, 2002; Lei & Zhao, 2007; Park & Ertmer, 2007; Schrum & Levin, 2009) and about the facilitating and inhibiting components of successful integration (Ertmer, 2005; Ertmer, Addison, Lane, Ross, & Woods, 1999; Ertmer & Ottenbreit-Leftwich, 2010), but limited studies could be found that examined how teachers are making meaning of these measures and the why and how behind their eventual success or failure. Future studies could focus on how technology integration best practices fit into different situations though the comparison between teachers working in varying locations (based on geography, socioeconomic, language, etc.), teachers with different preparations (traditional vs. alternative certification), or teachers with differing amounts of experience (early career vs. late career).

Operationalization of Constructs

Ubiquitous computing: The word ubiquitous literally means "existing or being everywhere at the same time," implying that computers are something that are constantly encountered and widespread (Ubiquitous, 2015). The term "ubiquitous computing" was coined by Mark Weiser of Xerox PARC: "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it" (Weiser, 1991, p. 75).

One-to-one (or 1:1) computer initiative (or adoption): K–12 schools and districts have taken steps to provide expanded access to technology for students. One such effort is to provide each student with a school-provided laptop, netbook, or tablet computer for use at school and at home. These initiatives, commonly referred to as one-to-one computing, address the issue of lack of regular, sustainable access to technology (Topper & Lancaster, 2013). For the purpose of this study, the provided device is a Google Chromebook.

One-to-one (1:1) computer environment: This term refers to a classroom environment where there is one Internet-connected device for each student (Bebell & O'Dwyer, 2010).

Pedagogy: This term refers to the methods and practices of teaching. Pedagogy encompasses what a teacher believes, the skills he or she needs to be successful, and his or her collaboration and discourse with other adults (Adams, 2004).

Chapter Summary

In this chapter I outlined the background and context for 1:1 computer integration in education, and emphasized the rapid growth of this intervention in the field. Additionally, I highlighted the lack of research that focus on teachers' experiences on this technology-focused intervention. I established the appropriateness of using the qualitative research methodology of

case study and proposed an investigation that explored the experiences of two middle school teachers participating in a 1:1 adoption. I then presented the methodological framework of symbolic interactionism as the lens through which I investigated how the participants generated meaning from their experiences. Next, I introduced the TPACK framework as the substantive framework steering this study. The TPACK framework provided the language necessary to analyze and discuss the participants' narratives. Last, I enumerated the limitations and possibilities of the study.

Chapter 2 - Literature Review

This chapter is divided into eight sections. The first section provides a brief orientation on the subject of information and communication technology (ICT) and its adoption in the educational setting. Section two addresses the idea of systemic change facilitated by the adoption of ICT into the educational environment. The third section addresses the changing role of education brought about by technological progress. Section four is an explanation of the constructivist learning theory, which is currently thought to be best facilitated by ICT. Section five continues the theme of change and highlights the current literature on how technology integration fits into the future vision of education. Section six is a brief history of 1:1 initiatives and the elements of change that they represent in order to provide a working definition and historical context for this study. The seventh section introduces the TPACK model and address other frameworks/models of technology adoption necessary to undertake this investigation. The final section presents a perceived gap in the research and describes the need for this study.

Introduction

Digital technology is pervasive and is essential in the way we communicate, learn, and live. Digital technology tools have penetrated the brick and mortar walls of educational institutions and classrooms where teachers define how and when various technologies will be used for instructional purposes. Over one third of U.S. students have a school-issued device to use throughout the school year, and 89% of high school students have access to a smartphone throughout the school day (Purcell, Heaps, Buchanan, & Friedrich, 2013), reinforcing an expectation for teachers to leverage the digital technologies available into their instructional decisions. Teachers are a critical component to the success of technology integration and the

success of 1:1 device programs in education; unfortunately, some in-service teachers are unprepared to use technology to extend and enhance student learning (U.S. Department of Education, 2010). In recent years, many schools have implemented 1:1 device programs, either with a school-provided device or with a bring your own device option (ISTE, 2016). Schools addressing teacher preparedness through professional development opportunities prior to or throughout the implementation process place those 1:1 device programs in a position to succeed (Vongkulluksn, Xie, & Bowman, 2018).

Computers, smartphones, tablets, and other devices have changed the landscape of our society and the landscape of education with the potential for students and teachers to leverage technology to enhance student learning and prepare students for the 21st-century workplace (Lowther, Inan, Ross, & Strahl, 2012). Obstacles for integrating digital technology into school curricula are a lack of teacher experience, education, and training in the use of digital tools to meet the curricular demands of their discipline (Elanmani, 2013; MacDonald, 2008; Makki, O'Neal, Cotten, & Rikard, 2018; Means, 2010; Morris, 2012).

This study is predicated on the understanding that technology integrated into the K-12 classroom can effect student learning by providing alternate ways to construct meaning (Bebell, O'Dwyer, Russell, & Hoffman, 2010) and that effective technology integration into instruction provides an opportunity to employ constructivist teaching models in innovative ways (Schunk, 2014).

Technology Integration and Systemic Change

In this section I provide a brief overview of systemic change to orient the reader to the process of organizational change in education. Next, I describe research-based best practices for proceeding through the change process. Additionally, I address the educational change process

with an emphasis on technology integration. Last, I present several established reasons why the adoption of integrated technology in the classroom can frequently result in rejection.

Institutionalizing sustained change in the American educational system has proven to be a difficult task, as tradition and familiar routines are easy to maintain and follow and attempts at innovation can end with slipping back into a traditional mode of operation that is safe and familiar (Rallis & Lawrence, 2018). Cuban (2013a) contends that the chronic failure of school reform is not in the ideas, but in the implementation. Sustained and meaningful change is a phenomenon attempted by many policy makers, administrators, and teachers, but one that has fallen short in execution (Fullan, 2001, 2007). Fullan (2007) explains a possible reason for the multitude of ineffective efforts by describing educational change as "technically simple yet socially complex" (p. 84). The process of change is socially complex because it involves many moving components that cannot be controlled, but only guided (Ertmer, Ottenbreit-Leftwich, & Tondeur, 2015). Bringing about educational change may involve implementing new innovations, a change of behavior, or a combination of both. The idea to proceed with educational change within an organization generates questions pertaining to what it looks like, how to proceed, who will be involved, what resources are needed, and how to accomplish the end goal.

Change is where knowledge is created; it is a complex process that involves the ability to generate, learn, and become skilled and competent in the use of new methods, not just to acquire best practices as products (Fullan, 2001). In order to encourage involvement in the change processes, it is the responsibility of the organization to build knowledge among its constituents about the need for change (Ertmer et al., 2015; Fullan, 2001; Vongkulluksn et al., 2018). Providing tangible, authentic, successful examples of change increases the chance of stakeholder

buy-in into the process. Therefore, it is significant for an organization to understand the idea that effective change takes time to plan, implement, and sustain.

The stereotypical school organization has not always fared well in the court of public opinion in regard to being open to change. Structures, systems, practices, and cultures have often been more of a drag on change than a facilitator (Senge et al., 2000). The rate of change in the modern world is not likely to subside. If anything, competition and innovations, along with the resultant changes to systems and society in many areas, will likely increase over the following years. One-to-one computing is one such reform that schools are facing.

Implementing Change – Best Practice

Despite the lack of sustained change in education, there is much research to establish procedures and processes for success (Chauncey, 2010; Fullan, 2007; Gardner, 2008; Vongkulluksn et al., 2018). In this section I will discuss research-based characteristics and practices that best support the process of change in education. Additionally, I will present crucial concerns for educational leaders looking to implement technology integration.

Strategy is one such characteristic that is critical to the success of educational change (Chauncey, 2010). There are many external influences, such as political pressure and competing stakeholder priorities, that may distract organizations from remaining focused on teaching and learning. The result of these distractions is unacceptable, as it causes improvement efforts to be fractured, disorganized, partly implemented, and never assessed (Chauncey, 2010). School districts that attempt 1:1 initiatives aim to create a new technological reality for students. Chauncey (2010) emphasizes the importance of starting with a coherent strategy when undertaking this process. Chauncey specifically outlines six characteristics of strategy that an organization may consider relative to attempting educational change: investigates new ways to

quicken improvement, addresses an internal audience, focuses on doing a few things well, integrates few key initiatives, requires people to work together in new ways, and is continually reconsidered and adapted. Organizations that apply these characteristics into their planning of educational change are one step closer in their ability to purposefully act in a focused and logical manner when adopting, implementing, and sustaining new innovation.

Similarly, Fullan (2001) identifies several organization principles for successful educational reform strategies. His main principle is to make sure the reform is about instruction. People are then able to plan, implement, and reflect on their progress by keeping the instructional improvement as the agreed-upon focus. Fullan (2001) also stresses the importance of tapping the shared expertise of talented people working together to help drive instructional change. Finally, he suggests that the focus be on decentralized, system-wide improvement, where clear expectations allow the change to proceed through a common goal, a shared sense of purpose, collegiality, caring, and respect (Fullan, 2001).

Fullan (2001) concludes that the main problem with schools is not the absence of innovations but the presence of too many disconnected, intermittent, fragmentary, superficially linked projects. Schools cannot afford to be disconnected or episodic with major change initiatives, such as 1:1 computing. Additionally, Fullan maintains that schools suffer from the additional burden of having many unsolicited, uncoordinated policies and innovations handed down to them by hierarchical bureaucracies. Therefore, it is important for schools to understand the policies and procedures necessary to support technology-centered innovations before jumping into a 1:1 initiative.

School leaders may benefit from thinking beyond simply setting policy and procedures and instead working to engage all stakeholders in the planning and implantation stages where

practical. Gardner (2006) addresses this fundamental question: exactly how and when do we accept change? He challenges people to think about the last time they tried to change someone's mind about something important and asserts that the effort was likely unsuccessful. One difficulty that schools are facing is that they have to ultimately change stakeholder beliefs, along with behaviors, for a reform to be sustainable.

One crucial stakeholder that school leaders have considered during successful 1:1 initiatives is the classroom teacher. Recognizing that reform is not usually organic, Fullan (2007) highlights the importance of focusing on building teacher capacity rather than simply imposing policy goals:

> Centralized, high-stake accountability schemes have failed to produce ownership as has decentralized site-based management. The clear advice — is the government must go beyond standards and accountability and focus on capacity building linked to results, engaging all levels of the system. (pp. 261-262)

In this case, capacity building is an effort to enable classroom teachers and other building-level practitioners to identify and lead their own school improvement efforts. The hope is that these site-based initiatives can be more meaningful—and therefore sustainable—than reforms imposed from the top of the organizational structure.

Beyond structuring, procedures, or academic standards, change within the technological status quo of education is inevitable. Technology pushes change and innovation. To this end, school districts are spending millions of dollars on technology with the hope of transforming the learning environment in the pursuit of improving student success, as measured by every metric imaginable. In order to successfully implement a 1:1 initiative, Cuban (2013) argues that school leaders need to engage stakeholders, be mindful of existing programs and policies, and consider

exactly how the initiative will fit into the current physical structure and culture of the school. As such, it is important that leaders understand to the best extent possible how these changes will affect the teachers that will be leading the effort while simultaneously being profoundly affected by it.

Adopting Technology

Adopting technology into classroom practice involves change, just like any other educational initiative. As with most other school reform efforts, research suggests that teachers play a fundamental role in its success (Cuban, 2013a; Luo, 2011; Schaefer & Levin, 2012; Vongkulluksn et al., 2018). In this section I discuss the inherent difficulties of changing individual behavior, three fundamental outcomes for technology adoption, and the effect of teachers' pedagogical beliefs on their eventual level of utilization of technology in their practice.

Difficulties arise with the implementation of any new innovation. Hall (2010) argues that one ongoing challenge with technology innovation is the ability to move past implementation by early adopters and scale up to widespread use. Changing individuals' behavior is a fundamental struggle organizations face when attempting to implement innovation (Klein & Sorra, 1996). Researchers have observed that few teachers actually use new innovations, and when they do, they tend to replace tools that exist in the classroom rather than utilize the technology in ways that transform teaching and learning (Cuban, 2001; Emeling, 2010; Fullan, 2007; Lee & Winzenried, 2009). Galla (2010) explains this low rate of transformative adoption by pointing out that "the exponential speed at which electronic technology develops today is comparable to the rate in which some educators have become exponentially unfamiliar with technology" (p. 24). Essentially, one issue driving the substitutive rather than transformative adoption of new

technologies in the classroom may be that the speed of innovation overwhelms the ability of those less intrinsically invested to stay up-to-date with current technological trends.

Fullan (2007) proposes that innovation is multidimensional, meaning that there are three outcomes at stake when implementing new programs or policies: (1) the possible use of new or revised materials, (2) the possible use of new teaching approaches, and (3) the possible alteration of beliefs. These outcomes involve changes to what the teacher uses, what the teacher does, and what the teacher believes. In the context of educational change, understanding all three elements is important in developing the ability to reach teaching and learning goals. Moreover, Fullan notes that in order for change to occur, it needs to be on the continuum of these three aspects, and most new innovations involve substantial change by implementers along the spectrum. For example, with an adoption of new materials (technological device), a teacher may be required to utilize different teaching approaches (21st-century instructional strategies), but may not make an effort to understand the beliefs underlying the change (transformational teaching and learning). They may disagree with the strategy within the context of their own belief system about teaching and learning and refuse to make the change. This tendency to disagree is supported by Muir, Knezek, and Christensen (2004), who contend that while new routines and behaviors are initially difficult to integrate into the classroom, as teachers begin to realize the benefits for their students, they can become an integral part of the educational change process. This understanding supports the idea that an effort to help teachers understand the underlying meaning for the new innovation and how it is for the betterment of teaching and learning is critical to the implementation process.

As teachers move through the process of adapting ICT into their classrooms, many will experience cognitive discomfort. Some will accept the change and others will reject it, but both

groups will end up reevaluating their teaching practice in the process (Fullan, 1993). Christensen (2008) states that motivation to master an innovation or program comes from within an individual. She contends that motivation is one of the catalyzing ingredients for learning, as well as for every successful innovation. Teachers are most likely to be successful when they have a willing and open frame of mind to allow change to occur naturally when adopting changes in their teaching. As explored earlier, genuine transformation is difficult to achieve because it involves change of behavior and beliefs (Fullan, 2007; Hall & Hord, 2011; Harvey, 2002). When reflecting upon their teaching, educators are able to judge whether they believe that a new innovation is effective and whether it will positively influence their classroom environment throughout the process. Fullan (1993) emphasizes that individuals need to feel pressure to change, and only when they take action to alter their own environments will true change occur. Technology is a resource rather than an instrument that inherently drives change, and it best facilitates the process of change when used as such.

Rejection of New Practices

Teachers are often the sole decision makers in regard to whether and how technology is used for instruction (Ertmer et al., 2015). In this section I address how educators can react when presented with the disruptions produced by ubiquitous technology access, as well as the consequences that may result from the various routes of adoption.

Educators adopt a variety of orientations when presented with new technology. Hargreaves and Shirley (2012) state that educators often assume four strategic positions regarding technology: (1) embrace it, (2) challenge it, (3) protect children from it, or (4) blend it with other interests. Additionally, they found that a teacher's psychological state about innovations is key to whether they move forward with implementing new innovations. This

means that personal elements such as past experiences, the point in one's career, and personalities all influence the teachers' likelihood of embracing a position conducive to adopting technology into their practice. These findings further reinforce the notion that teachers play a fundamental role in the successful integration of technology initiatives.

While not outright rejecting new practices, some teachers have been slow to adopt them, even in this era of rapid technological advancement (Makki et al., 2018). Gorder (2008) notes that teachers typically use technology for professional productivity but lack the ability to incorporate it into instruction effectively, although it is not clear why this is. Hall and Hord (2011) propose that when individuals have to change, they are asked to give up something they know how to do well and like doing, which creates a sense of loss. Teachers' pedagogical beliefs about schooling are instilled with the traditional roots of education and are difficult to alter (Cuban, 2001). These existing beliefs shape the implementation of any initiative, as teachers are most inclined to use technology in ways that are consistent with their individual perspectives.

When teachers reject new technologies, it can be misconstrued as resistance to the technology itself rather than the change in perspective it represents. However, Baylor and Ritchie (2008) contend that it is ultimately the teacher's willingness to change that will influence whether they will integrate new technologies. Unless motivation is the reason for embracing a new classroom technology, teachers will reject the struggles that occur and abandon it before reaching full implementation (Christensen, 2008). Muir-Herzig (2004) cautions that the shift from a teacher-centered delivery to a student-centered learning model potentially leads to a resistance to change because of the challenge most educators will face in shifting teaching and learning methods, as well as relinquishing the traditional educational roles. As such, a priority during the implementation of a technology initiative could be communicating with teachers

about the importance of moving away from teacher-centric roles to increase their comfort level when that natural transition occurs. When viewed through Fullan's (2007) lens of an innovation-focused and capacity-building approach, the need for documenting a representation of the individual experiences of district personnel as they adapt to the technology present in their environment and move through the process of change becomes clear.

In conclusion, today's teachers have access to an unprecedented amount of technology to supplement their instruction. As the ultimate decision makers of what actually happens in the classroom, they play an important role in the success of any organized technology initiatives. As mentioned earlier, teachers have several orientations that they can adopt during such a transition, ranging from transformative to full rejection. Additionally, even those that do choose to adopt the innovation may do so at a slow pace. Finally, a rejection of a technology initiative may be more a reflection on a teacher's willingness to change than a denunciation of the technology itself.

The Changing Role and Purpose of Education

The increased access to ICT and the availability of information through the Internet has influenced the role of education because students can now easily acquire information that once was restricted to knowledgeable persons or research databases (Hancock, Knezek, & Christensen, 2007). This change in the location and acquisition of knowledge may be bringing with it an adjustment in teaching ideology and may ultimately be necessitating a shift to a more constructivist paradigm of education (Cuban, 2013a).

Traditionally, teachers have identified what students need to know, found the information, evaluated it, and synthesized it for the students' consumption. In this model, the teacher thinks critically for the students and the students accept the interpretation provided so

they may reproduce it when evaluated. Applebee (1996) termed this phenomenon a *deadly tradition* because students learn to memorize rather than to question, reason, or engage within their own learning. Thoman and Jolls (2005) state the challenges facing 21st-century education:

> For centuries, schooling has been designed to make sure students learned facts about the world—which they proved they knew by correctly answering questions. Such a system is no longer relevant when most up-to-date facts are available at a touch of a button. What students need today is to learn how to find what they need to know, when they need to know it, and to have the higher order thinking skills to analyze and evaluate whether the information they find is useful for what they want to know. (p. 181)

By changing the focus of education to empowering students, Thoman and Jolls argue for a shift in the teacher's role from provider of knowledge to a supporter of students' own exploration. According to this way of thinking, students would be best prepared for the future if they learn how to identify what they need to know to extend their learning and how to access, evaluate, and synthesize information to assist them in their understanding.

Compare this teacher-as-keeper-of knowledge approach with a world characterized by the easy access that ICT provides for students to engage with a variety of topics. Students may actively participate in educational conversations using digital tools or research nearly any concept or topic, all while applying these concepts in their practice of meaningful learning (Baviskar, Hartle, & Whitney, 2009). Authors such as Thoman and Jolls (2005) believe that "creative classrooms today are ones where everyone is learning, including the teacher" (p. 184), which is in direct contrast with the traditional notion of a teacher as the dispenser of knowledge.

The Internet and other information and communication technologies have changed how knowledge is being accessed. This democratization of knowledge, along with shifting ideas of

what skills modern students need to possess, has put pressure on educational leaders to change the status quo of how students are taught. In response, some schools are shifting to a more constructivist learning model (Hancock et al., 2007).

Although innovative ideas on teaching and learning have been progressively introduced over the past few decades, traditional views have been difficult to change. Such views often consider students as empty vessels waiting to be filled with knowledge by the teacher. Modern students are now learners who come to the classroom with diverse backgrounds, experiences, and learning styles, as well as access to a wealth of information at a touch of a button. The guiding principle of constructivist learning theories is the learner's own active initiative in learning and personal knowledge construction (Bandura, 1993). In this paradigm, the student does not passively take in knowledge, but actively constructs it on the basis of his or her prior knowledge and experiences (Piaget, 1972).

From the constructivist pedagogical point of view, a student's learning activities are most effective when directed at examining his or her own prior understandings and relating them to the new knowledge and when the learning environment provides the learner with opportunities to test and try out new conceptual understanding in various applied circumstances, such as problem solving (Piaget, 1972). constructivism can, therefore, be directly contrasted against objectivism, which is the traditional view that knowledge is an external unit with an absolute value that can be transferred from teacher to learner (Jonassen, 1991).

There is no single constructivist learning theory, but according to a literature review conducted by Baviskar et al. (2009), common practices in the implementation of constructivism include the following: students are active in their learning process, the learning is situated in context, students build on prior knowledge to apply new knowledge, and students reflect on what

they have learned. Vygotsky (1978), a prominent sociocultural learning theorist foundational to constructivism, posits that learning is socially constructed through interactions within a community of learners. By highlighting the effects of social interactions on cognitive development, Vygotsky reveals the critical role that external activities play in building understanding. Constructivist learning theory balances the roles of teacher and students as equal contributors to the learning environment, with each bringing in prior knowledge and experiences (Vygotsky, 1978). Morphew (2009) identifies three key elements for a constructivist-learning environment: a meaningful experience, prior knowledge, and interactions. According to Morphew, for an experience to be meaningful, it needs to make sense to the student and connect curricula to what students already know (their prior knowledge). Prior knowledge enables students to associate, retain, and value the learning experience. Interactions are essential to the constructivist-based classroom. The interaction between a teacher and a student or a student and another student may trigger prior knowledge or experiences that foster growth for all involved (Morphew, 2009).

Vygotsky's (1978) zone of proximal development emphasizes his belief that learning is fundamentally a socially mediated activity. This zone is defined as the distance between a child's "actual developmental level as determined by independent problem solving" (p. 86) and the higher level of "potential development as determined through problem solving" (p. 86) under adult guidance or in collaboration with more capable peers (Vygotsky, 1978). Vygotsky argues that instruction should be tied both to the level of potential development as well as to the level of actual development, as the opportunity for intellectual gain is greatest when students are challenged near their ability but at an appropriately rigorous intensity.

It is the teacher's role to identify students' zone of proximal development in order to tailor instruction and overcome the difference between what the student can do with and without support (Vygotsky, 1978). A teacher can use scaffolding to support student-centered learning with digital resources to reduce the gap between what the learner can do and cannot do without assistance (Azevedo & Hadwin, 2005). Scaffolding enables students to learn difficult concepts that may initially be outside of their ability range. This process is what Collins, Brown, and Holum (1991) define as cognitive apprenticeship, in which the role of the teacher transforms from knowledge expert to a mentor that evaluates progress and supports students in their construction of knowledge when necessary. The use of technology to screen for student academic ability, more easily differentiate instruction, and allow students more ownership of their learning has contributed towards the shift in ideology towards constructivism in some environments (Cuban, 2013a).

Ubiquitous computer access enables a transition from the traditional theory of technology integration, often enacted through an occasional visit to a computer lab, to an environment of seemingly unlimited exploration and collaboration (Collins et al., 1991). As more students gain access to digital devices, the opportunities for student learning expand from classroom lectures on specific content to opportunities to learn anything, anywhere, at any time. This prospect of unlimited access to information challenges the role of a teacher as the sole provider of content knowledge, as students are constantly exposed to information that was at one time limited to specialists in their educational field. Digital access enables individual learning to be self-directed and knowledge to be constructed through personal experiences. Constructivist learning theory supports the notion of students working independently to construct their own knowledge, with teachers as facilitators of learning.

Technology Integration

In this section I present what 21st-century learning looks like in terms of technology integration and provide an argument as to why schools should endeavor to integrate technology into teachers' classroom practice. This is followed by a brief orientation to the concept of 1:1 initiatives as a means of technology integration. Next, I discuss how 1:1 initiatives can affect teachers' attitudes and pedagogical beliefs and how this can shift the traditional roles of teachers and students. Last, I present the human barriers to technology integration and how this has shaped current attempts at integration.

The practice in which technology is utilized as a tool to sustain the tasks of classroom practices is known as technology integration (Keengwe & Onchwari, 2009). Since computers and related technologies were first developed, the definition and designation of what these devices can accomplish have repeatedly expanded (Dede, 2007). There is no definitive definition for the term technology integration (Bebell et al., 2010; Hew & Brush, 2007). However, technology integration generally incorporates the elements of computing devices, software, and Web content that is meant for K-12 instructional use (Hew & Brush, 2007). Also, technology in an educational context includes a wide range of devices, along with accompanying applications and software, that are used for communication and motivation purposes (Sturdivant, Dunham, & Jardine, 2009). Early efforts to computerize instruction occurred before computers were readily accessible; often, they were housed in laboratories and teachers were assigned short weekly sessions to schedule lab times for their learners (Niederhauser & Lindstorm, 2006).

The first serious attempt at studying the effect of computer integration in the classroom was the seminal Apple Classrooms of Tomorrow project. This project was designed to study the teaching and learning outcomes of classroom environments that were modeled on a technology-

rich platform (Apple Computer, 1995). As such, the Apple Classrooms of Tomorrow study laid the groundwork for future research concerning the use of technology in the classroom (Barron, Kemker, Harmes, & Kalaydjian, 2003).

Some researchers have found that increased access to ICT in the classroom has resulted in positive changes in student learning (Bebell & O'Dwyer, 2010; Holcomb, 2009; Rockman et al., 2000). In Holcomb's 2009 study, students with laptops spent more time engaged in collaborative and project-based instruction than did non-laptop equipped students. Furthermore, Holcomb found that students participating in 1:1 programs earned higher scores on high stakes tests than did their peers. In addition to higher test scores, Rockman et al. (2000) found a correlation with the 1:1 technology schools that were producing increased test scores being those that also moved toward more constructivist pedagogy in which students participate in student-led inquiry and work collaboratively. To advocates of 1:1 initiatives, this is encouraging news, as it suggests that ubiquitous computer access can help students be engaged, reflective, and active in their learning.

However, not all researchers agree on the extent to which the use of this technology leads to improved instructional practices (Bebell et al., 2010; Cuban, 2006; Debell, O'Dwyer, Russel, & Hoffman, 2010; Oncu, Delialioglu, & Brown, 2008). Among these differing views is the idea that computer technology use in schools is still deficient because of a lack of quantity and quality of use (Mueller, Wood, Willoughby, Ross, & Specht, 2008). In fact, Kay, Knaack, and Petrarca (2009) note that the "mass infusion of technology in our learning environments has only had a modest impact on learner outcomes" (p. 27). Furthermore, the idea that educational technology integration has been oversold is the focus of research by some leading scholars, such as Clark (1994) and Cuban et al. (2001). These researchers suggest that technology integration reforms

fail to produce the promised positive effect on overall educational practices despite the availability of advanced technologies and are questioning whether the integration of technology really improves teaching and learning (Cuban, 2013a). These are noteworthy observations, given that improving test scores is often mentioned by school leaders as a primary justification for purchasing technology for student use.

Despite lacking material evidence of its improving educational outcomes, many school districts are proceeding with varying forms of ICT adoption. As such, countless aspects of education are being reshaped by the corresponding emergence and adoption of new tools, media, applications, and infrastructures (Dede, 2007). In fact, Howard and Tomei (2008) suggest that the convergence of the standards movement, teacher quality movement, and educational technology movement are some of the most significant developments currently occurring within the field of education. Redesigning education and schooling through emerging technologies "is sophisticated and requires a transformative vision that stems from political resolve and professional commitment" (Dede, 2007, p. 11). As a result of this movement, many governments have implemented extensive plans to promote the integration of technology in their school systems in hopes that that student learning is positively influenced by technology (Hew & Brush, 2007).

In summary, much has been written about the perceived value of technology integration at school (Ertmer & Ottenbreit-Leftwich, 2010). There is a need for higher levels of technology integration in schools (Marzano, 2009). The existence of NETS for Students Standards represents the emphasis placed nationally on promoting technology literacy among students (ISTE, 2016). Notwithstanding the importance of promoting technology literacy among students, research shows that teachers primarily use technology to perform and continue existing practices

(Dede, 2007; Ertmer, 2005; Ertmer & Ottenbreit-Leftwich, 2010). This disconnect presents a major issue of concern for researchers who seek to understand why teachers are not using technology effectively in the classroom.

Why Integrate Technology?

Why might some informed school districts still proceed with ICT adoption despite the lack of conclusive evidence of it improving test scores? Behrens, Mislevy, DiCerbo, and Levy (2010) suggest, in their report for The National Center for Education and the Economy, that workers need new, sophisticated skills to compete in the modern-day workplace. Their study suggests that future workers will need to be able to create with technology and to renew innovations with 21st-century century tools. Additional studies by Gardner (2006) and Kereluik et al. (2013) support this belief that teaching with technology will prepare students for the 21st-century workplace and engage students by incorporating tools they use every day.

Labbo and Reinking (1999) propose that the effective incorporation of technology into teaching and learning can transform instruction, the way students think, and the classroom culture. In their research, they found there is no set path for the incorporation of technology into instruction or into content. They posit that incorporation of technology is a formidable endeavor, yet see "technology as a potential catalyst for transforming instruction" (p. 488). However, the limitations schools have placed on the presence of mobile devices has maintained a separation of technology as a means to communicate and share socially, rather than using technology as a means to extend learning beyond the knowledge of the teacher, the information provided in the printed text, or the opportunities to demonstrate understanding (Cuban, 2006).

Weston and Bain (2010) advise schools as they invest in 1:1 devices that digital technologies are best viewed as tools to transform education rather than tools used to assimilate

tasks already present in the classroom. Similar studies support Weston and Bain's concern and highlight the need for teachers to have the knowledge and skills necessary to use digital resources effectively in their instructional practices (Warschaeaur & Ames, 2010; Woolf, 2010). Tellingly, investigations indicate that most technology use is teacher centered, in which technology influences administrative teaching responsibilities and lesson plan preparation but rarely affects instructional purposes (Hennessey, Ruthven, & Brindley, 2005; Russell, Bebell, O'Dwyer, & O'Connor, 2003). As shown above, some researchers argue that teachers need support from education programs and professional development to transition pedagogically from leading classrooms where they were once viewed as keepers of knowledge to classrooms where they integrate technology into their instruction practices and create student-centered technological learning opportunities.

Ultimately, the reality is that devices such as cellphones and laptops have become a part of the educational landscape through societal adoption, 1:1 programs, bring-your-own-device programs, and increased access to computers throughout the school day. Consequently, teachers and students are increasingly repurposing personal devices as tools for teaching and learning. How this technology is assimilated frequently varies from classroom to classroom, presenting a challenge regularly associated with technology integration, which is the diverse perception of what it means to integrate technology into the classroom (Bebell & O'Dwyer, 2010; Hew & Brush, 2007). While the specific devices present in classrooms may vary, what is clear is that ICT devices are on the path to becoming another ubiquitous classroom technology.

One-to-One Initiatives

One-to-one initiatives are propelling educational change with the intent of providing benefits that include improving academic achievement, increasing equity of access to digital

resources, increasing economic competitiveness by preparing students for today's workplaces, and transforming the quality of instruction (Bebell & O'Dwyer, 2010). These initiatives predominantly focus on providing every student in a given system with one digital device.

One-to-one computing initiatives have been championed as a transformational reform the likes of which have not been seen in education. There is much research available on 1:1 laptop initiatives and their effect on education. That research has focused primarily on the influence 1:1 programs have had on students and has returned mixed and often contradictory results. Alternatively, research supports the promise of how technology can positively affect teaching and learning (Fleischer, 2012; Holcomb, 2009; Maninger & Holden, 2009; Silvernail & Pinkham, 2011; Weston & Bain, 2010). Other research indicates a lack of widespread adoption in practice on the part of teachers (Becker, 2000; Cuban, 2006, 2013a, 2013b; Cuban, Kirkpatrick, & Peck, 2001). In a study of schools with widespread access to computers, Cuban (2009) found that less than five percent of teachers integrated computer technology into their regular instructional practice. A plausible explanation for why laptop initiatives have experienced such varying degrees of success is that this success is largely dependent on teacher practice. There is an obvious link between teacher practice and student learning; however, little research has been conducted to evaluate what kind of effect laptop programs have had on the instructional practice of teachers. For the purposes of this study, Penuel's (2006) widely accepted definition of 1:1 computer programs is applied, which offers three core features: provides students with individual devices loaded with contemporary software, allows access to the internet for students through the school's networks, and necessitates the use of the devices to complete coursework.

The number of districts utilizing 1:1 initiatives has grown dramatically over the last decade (Stanhope & Corn, 2014). There has been an accompanying growth in the body of research around various aspects of 1:1 programs in schools. Earlier research focused on elements associated with successful implementation, such as teacher professional development, access to technical support, and positive teacher attitudes towards technology use, as well as evaluating initiatives' influences on skills such as technical literacy and writing (Penuel, 2006). More recent research has focused on those aspects, as well as others, such as the varying levels of effectiveness of technology integration, low levels of use tied to weak implementation plans, and teacher use of the technology (Lee, Spires, Wiebe, Hollebrands, & Young, 2015). A key area that is lacking in the literature is an emphasis on identifying the extent of teacher practice that is consistent with expectations for how the laptops are to be used.

Much of the initial research on these laptop initiatives indicated that the use of technology would increase collaboration among students and between teachers and students in addition to increasing engagement, but there is conflicting evidence regarding instruction utilizing laptops increasing student achievement (Fleischer, 2012). Fleischer's review of 605 research articles focusing on 1:1 initiatives shows that much of the existing body of research concentrates on device usage in the 1:1 environment, with four clear themes in terms of the how the personal devices are frequently used:

- exploration: primarily for conducting research using the internet;
- expression: utilization of the device for students to produce work, often through the use of Microsoft Office Suite products such as Word, PowerPoint and Excel;
- communication: used for increased communication both with peers and teachers; and

- organization: to collect and organize student work.

Moreover, Fleischer also found in addition to device usage, many studies also revolved around the experiences of learning such as evidences of increased knowledge formation or increased student motivation and engagement. These potential gains make the benefits of the increased use of technology especially attractive, but the technology comes with an enormously high price tag. Laptop initiatives are among the most expensive and widespread educational initiatives of recent years (Holcomb, 2009). Little of the existing research offers insight into the way teachers utilize laptops beyond measuring how much they use them. However, Fleischer notes that "when considering the thematic aspects of the results, there is an extended focus on activities, but less focus on the qualities and processes of knowledge formation inspired by one-to-one" (p. 119). This leaves a gap in understanding how teachers implement the technology and if they are utilizing laptops as constructivist or traditional tools. A significant and untapped area of research in the 1:1 realm is whether or not teachers are implementing the laptops into instruction with fidelity to the intended reform of shifting instruction to be more student-centered. That is, are they genuinely adopting the constructivist reform effort, or are they using the technology while maintaining traditional practices, thus symbolically adopting the reform?

Teachers' Attitudes and Pedagogical Beliefs

Ertmer (2005) recognizes teacher pedagogical beliefs as a determining influence for technology integration. It is important to address some beliefs that are resistant to change, especially when it is difficult to determine if the resistance is related to belief or technological knowledge (Ertmer et al., 1999). Teacher beliefs are defined by Ertmer as teachers' attitudes about education, including attitudes about schooling, teaching, learning, and students. November

(2010) goes on to define teacher beliefs to include pedagogical beliefs and beliefs about how technology can facilitate student learning.

When it comes to technology integration in classrooms, a teacher's beliefs are associated with the amount of effort and emotional cost required to take action or to integrate technology (Abbitt, 2011). Bandura (1993) defines self-efficacy as "beliefs in one's capabilities to organize and execute the courses of actions required to produce given attainments" (p. 3). This construct suggests that when a teacher's knowledge increases, his or her self-efficacy may increase motivation to incorporate technology into his or her instructional practices. In the case of digital technology integration, as understanding of technology increases, use will increase because it is based on knowledge of pedagogy and content rather than technology use in isolation (Niess & Walker, 2010).

A teacher's beliefs influence student learning and technology integration because teachers are decision makers in the classroom (Oncu et al., 2008). Teacher belief is a crucial issue for technology integration (Ertmer & Ottenbreit-Leftwich, 2010; Levin & Wadmany, 2006; Zhao & Frank, 2003). The teacher considerations that influence success are teacher attitude toward change, teacher pedagogical and pedagogical knowledge and teacher perception of school as a learning organization (Fullan, 2001). To improve teacher preparation or integration of technology, teacher educators address teacher beliefs because teachers' understandings often influence their practice and technology integration often does not fit within existing instructional practices and beliefs (Ertmer, 2005; Pajares, 1992). Teacher education programs are addressing teaching beliefs by modeling and exposing preservice and in-service teachers to teaching practices that incorporate technology into instructional practices. Stand-alone courses to expose teachers to educational technology have been a staple in teacher education programs, but

Bielefeldt (2006) argues these stand-alone courses may not provide the necessary preparation for teachers to effectively integrate technology into their instruction. The ability to envision and use technology in instructional practices is influenced by individual teachers' beliefs and may not be influenced by experiences in stand-alone courses or professional development opportunities that are not specific to content (Ertmer & Ottenbreit-Leftwich, 2010). Ertmer and Ottenbreit-Leftwich emphasize that positive experience with technology implementation often occurs before teachers begin to believe in the efficacy of technology integration in instruction.

While changes in teaching practices are critical to the success of 1:1 computing programs, teachers' pedagogical beliefs about technology also directly impact the success of such initiatives. Penuel (2006) found in his qualitative narrative research that

> teachers who believe that students are capable of completing complex assignments on their own or in collaboration with peers may be more likely to assign extended projects that require laptop use and allow students to choose the topics for their own research projects. (p. 337)

Penuel (2006) analyzed research studies they deemed as being of high quality that analyzed implementation and outcomes of 1:1 initiatives. His research indicated that teachers who view technology as a valuable tool use it more often with students than do those who devalue its use. His findings are further validated in the mixed-methods research conducted by Drayton, Falk, Stroud, Hobbs, and Hammerman (2010), which examined three high schools that implemented 1:1 environments for at least five years in the science curriculum, specifically focusing on year three. In their research, Drayton et al. realized that "inquiry-oriented teachers deployed the technology to support and expand inquiry; whereas more traditional teachers likewise use the technology according to their values in conducting teacher-centered classrooms"

(Drayton et al., 2010, p. 45). Penuel's study confirms the idea that teachers' beliefs affect teaching practices and technological integration.

Teachers' beliefs about the merits and value of technology are affected by their experiences (Sturdivant et al., 2009). Additionally, teachers' decisions on technology integration are influenced by their pedagogical beliefs and different contextual influences (Bakia, Means, Gallagher, Chen, & Jones, 2009). For instance, a lack of confidence in their own technology skills may make some teachers reluctant users of technology in the classroom (Sturdivant et al., 2009). Thus, it is important to build and promote the teacher's confidence and self-belief regarding technology (Oncu et al., 2008).

Teachers' beliefs alone do not determine the extent and technique of technology integration. Teachers' technological abilities and comfort level with technology are key for determining classroom practice with computers. Maninger and Holden's (2009) mixed-methods research study also substantiates the reality that teachers' skills, along with their attitudes, practices, and beliefs, directly affect the implementation of technology integration. Maninger and Holden worked with a private school that implemented a 1:1 environment focusing on fifth- through eighth-grade students and teachers. Their research indicated that "with additional experience, training and technical support, many teachers have expanded their use of technology to include curricular planning, problem solving and decision making" (p. 15). Additionally, Prestridge's (2012) study shows a clear relationship among information and communication technologies competence, confidence, and practice. Both study's authors found that as teachers reported higher levels of competency with ICT, they had greater confidence and levels of implementation of ICT in the classroom. It is of note, however, that level of competency and confidence did not necessarily correlate to types of ICT practices. Teachers with the necessary

will and skill to effectively utilize technology in instruction can be limited if there is not adequate access to the technology.

Thus, a key to successful implementation of a 1:1 program or other technology initiative appears to be the teacher. Without properly addressing these professional development needs of teachers, initiatives have been found to fail or to make little change in actual teaching. For example, a study by Peck, Cuban, and Kirkpatrick (2002) found that teachers continued to use their traditional teacher-centered practices, such as lectures and textbooks, rather than change to make more use of the provided computer technology. Looking at the changes in teachers' classroom activities and actions can help determine whether the professional development is affecting teacher practice. This research highlights how a teacher's beliefs and teaching practices prior to the implementation of a 1:1 computing program may not significantly change after adopting a technology initiative.

Human Barriers to Technology Integration

Research shows that student technology use in classrooms is rarely meaningful or transformative for students (Barrios, 2004; Breg, Benz, Lasley, & Raisch, 1998; Cengiz Gulek & Demirtas, 2005). In a study of technology integration into teacher practice, Hennessey, Ruthven, & Brindley (2005) found that teacher technology use was frequently underutilized: that teachers tend to assimilate instructional technology tools into existing instructional practice as opposed to changing their pedagogies (Cuban et al., 2001; Goodson & Mangan, 1995). That is to say, technology is sometimes used to support existing classroom practice rather than transform it.

Integrating technology requires time for the teacher to embrace technological resources, time for teachers to research and practice using the resources, and confidence that the use of digital tools will prepare students for state-mandated, high-stakes testing of content knowledge.

Studies have attributed the success of technology integration to teacher training and district- and school-level influence (Cuban et al., 2001; Lee et al., 2015; November, 2010; Stanhope & Corn, 2014). These studies suggest that for technology integration to be effective, teachers should believe technology can help them achieve their goals more effectively and will not interfere with student learning. Moreover, teachers are most likely to successfully integrate technology into their practice when they believe they have adequate ability and sufficient resources to use technology (Zhao & Frank, 2003; Zhao & Lei, 2008).

While education programs are trying to equip their preservice teachers to be 21st-century educators, sometimes by offering courses incorporating or demonstrating teaching with technology in their teacher preparation programs, they are largely attempting this preparation through 20th-century avenues, simply converting existing assignments into ones that use technology in some way (Al-Awidi & Alghazo, 2012). Incorporating technology into instruction and assignments in this way may become a gimmick rather than an effective teaching tool (Drayton et al., 2010). Most teachers simply have not had the time to become fluent in using media tools or the training to understand how to use media texts or media issues to promote critical thinking, and both beginning and experienced teachers may believe "the implementation of new technologies could result in reductions in efficiency" (Russell et al., 2003, p. 299). In an assessment-driven system, this is a risk they are often not willing to take.

A teacher's lack of technological pedagogical knowledge may hinder technology integration in classrooms (Harris & Hofer, 2011). Rather than seeing technology as transformative, Harris and Hofer warn that technology is often seen as a "different means to reach the same goal, *replacement;* a way to accomplish the same goal more efficiently, *amplification;* or, means to reorganize cognitive process and problem-solving activities,

transformation" (p. 211). This caution addresses the needs identified by Harris, Mishra, and Koehler (2009), who emphasize the importance of helping teachers develop and apply integrated and independent understandings of technology, pedagogy, content, and context. This embedded view of technology use in teaching is in contrast to most professional development programs for teachers, which focus on teaching technology skills in isolation. This, in turn, does little to help teachers integrate technology effectively to extend or enhance student learning.

The most common reasons teachers provide for "failure to use technology are a lack of knowledge or skills necessary to incorporate technology into their pedagogy" (Hew & Brush, 2007, p. 303). Teachers often have limited understanding or experience about how technology is meaningfully integrated into various instructional formats or how to integrate technology to facilitate teaching and learning. As a result of their limited exposure, teachers frequently elect to continue teaching the way they always have for fear of the effect that compromising their curriculum or pedagogy may have on their students' performance. As for first- or second-year teachers, Miller (2007) notes that these teachers often fear a loss of position as knowledge expert when confronted with keeping up with current technology trends and knowing how to use them effectively in their classroom instruction. This concern can be overcome by adequate training, further reinforcing the need for strong and focused professional development to accompany any technology adoption initiative.

The human barriers present when trying to promote meaningful technology integration in the classroom are numerous. As stated, part of this is due to the tendency to assimilate the technology into existing practices rather than to use it to alter one's existing practices and beliefs. Additionally, technology integration takes time for practitioners to adapt to it, and training is often required to overcome the lack of skills and develop confidence in their abilities.

Substantive Framework – The TPACK Model of Technology Integration

The TPACK model is a framework for describing meaningful technology use in teaching and learning. TPACK is an acronym for Technological Pedagogical Content Knowledge (Mishra & Koehler, 2006). TPACK is an extension of the concept of PCK, or Pedagogical Content Knowledge (Shulman, 1986), which describes the way in which the expert teacher combines content knowledge (CK) about the subject to be taught with pedagogical knowledge (PK).

The basis of Shulman's (1986) PCK framework is the idea that teaching is a highly complex activity that draws on many kinds of knowledge. It is a multifaceted, cognitive skill occurring in an often unideal, dynamic environment (Leinhardt & Greeno, 1986). There are many knowledge systems that are fundamental to teaching, including knowledge of student thinking and learning, as well as knowledge of subject matter. As such, expertise in teaching is dependent on flexible access to these highly-organized systems of knowledge (Shulman, 1986).

Historically, teacher education focused primarily on the content knowledge of the teacher (Shulman, 1986). This focus would later shift, as teacher education began to focus more on pedagogy, emphasizing general pedagogical classroom practices independent of subject matter, often at the expense of content knowledge (Ball, Knoblock, & Hoop, 2007). This divided way of looking at teacher knowledge can be thought of as two circles completely independent of each other. For instance, different approaches toward teacher education had frequently emphasized one or the other domain of knowledge, focusing exclusively on knowledge of content (C) or knowledge of pedagogy (P). He claims that the extreme emphases on teachers' subject knowledge and pedagogy were causing them to be treated as mutually exclusive domains (Shulman, 1987). The reality of such a dichotomy was teacher education programs in which a focus on either subject matter or pedagogy dominated. To address this separation, Shulman

proposed considering the necessary relationship between the two by introducing the notion of Pedagogical Content Knowledge which adds focus to the area of intersection between content and pedagogy (see Figure 2.1).

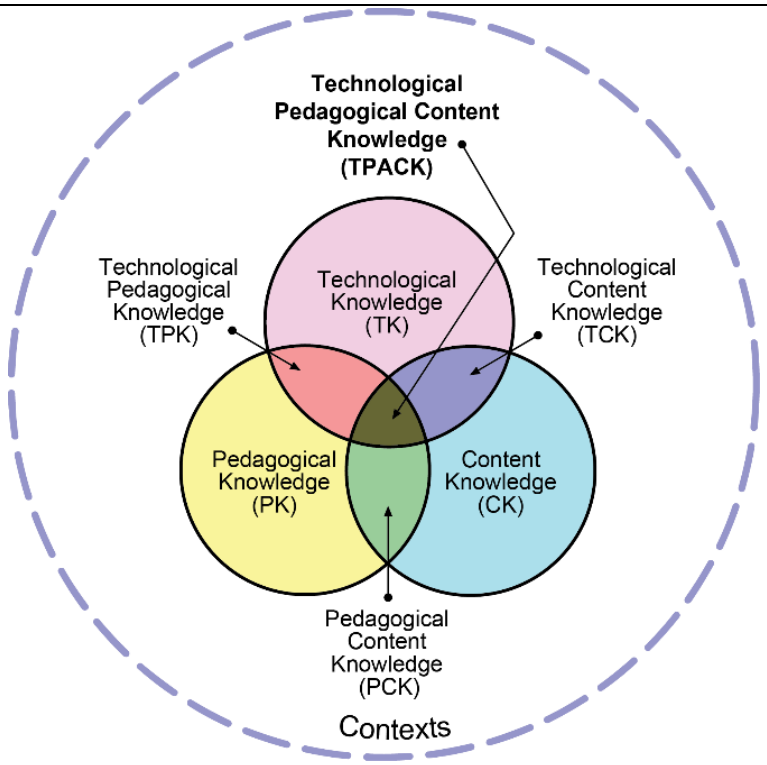

Figure 2.1. Technological Pedagogical Content Knowledge (TPACK) framework. Reprinted from tpack.org, Retrieved July 14, 2016, from http://www.tpack.org. Copyright 2012 by Mathew Koehler. Reprinted with permission.

As such, it goes beyond a simple consideration of content or pedagogy in isolation from one another. It represents the blending of content and pedagogy knowledge into an understanding of how particular aspects of subject matter are ordered, revised, and characterized for instruction. Shulman (1986) insists that having knowledge of subject matter and general pedagogical strategies, though necessary, is not sufficient for capturing the knowledge of good teachers. To characterize the complex ways in which teachers think about how particular content is most effectively taught, he defines pedagogical content knowledge as the content knowledge that deals

with the teaching process, including "the ways of representing and formulating the subject that make it comprehensible to others" (p. 9). For teachers to be successful, they would have to be cognizant of both content and pedagogy simultaneously by embodying "the aspects of content most suitable to its teachability" (p. 9). This occurs when the teacher interprets the subject matter and finds different ways to represent it and make it accessible to learners. In Shulman's (1986) words, this intersection contains within it

> the most regularly taught topics in one's subject area, the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations, the ways of representing and formulating the subject that make it comprehensible to others. (p. 9)

In short, at the heart of PCK is the manner in which subject matter content is transformed for teaching. The intersection of technology, content, and pedagogy determines which technologies may facilitate or support learning of specific content. Teachers who are comfortable with the intersections of technology, pedagogy, and content generally integrate technology effectively (Koehler, Mishra, & Yahya, 2007). Teachers often make pedagogical decisions in relation to content demands first. As technology becomes more prevalent in classrooms, teachers are tasked with determining which, if any, digital tools will best support their content and pedagogical aims. Currently, there is little documentation with respect to teacher beliefs with regard to technology integration as it pertains to using technology to support and extend student learning of specific content areas (Nelson et al., 2009).

When Shulman first made his argument in 1986, issues surrounding technologies simply were not in the foreground of concern. Traditional classrooms used a variety of technologies, from textbooks to overhead projectors, from typewriters to charts of the periodic table on the

walls of science classrooms. At the time, much of the available educational technologies used in classrooms had been rendered "transparent"; in other words, they had become so commonplace that they were not even regarded as technologies (Koehler & Mishra, 2006). Since the 1980s, much has changed in the technological landscape of education. New technologies have changed the nature of the classroom or at least seem to have the potential to do so. Recall the aspects that Shulman provided as being important to PCK, such as the ways of representing content to make it more accessible and comprehensible. Clearly, technologies play a critical role in this aspect. Ranging from drawings on a whiteboard to interactive multimedia simulations to complex 3D modeling, technologies have both inhibited and provided a range of representations, examples, explanations, demonstrations, and activities that can help make subject matter more accessible to students.

Though not all teachers have embraced new technologies for a range of reasons, including a fear of change and lack of time and support, the fact that these technologies are here to stay cannot be doubted (Mishra & Koehler, 2006). Moreover, the rapid rate of evolution of these new digital and information communication technologies will likely prevent them from becoming *transparent* any time soon. Teachers will have to do more than simply learn to use currently available tools; they also will have to learn new techniques and skills as current technologies become obsolete.

Practitioner-Informed Framework

Teacher belief is an integral part of their decision to adopt new technology tools into their pedagogy; as a result, several theories and models other than TPACK have been applied to technology integration practices as a means to inform teacher education programs, professional development programs, and instructional resources. While the primary lens through which I

approached my study is the TPACK model of technology integration, it is possible that other frameworks used professionally within K-12 technology integration discourses could also inform this study. The SAMR model is used extensively in the school district in which the participants work and informed their understanding of technology integration.

The SAMR model was developed by Puentedura (2012) to help teachers access the use of technology in the classroom. There are four levels of technology use in the SAMR model: substitution, in which students complete the same task using technology that they would complete without technology; augmentation, which is similar to substitution in that the assignment does not change, although there are some improvements to instructional practices; modification, in which assignments are created that could not be done without technology; and redefinition, in which assignments could not be created without technology and are developed for a global audience. Puentedura (2015) aligned his model with Bloom's taxonomy to connect these categories to more familiar educational terms. (see Table 2.1)

Table 2.1
SAMR with Blooms Taxonomy

SAMR Term	Bloom's Taxonomy Pair	Example
Substitution	Remembering	A student using a PDF in place of a textbook.
Augmentation	Understanding	A student using an advanced eBook with electronic tools for marking the text, a text-to-speech function, and a built-in dictionary.
Modification	Analyzing	A student using prior knowledge to locate and evaluate Internet-based resources to support or refute their interpretation.
Redefinition	Synthesizing	A student creating their own textbook chapter with original text and user-created images, charts, and figures which they then publish electronically to share with another class studying the same information.

Bloom's cognitive taxonomy is a scale of increasingly complex levels of thinking that students demonstrate as they learn — moving from rote recall to higher order skills like creation and evaluation. This taxonomy provides verbs that describe the cognitive processes students use during learning. By contrast, Puentedura's SAMR model suggests increasingly complex ways that technology affects the classroom. From tools that substitute to those that redefine the nature of instruction, technology is seen as a tool that has the potential to influence the nature of teaching. For example, technology tools in the augment category provide teachers with improved ways of interacting with students. Bloom's taxonomy is essential for teachers to identify student's levels of thinking, whereas Puentedura's SAMR is needed for teachers to identify the

tools that can be used to innovate on instruction. The two are not synonymous and point to two potential views of technology and education: one where the technology guides instruction, and the other where skillful teachers guide instruction supported by technological tools. In the SAMR model, technology in the hands of a knowledgeable educator can transcend traditional teaching and learning in distinct and meaningful ways.

Situating This Study Within the Literature

The potential of educational technology tools resides in their ability to untether our nation's teachers from the physical boundaries of their classrooms and untie our nation's students from arbitrary groupings while unleashing a new level of immersive learning. A single tool, even with the most advanced artificial intelligence, will likely never be a panacea for education. But technology does empower teachers to take learners to worlds beyond their imagination while making learning visible and actionable. Educational technology tools that help make learning visible allow teachers to scaffold instruction and meet the needs of all of their learners.

There is much research on the failure of historical educational reform efforts to have a transformative and sustained effect in the classroom, with success often measured solely by test scores (Cuban, 2006, 2009; Fullan, 2007; Hall, 2010; Vongkulluksn et al., 2018). Also, research has shown that teachers are often not adequately prepared for reforms and bring with them resistant attitudes, which can undermine educational reforms (Ertmer et al., 2015; Lee et al., 2015; Stanhope & Corn, 2014). As a result, reforms have often only superficially influenced education or have not realized the change they had originally sought. Failure of these reforms may well lie in the fact that teachers often do not attempt to implement new methods of instruction or do so in a flawed manner.

Existing studies on the effects of 1:1 programs on student assessment results are varied (Fleischer, 2012; Lee et al., 2015; Silvernail & Pinkham, 2011; Weston & Bain, 2010). There seems to be no consistency or predictability among these studies of what influence 1:1 laptop initiatives have on student achievement. This may, in part, be associated with how inconsistent the initiatives are in terms of how they are implemented, as well as the varying levels of adoption. Also, it may be a result of student achievement being tied to test scores that may be largely impervious to the difference in constructivist and traditional instruction. The will and skill of teachers, professional development, technical and instructional support, teacher background, and other aspects are associated with how the reform is adopted and, ultimately, the success of the initiative in shifting instructional practice. Research that does not account for teaching philosophy and practice, and the level of adoption of the reform, cannot provide a complete picture of what is happening in 1:1 classrooms.

Given this historical lack of meaningful, sustained change at the classroom level, and the understanding of the connection between teacher practice and student learning, it is curious that research on the effectiveness of 1:1 initiatives as a major reform in education has largely lacked a focus on how these initiatives have affected teacher practice and on the perceptions of the teachers that are implementing these reforms. Interestingly, the little research that does exist presents evidence that teacher beliefs and attitudes towards technology are critical in determining how they will use technology (Ertmer, 2005; Hermans et al., 2008). I chose for this study to explore more deeply the educators' perceived experiences in order to gain a fresh perspective on a well-studied subject beyond the use of surveys and quantitative analysis of student achievement using an inquiry that allows in-depth contextual analysis.

Chapter Summary

This chapter began with a discussion of research relative to the role of technology in the classroom. My review of the literature revealed how ICT is often expected to serve as the catalyst for systemic educational change. I highlighted the six characteristics of strategy that an organization may consider when attempting to implement the change process, as well as other considerations that are deemed best practice when attempting to adopt sustained change. I also examined what change looks like, specifically in regard to adopting technology, and reviewed common reasons why these adoptions often fail. I found that those seeking to implement technology-based change, based on the literature reviewed, must acknowledge that teachers are often the ultimate decision makers in regard to whether or not a new technology results in a transformation of pedagogy, is merely assimilated into existing practices, or is ignored altogether (Ertmer & Ottenbreit-Leftwich, 2010). Next, I analyzed how technology in education is leading to a change away from traditional teaching and learning roles to a more constructivist paradigm. I then provided by a brief summary of constructivist learning theory. In the next section, I presented a vision for 21st-century learning, position technology integration as a means to this end. I then provided a research-backed argument for why schools often choose to integrate technology into instruction. In the third section, I offered a brief orientation of historical 1:1 computer initiatives and review how they may influence teachers' attitudes and pedagogical beliefs, as well as change the roles of learner and teachers overall. I then addressed the lens through which this study will be viewed, TPACK, as well as the additional practitioner-informed framework of SAMR. Last, I situated my study in regard to existing research and explain why there is a need for inquiry that allows in-depth contextual analysis.

Overall, I found that the research revealed mixed results about technology acceptance and use, while providing an agreed-upon list of commonly accepted barriers to successful implementation and catalysts for success. Studies revealed that while more technology is available to classrooms, the technology is not always accepted and fully utilized in the pedagogical planning and execution of lessons. In order to increase both the quantity and quality of the use of technology in the pedagogy of educators, it is important to understand the nuances of why the barriers hinder implementation and how the catalysts accelerate it. While there have been numerous studies about the topic, most have focused on macro-level indicators, such as student achievement as measured by a gauge like test scores or the quantified level of technology integration by the classroom instructor. This study addressed this perceived gap in the literature by focusing on the perceptions of the people that are so often studied rather than their end products or overt behaviors.

Chapter 3 - Methodology

The purpose of this study was to explore how two middle school teachers in a Midwestern city described the effects of ubiquitous computer access for students on their instructional practices and overall student learning as they participated in a district-wide 1:1 computer initiative. Three research questions guided the study:

1. What were the participants' experiences during the early phases of a 1:1 computer initiative?

2. What were the participants' perceptions of the effect of a 1:1 computer environment on their pedagogical practices?

3. What were the participants' perceptions of the role and value of technology in the support of student learning?

Subjectivity in Qualitative Research

Subjectivities, or "personal stakes of the researcher" (Peshkin, 1988, p. 17), are present in both qualitative and quantitative research. Bhattacharya (2007) defines subjectivities as the researcher's personal and professional investments, assumptions, and values that the "researcher brings to the table" (p. 10). These subjectivities, if unacknowledged, can play a role in influencing one's study. As Davies (1999) states, subjectivity can "refer to the way in which the products of research are affected by the personnel and process of doing research" (p. 4). In this section, I will provide a brief orientation to the importance of recognizing subjectivity though personal reflection, as well as a statement to help lay bare some of my own experiences that have shaped the lens through which I have approached this study. Declaring subjectivities does not render a researcher's methodological processes innocent or beyond critical scrutiny. Instead, such a disclosure allows a depiction of intellectual honesty, which speaks to the need for

transparency and rigor in qualitative research. Throughout this process I was critically reflecting on personal experiences and interrogating the narratives that could inform and influence this study.

Personal reflection, as Hertz (1997) proposes, is best focused upon the *what I know* and the *how I know it* and involves "an ongoing conversation about experience while simultaneously living in the moment" (p. viii). This emphasis on understanding the moment requires the researcher to be "critically conscious through personal accounting of how the researcher's experiences and interests influence all stages of the research process" (Callaway, 1992, p. 33). Hertz (1997) argues that the intended result of this reflexivity is to "produce research that questions its own interpretations and is open about its own knowledge production towards the goal of producing better, less distorted research accounts" (p. viii). Accordingly, an effective qualitative researcher will endeavor to collect and present information in as objective a manner as possible, while recognizing that pure objectivity is unattainable.

Acknowledging one's subjectivities is a necessary aspect of all research and can be understood as involving an ongoing critical self-awareness during the research process. Peshkin (1988) urges researchers to acknowledge their subjectivities consciously and to "systematically identify their subjectivity throughout the course of the research" (p. 17). Being cognizant of my subjectivities added trustworthiness and accuracy to this study. In order to attend to one's subjectivities, researchers need to be reflexive about their work and remain attentive regarding the roles they play in design, data collection, analysis, and representation (Pillow, 2003). By recognizing the assumptions that I brought to the table and the role they played in constructing a shared understanding of the participants' lived experiences, I was able to demonstrate my due diligence in sharing co-constructed narratives of participants' lives.

Subjectivity Story - Beliefs and Assumptions

It occurred to me once as I was asking a former student of mine (now a high school student) for advice on how to tame a finicky 3D printer that my generation of teachers is perhaps the last to straddle a life experience both with and without ubiquitous computing, the Internet, and all its social media marvels. We, the younger Gen. X and older Gen. Y variety, were raised during a time when MTV actually played music videos, friending had not yet become a verb, and cell phones were not a middle school discipline issue. I can remember watching video games shift from the arcade to the living room and personal desktop computers becoming the must have accessory for eager college freshmen with financial means. My generation, it seems, had one of the last of the low-tech childhoods, and now we are among the first expected to be the truly high-tech teachers. I consider myself a resident of the border between Prensky's (2001) concept of a digital natives and digital immigrants. While I appreciate life before ubiquitous computing technology, I also consider myself to possess what (Prensky, 2009) more recently referred to as *digital wisdom*.

I grew up playing with Legos and riding my bike. When I was bored, I staged imaginary battles with my G.I. Joes on an epic scale. I can recall a time when entertainment often involved nothing more than a prop and my imagination, as well as a time before nearly any question could be answered with a few clicks of a mouse or taps on a screen. Then came home computers and, along with it, access to the World Wide Web. I can remember life before the Internet, but I also admit that I happily embraced it and consider the tell-tale squawk of a 28.8k modem making a successful connection to be a fond memory.

Although I am perfectly able to use them, computers and the Internet seem more innate to my students, as most of them would rather make a PowerPoint presentation than a poster, turn to

Google when they are stuck on their math homework, and would gladly spend as much class time as I would let them watching YouTube videos of other people playing Call of Duty, which happens to be an activity that I just cannot understand no matter how hard I try. In fact, many of my students are hardly older than YouTube itself.

I am standing in the middle—between the generations of my parents and my students—when it comes to technology and education, with one foot dipped in the waters of Instagram and Twitter and the other still stuck in the mud of writing paper notes, sending real letters to pen pals, and speaking to friends and acquaintances face to face. When it comes to teaching, I find this middle ground both extremely uncomfortable and also exciting. I know what childhood and adolescence were like before the Internet, and I realize now as an educational professional just how much the system of education is based on that era. Nevertheless, I am excited because I can appreciate all of the yet unrealized marvels that computers and access to technology can do for education.

Even though I can grasp the powerful draw of the culture of modern technology and participate in it willingly, it scares me when it comes to my students and how it will mold them and diverge their experience from mine. Will my students ever have their own awkward-but-touching John Hughes-worthy moments, as teenagers today can have entire relationships over text message? Would the kids in *The Breakfast Club* even talk to each other if they found themselves in a Saturday morning detention today? What is clear to me is that they live in a different world, and I believe education will have to change to meet them where they are. It is also clear to me that this will likely be difficult for the adults that are tasked with leading and participating in the transition.

My students may never understand why I prefer the feel of a physically present, printed book, but I have decided to be okay with knowing that. The truth is that my generation of teachers are pioneers in this educational space whether we like it or not. We can try as hard as we want to push back and to carve space into our students' lives for the way things were when we were in school, but in the end, our students will grow up with the whole world at their fingertips—a new world, courtesy of 24/7 connectivity and a touch screen. It is my job as a teacher to help them navigate this new world.

Overall, my experiences with technology and students have influenced my belief in the positive effects technology can have on learning with a generation that has never known life without Google or pocket cellphones that are more powerful than the computers that originally took the United States to the moon; however, I know others do not share this opinion. As a researcher, I am not overly concerned with changing their minds. Instead, my goal is only to provide more information so we can make good decisions when it comes to educating modern students in response to their needs.

Through this narrative, I hope that I have provided a glimpse into the experiences and beliefs that are the inspiration for this study. I choose to share this story because I cannot shed these experiences and beliefs in the name of conducting a purely objective study. They are intertwined with me as a person and with my interpretations of the participants' stories. Peshkin (1988) states that "subjectivity is not a badge of honor, and paraded around on special occasions for all to see. Whatever the stance of one's persuasion at a given point, one's subjectivity is like a garment and cannot be removed" (p. 17). My subjectivity influences my thinking in both the research and non-research aspects of my life. Rose supports this concept of the omnipresent notion of subjectivity: "There is no neutrality. There is only greater or less awareness of one's

biases. And if you do not appreciate the force of what you're leaving out, you are not fully in command of what you're doing" (as cited in Dwyer, 2009, p. 55). My first step towards greater awareness was acknowledging that my personal experience shapes and informs me in terms of who I am as a person, teacher, and academic. This, in turn, informs the process of knowledge making, critical thinking, data management, analysis, and representation in this study.

Methodological Framework

This study was grounded in in the epistemology of constructivism and the framework of symbolic interactionism. Symbolic interactionism is derived from American pragmatism and based primarily on the work of Herbert Blumer, who, in turn, was influenced by the philosopher, sociologist, and psychologist George Herbert Mead (Blumer & Morrione, 2004). Symbolic interactionism, like most frameworks informing qualitative studies, comes in a variety of forms and is thus difficult to summarize (Schwandt, 2007). The Blumer-Mead version of symbolic interactionism places particular emphasis on the meaning people attach to their social interactions and objects around them (Schwandt, 2007). Symbolic interactionism an appropriate choice of methodological framework because of its focus on the participants' meaning-making of their experiences as educators. The premise that a teacher's reality is constructed by the teacher through the processes of observing, interpreting his or her surroundings, assessing options, and planning out a potential line of action provides a fundamental basis for this study. The interconnected nature of symbolic interactionism means that in order to analyze a person's choices, one has to observe the social processes by which their decisions are constructed (Blumer, 1986).

One of the primary social processes of symbolic interactionism is that of meaning-making through interactions (Schwandt, 2007). Through interactions, participants use symbols

such as language to understand their environment. Blumer's (1998) theory of symbolic interaction rests on three guiding principles:

> 1) Human beings act toward things on the basis of the meanings that the things have for them.
>
> 2) The meaning of such things is derived from, or arises out of, the social interactions that one has with one's fellows.
>
> 3) These meanings are handled in and modified through an interpretive process used by the person in dealing with the things he or she encounters (p. 2).

As shown in Blumer's three principals, we frequently apply meaning to objects according to socially derived interactions in an effort to organize and understand our world.

Blumer states that "an object is anything that can be indicated, anything that is pointed to or referred to" (p. 10) and may be divided into three categories: physical objects, social objects, and abstract objects. Although objects themselves possess no intrinsic meaning, people place meaning on these different types of objects in an effort to understand and make sense of their world.

Within this framework, the focus is on the subjective experience of individuals and the meanings they apply to their world as the basis for understanding and studying society or a system of society, such as the teacher's place in an education system. Teachers, as people, interact socially and adjust behavior and beliefs in response to the actions of others and in response to the objects with which they interact. This meaning is dependent upon interactions between all the actors and the socially constructed realities of their environment. Thus, individual interpretations of fundamental premises—such as professional identity, purpose, success, and failure—will exist amongst teachers.

Since the focus of this study was to explore the varied and unique individual experiences of teachers as they adapted to a 1:1 computer initiative, the framework of symbolic interactionism provided a suitable theoretical lens to analyze these teachers' perspectives as they adjusted their teaching practices and sense of identity.

Research Design

The specific methodology chosen for this study was an interpretive case study approach. This approach lends itself well to gathering the varied data sources needed to develop the comprehensive understanding necessary to see both the actions of the participants and the context in which they were acting. Creswell (2007) defines case study research as a "study of an issue explored through one or more cases within a bounded system" (p. 73). The underlying criterion for selecting an information-rich case is that it must be one from which others can learn a great deal about matters of importance and, therefore, worthy of in-depth study (Patton, 2002). For the purposes of this study, the bounded system was a teacher's experiences with a 1:1 computer initiative. In case studies, issues are explored through in-depth data collection procedures involving multiple sources of information, such as observations, interviews, audiovisual material, documents, and reports (Creswell, 2007).

Case study research is a popular approach among qualitative researchers (Thomas, 2011). Several prominent authors, such as Creswell (2007), Denzin (2009), Denzin and Lincoln (2013), and Yin (2006), have contributed to methodological developments, which has increased the popularity of case study approaches across disciplines. Case studies are designed "to suit the specific case and research questions so published case studies demonstrate a wide diversity in study design"(Hyett, Kenny, & Dickson-Swift, 2014, p. 1). This build-to-suit nature provided a level of flexibility that I, as a novice qualitative researcher, was particularly drawn to.

A case study approach was selected in order to provide a snapshot of deep insight into the individually constructed realities perceived by the participants. This approach is in line with both the social constructivist paradigm and the theoretical framework of symbolic interactionism that form the foundational lens for my study. Schwandt and Denzin (1994) assert that in using an interpretive case study approach, one can attain deep insight into "the complex world of lived experience from the point of view of those who live it" (p. 118). Cavana, Delahaye, and Sekaran further note that "interpretive research assumes that reality is socially constructed and the researcher becomes the vehicle by which the reality is revealed" (as cited in Andrade, 2009, p. 43). Crotty (2003) argues the merits of using an interpretive approach in this manner, as it "looks for culturally derived and historically situated interpretations of the social life-world" (p. 67). Mingers (2001) adds that this is consistent with the construction of the social world, which is characterized by the interaction between the researcher and the participants. This view of the interpretive case study exploring the construction of reality, born of both a personal interpretation and of social interaction, further justified grounding this study in the framework of symbolic interactionism.

The particular bounded case selected for this study is the experience of teachers participating in a 1:1 computer adoption. The case study approach was selected as the methodology for this study because it lends itself to the in-depth data collection and analysis necessary to develop pertinent and cross-cutting themes. In-depth data collection, across multiple sources of data, allowed for triangulation and contributed to the trustworthiness and rigor of the study, while also allowing for attention to detail and awareness of its context. This level of detail helped inform my understanding of the participants' individual interpretations, supporting the constructionist epistemology and framework of symbolic interaction guiding this study.

Moreover, a case study approach provided a level of flexibility appreciated by this novice researcher.

Research Site and Gaining Access

This study involved individual participants from an urban, Midwestern school district. as well as those with limited physical access to the schools. In order to conduct this research, I needed to gain access to both people and physical spaces. Gaining access involves acquiring permission "to go wherever you want, whenever you want, observe whatever you want, obtain and read whatever documents you require, and do all of this for whatever period of time" (Glesne, 2011, p. 57). While this might be a general description, in the practice of inquiry, people do not have unfettered access like that, nor is it realistic to assume that such access will be provided. Whatever the mitigated access might be, as a researcher, I tried to respect the participants' agencies in regards to the access they are willing to provide.

The first step in gaining access was to seek permission from the school board for the study. After gaining written approval (see appendix B), I contacted the building principal via email and asked him to forward to his staff a prepared statement on my behalf. I was then able to proceed with purposeful, criteria-based sampling to select the two participants as described in the next section.

Participant Selection

This study focused on the experiences of two classroom teachers. It was essential to select individuals who were accessible to me, willing to provide information, and eager to shed light on the specific issue under study (Creswell, 2007). I developed two primary criteria for selecting the participants for this study: (a) the teacher had to be willing to participate in the study; and (b) the teacher needed to be in the initial phases of a 1:1 computer adoption with his

or her students. As I was interested in exploring the experiences of a specific subset of educators, I used the purposeful approach of emblematic sampling. Emblematic sampling involves choosing a case because it is "extreme or deviant, typical or average, or emerging or novel" (Schwandt, 2007, p. 271). This case, in regard to emblematic sampling, would be considered typical or average, as it involved teachers participating in a seemingly usual 1:1 computer initiative that was neither extreme nor novel. In this circumstance, I sought to explore the experiences of one teacher who was comfortable with technology and one who was not.

The process for how I selected the participants is illustrated in Figure 3.1. The first step was to approach the building principal and ask him to send out emails soliciting participants on my behalf (Appendix C). Based on the responses received, I selected potential participants from a larger pool of teachers who met the previously mentioned criteria. I conducted a brief preliminary interview to gauge their comfort with technology and discussed the study with one potential participant at a time. In these meetings, I provided the details of the study and described to the individuals the expectations, risks, and benefits of participating in the study, including the fact that they could leave the study at any time without penalty or prejudice. At that time, the participants reviewed the informed consent form. Based on the most information-rich participants who met the criteria for the study, the final two participants were selected. I then answered any questions the selected participants had regarding the study and asked that they sign the informed consent form. I then signed the forms and gave each participant a signed copy (Appendix D).

If more than two participants had agreed to take part in the study, I would have selected two and retained the others as potential replacements if attrition had occurred. If I had not received any positive responses to the initial solicitation email, I would have started the process

over, targeting teachers at a different building and continuing the process until I had successfully selected the participants.

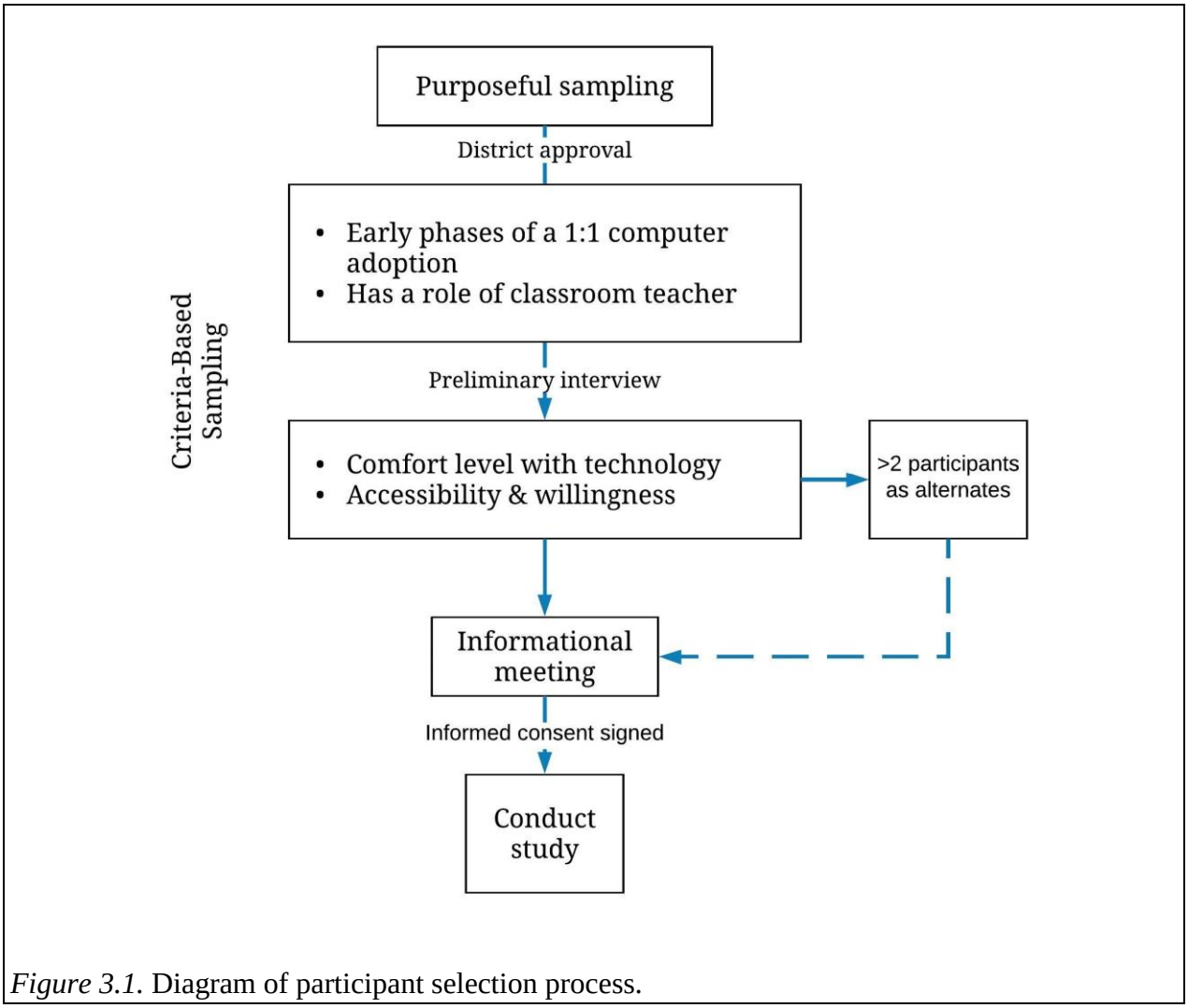

Figure 3.1. Diagram of participant selection process.

Membership Role

The qualitative researcher is an instrument in data collection and recognition and, therefore, is unable to adopt a completely neutral role in the field and while interacting with participants (Flick, 2009). For this reason, researchers assume roles situated within the context of their research. Using the idea that a researcher-observer can never be truly and completely

removed from that which they are observing in the field, Adler and Adler (1987) present three membership roles a researcher can assume while doing investigative participation:

> *Peripheral member* – The researcher's interactions with members varies from acquaintanceship to close friendship with key informants. This is a chiefly marginal role and the least intertwined in the context.
>
> *Active member* – The researcher assumes a more central place in the setting that involves a functional role in addition to an observational role. This facilitates trust and acceptance of the researcher, but increases the identification of the researcher with members of the setting. Self-reflexivity, role awareness, and periodic withdrawal from the setting are needed to maintain the research role.
>
> *Complete member* – The research is fully immersed in the research setting. One may study a setting in which he or she is already actively a member or "become the phenomenon" of interest. (p. 33)

The researcher's membership role then functions to dictate which information the researcher can access (Flick, 2009). Each role comes with varying degrees of benefits and drawbacks, such as different levels of access to data and context or requirements of time and social capital.

As I was a participant of the social group that I intended to study, I considered myself to be taking on the membership role of a complete member with an insider perspective. There are a number of benefits of having such status while doing qualitative research, one of which is having a greater understanding of the culture being studied (Pugh, 2000). This allowed me to focus more attention on the subtleties, as I had to expend less energy to understand the fundamentals of what was occurring. Another advantage was that my status helped establish rapport more quickly with the participants. Having a sense of shared understanding between the researcher and participants

promotes “both the telling and the judging of truth” (Bonner, 2002, p. 9). My personal experiences lent me some credibility and innate understanding, which may have helped build a relationship of trust more quickly than if I had been a total stranger to the field.

This is not to say that the role of an insider is without its disadvantages. Insider researchers also face challenges due to their closeness with the subject and must struggle with the related disadvantages, such as being seen as an advocate rather than a researcher, reliance on participants with whom the researcher feels comfortable, and prejudices towards interpretations (Bonner, 2002).

Qualitative researchers, as instruments of their data collection, occupy a membership role in the context of their research. As I occupied the membership role of a complete member, I had insight into the context of the study that an outsider may not possess. This benefitted me, as I needed to expend less conscious effort understanding the subtleties of the data and was able to focus more on developing themes. However, my closeness to the study necessitated that I pay careful attention to my subjectivities and preconceptions to ensure that I told the participants’ stories as accurately as possible, amplifying the saliency of their voices and experiences.

Data Collection

The data for this study were collected over a period of approximately 32 weeks (Appendix A). As informed by an earlier pilot study I conducted, a chief source of primary evidence came from interviews. Specifically, the data collection methods included semi-structured interviews, participant object elicitations, a researcher journal, and participant observations. I had anticipated gathering data from document analysis based on my experiences from the pilot study, but no documents ended up being formally collected during this study due to the digital nature of the resources used in this study. While conducting the study, I learned that

the participants' district had enacted strict data controls preventing the easy transfer of documents out of their school domain and had limited the teachers' access to printing. Therefore, the participants' reliance on digital documents limited my access to certain artifacts without causing an undue hardship. However, I made a conscious effort to include as many divergent sources of data in this study as possible, as "good case studies benefit from having multiple sources of evidence" (Yin, 2006, p. 115). Furthermore, data were purposefully gathered at different times, as temporal separation can contribute to the trustworthiness and authenticity of a study (Glesne, 2011).

Table 3.1 contains the anticipated number of pages as well as the actual number of pages generated as raw data during the case study research. The final number of pages became fixed once the data were collected.

Table 3.1
Data inventory

Source of data	Average calculation of pages	Actual number of total pages
2 one-hour interviews with each participant	2 x 21.75 pages/participant	87 pages
1 one-hour object-elicited interview with each participant	1 x 14.5 pages/participant	29 pages
Journal reflections for 32 weeks	1.5 pages per week	51 pages
2 thirty-minute participant observation each	3.75 pages per observation/participant	15 pages
Peer debriefing – 4 sessions	13 pages per session	52 pages
Member checks	4 pages per member check	47 pages
	Total Pages	**281 pages**

Interviews

Interviews are a means through which information and stories can be communicated, and conversation is a basic mode of human interaction. Kvale (1996) claims that "it is through conversations we get to know other people, get to learn about their experiences, feelings, and hopes and the world they live in" (p. 5). Similarly, deMarrais (2004) defines an interview as "a process in which a researcher and participant engage in a conversation focused on questions related to a research study" (p. 54). In a basic sense, interviews are conversations that can provide a valuable source of information for the researcher.

In an effort to provide clarification about the interview process, Kvale (1996) uses the allegory of a traveler to illustrate the role of an interviewer doing research. In this representation, the interviewer is a traveler walking the landscape of his or her research having conversations along the way. What the traveler hears and sees "is described qualitatively and is reconstructed as stories to be told to the people of the traveler's own village once they return home" (Kvale, 1996, p. 4). The researcher is the primary instrument of both data collection and analysis, meaning that the participant's stories are filtered through the lens of the interviewer, resulting in a collaborative effort. As such, the end result of the journey may be that of more than just new knowledge. The journey may "instigate a process of self-reflection that leads the interviewer to new ways of self-understanding as well as uncovering the desired information" (Kvale, 1996, p. 4). Kvale situates the traveler metaphor in qualitative theory, noting that it "refers to a postmodern constructive understanding that involves a conversational approach to social research" (p. 5). As in the metaphor described earlier, I was the traveler along for the ride, with the semi-structured interview process providing a guide and a personal sense of comfort, yet allowing the conversation go wherever the participant wanted to take me.

Although interviews can be a common activity in our society, interviewing for the sake of data collection in qualitative research is a structured process (Merriam, 2009). For the purpose of this study, interviews followed a semi-structured format. Using the research purpose and questions as a foundation, specific queries were developed for the first and subsequent interviews. Each participant's responses guided the direction of the interview and prompted the development of additional questions. While qualitative interview studies can be flexible in that questions are generated in the process of the interview, many studies benefit from an interview guide to serve as the basis for the conversation (deMarrais, 2004). The following prompts were prepared to guide the interviews:

1. Walk me though a typical instructional day.
2. Describe your thoughts and feelings when you first heard that your school would be adopting a 1:1 ratio of computers for your students.
    a. How did you overcome feelings of _____?
3. Can you give me some examples of how you prepared for this challenge?
4. Tell me about the supports you receive at your building or district level.
5. Tell me about a recent professional development experience related to the 1:1 initiative.
    a. How did this professional development session compare with other professional development you have attended?
    b. How has the training aligned with your goals and needs specific to the 1:1 initiative?
6. Describe a lesson using the new computers that went particularly well.
    a. What were the conditions for creating this positive experience?

    b. To what do you ascribe the success of this lesson/activity/project?
    c. How do you plan to improve upon this success?
7. Can you tell me about a lesson using the new computers that didn't work out?
    a. What support helped you through the worst experience?
8. Share with me an experience in which your students produced something in your classroom using their laptop that left an impression on you.
    a. What impressed/disappointed you the most about the project or new learning?
    b. How did you prepare students for the project?
    c. How did this project compare with your students from previous years without laptops?
9. Talk to me about how you prepare for instructing with laptops. Take me through your most recent lesson, from planning through implementation.
    a. Describe how you adapted to the change in instructional planning.
    b. How does planning for instruction with laptops differ from the way you planned before students had laptops?
    c. Were there any surprises you found when planning lessons for students?
    d. What changes do you foresee for yourself in the future as a result of planning for instruction with students using laptops?
10. What other information would you like to share with me about your experience with the 1:1 initiative?
11. If I were to walk in during instruction, what would I see/hear?
12. If I were to visit during lunch/PD/collaboration time, what would I see or hear teachers doing/saying about the 1:1 initiative?

13. Can you tell me about a time when you felt comfortable using computers in your instruction? (falsification)

All interviews were conducted at the location of each participant's choosing. Both Ada and Charles selected their respective classrooms as the preferred location for our meetings. This was likely due to their busy schedules and as a matter of convenience for them. Charles and I sat around his small group instruction table while we conversed. Ada chose to sit at her teacher desk during our meetings, while I sat in a student seat.

Interestingly, neither participant seemed overly concerned about maintaining confidentiality during this study, as evidenced by their selection of meeting place. While I was careful to not disclose the reason for my visits and to ensure I had a plausible pretense for my appointments, other staff members that I interacted with while in the building on at least two separate occasions seemed to know the reason for my presence. When asked about this, Charles simply replied, "We were talking in the [staff] workroom. I've got nothing to hide." Ada reflected a similar sentiment towards her apparent self-disclosure when she responded, "I've been teaching forever. Besides, sometimes the truth hurts." It is my belief that their attitude reflects their strong relationships with many of their peers and an overall building culture that is accepting of honesty and risk-taking.

At the conclusion of the first interview with a participant, we scheduled the second interview. How the participants responded in the first interview informed how the subsequent interviews were designed and executed. Simply stated, I based the interviews on the results of the preceding interview as much as possible. For example, having completed the first interview with each participant, I was intrigued by the manner in which both spoke about the start of the 1:1 adoption as a clear delineation in time and often talked in terms of before and after. I made

sure to investigate that topic further in subsequent interviews. For instance, when I asked Ada about the early stages of the 1:1 adoption, she shared, without missing a beat, how she felt that she and her colleagues were not consulted at all; rather, they were just informed that this would become a district priority. I made a note in my reflective journal that afternoon about how the quickness with which she offered that information may make some follow-up questions worthwhile. This reflection led me to update my list of prepared questions, adding a query that addressed Ada's concern when I later met with Charles for his first interview session. This feeling of a lack of input became a recurring topic throughout the following interviews and ultimately formed a pillar of my data analysis.

Participant Object Elicitation

Object elicitation is based on the idea of asking a participant to pre-select and insert an object into a research interview (Harper, 2002). The difference between interviews using objects and interviews using words alone lies in the ways we respond to these two forms of symbolic representation. People assign meaning to objects; consequently, these objects can be thought of as repositories of meaningful human experience. The use of object elicitation fit within this study's theoretical framework of symbolic interactionism, as it provided evidence and insight into the meanings that are attached to participants' interactions with other people and their environment. Object elicitation can provide insights into the literal relationships between people, objects, and attitudes. Turkle (2007) states that these insights from an object's "ability to provide a window into singular or shared understandings of particular issues and how people interpret and signify the realm of social action and meaning" (p. 14). Elicitation is based on the view that people have meaningful experiences and form emotional responses throughout the course of their lives that they may have a difficult time expressing. Turkle (2007) also asserts that objects can be

thought of as storage mechanisms for emotional content and lived experiences. In short, these objects can serve as proxies for human experiences and emotions and can sometimes open a dialog beyond that of pre-prepared questions.

I provided the following guidance when the participants shared their objects for elicited conversations:

1. Please describe this object and explain why you chose to bring it today.
2. Tell me about the connection between this object and your experiences as a classroom teacher during a 1:1 computing device initiative.
3. Tell me about specific experiences that are connected to your object(s).
4. Is there anything else you would like to share about your object(s) or experience?

I transcribed each interview during the week it was completed to ensure the information and experiences were fresh in my mind. I also performed member checks with the participants for the purpose of accuracy soon after each transcription was completed. Additionally, I performed preliminary data analysis in between interviews and any other data collection methods to inform subsequent interviews.

Ada chose to bring one of her early paper gradebooks[2] to our meeting. She joked that "it was amazing that I hadn't trashed this relic years ago." She explained that this particular gradebook was over 15 years old and was from, as she pointed out, "a different era." Ada remarked on how much teaching with technology had evolved over time:

[2] Ada was concerned about privacy issues related to the gradebook. Consequently, I have included parts from the elicited conversations rather than a picture of the gradebook.

> When I first started [teaching], computers were something down the hall in a lab. Then it moved into the classroom and was something I could use to make my life easier. Eventually, I was expected to use it to make my lessons better [or more] interesting. Now it's something we're supposed to help the students use.

The gradebook provided a tangible example of how much she felt things had changed over the course of her career. I found it interesting that although her rhetoric frequently referenced the students, much of her story was inwardly focused on how she had experienced this change.

Charles selected an example of a favorite digital document[3] of a recent student's work. He had just completed a lesson that was modeled loosely around the idea of project-based learning and was particularly pleased with how it turned out. He commented, "This is something that we never could have done before the 1:1." He explained that during this particular assignment, students had been expected to be researchers and, to some extent, make their own meaning of the topic. Charles relished the idea that the students were able to be more in charge of their learning. He pointed out that he had not attempted something like this before because of the difficulty in providing his students with all the different avenues that they might choose to explore. As he explained, "There just wasn't a way for me to prepare information ahead of time to let things go where they go." Having individual, Internet-connected devices broke down that barrier for Charles and allowed him freedom in lesson planning that he might not have otherwise have had.

[3] Based on his interpretation of district policies, Charles was unable to allow me to document this digital artifact.

Reflective Journal

A reflexive approach to the research process is widely accepted in much of qualitative research (Ortlipp, 2008). In this approach, researchers are urged to talk about themselves, "their presuppositions, choices, experiences, and actions during the research process" (Mruck & Breuer, 2003, p. 3). Reflective practice such as this aims to make visible to the reader the constructed nature of research outcomes, a construction that "originates in the various choices and decisions researchers undertake during the process of researching" (Mruck & Breuer, 2003, p. 3). The reflective journal proved to be a valuable tool for reflection and the organization of my thoughts throughout the data gathering and analysis process, as it did during the pilot study. One way in which the journaling process was especially valuable to me early in the process was helping keep my ideas orderly and documented. This proved true while I worked to solidify my choice of substantive framework early on in the process (see Figure 3.2) and while I struggled with the collected data not matching my preconceived notions (see Figure 3.3).

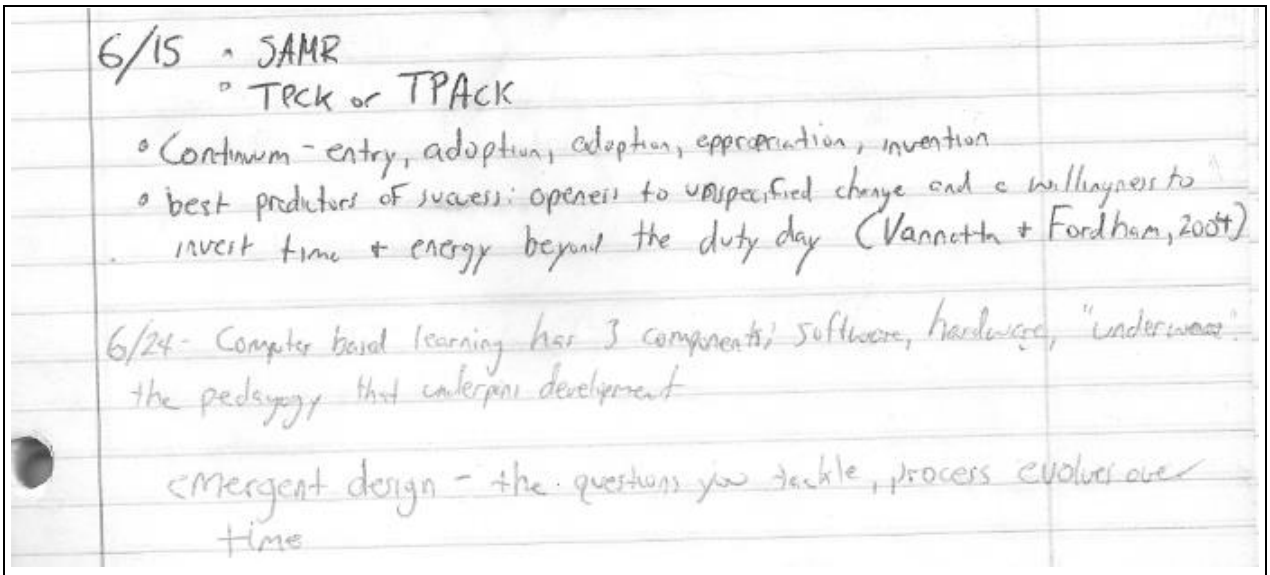

Figure 3.2. Researcher notes on possible substantive frameworks.

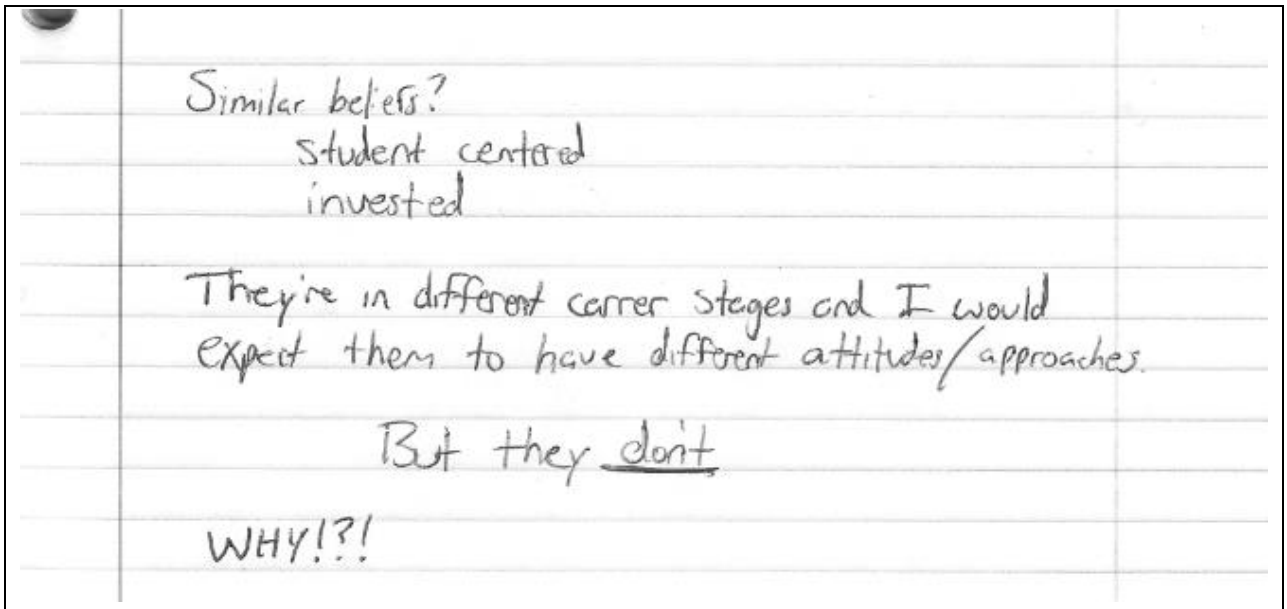

Figure 3.3. Researcher notes on conflicting expectations.

If it had not been for my journal, I am sure that many of my passing thoughts would have been lost to the ether.

Participant Observation

Extended periods of observation in the field define both anthropological work dating from the 1920s and fieldwork sociology originating in the Chicago School tradition of the 1930s (Schwandt, 2007). In fact, observation has been characterized as "the fundamental base of all research methods" in the social and behavior sciences (Alder & Alder as cited in Denzin & Lincoln, 2013, p. 151). Observation as a method of gathering data about human experience is characterized by the following traits:

- Event, actions, meanings, norms, and so on are viewed from the perspective of people being studied.
- A premium is placed on attention to detail.
- Events and actions can be understood only when they are set within a particular social and historical context.
- Social action is regarded as processional and dynamic, not as a set of discrete events.
- Efforts are made by the observer to avoid premature imposition of theoretical notions on participants' perspectives, although some general theoretical framework initially shapes the making and interpretation of observations. (Schwandt, 2007, p. 211)

Participant observation includes not just human activities, but also the settings in which they take place (Denzin & Lincoln, 2013). Therefore, using participant observation as a source of data was essential to deliver the descriptions necessary to document the context in which the activity is

occurring. As the observations occurred in the teachers' classrooms, I made a conscious effort during the recording of data to account for the students present as indirect participants.

Direct descriptive observations took place two times with each participant throughout this study. I made a conscious decision to conduct two shorter observations with each participant rather than a single longer one in order to provide temporal separation of the data collected. Descriptive observations occur whenever a researcher looks at an activity and tries to record as much as possible (Spradley, 1980). While recording observation data, I utilized a structure designed for note taking and organization of observations. Spradley (1980) identifies nine dimensions to describe what is going on in a social setting such as a classroom. The descriptive observation matrix used for this study considered Spradley's dimensions:

- space (the physical place)
- actors (the people involved)
- activity (a set of related acts people do)
- objects (the physical things that are present)
- acts (the single actions that people do)
- event (a set of related activities that people carry out)
- time (the sequencing that takes place over time)
- goals (the things that people are trying to accomplish)
- feelings (the emotions felt and expressed)

I used these nine dimensions during the classroom observations to focus and organize my attention. After each observation had concluded, field notes were re-written in a descriptive narrative of the situation. Figure 3.4 presents the written narrative from my first observation with Charles as an example of this process.

Observation #1 Charles:

- ~45 minutes (1/2 a class period)
- 24 students, 1 teacher, 1 para.
- The room is arranged with an interactive Promethean board marking the *front* of the room. The teacher's desk of in the front corner. A student desk is pulled over and sits touching it. I did not see a student use that desk during the observation.
- There are six round tables equally spaced throughout the room. Students sit four to a table, but in a way in which minimizes their backs being turned to the front.
- I joined the class already in session. Students are finishing a project that was started in a previous class. Some students are finishing and getting feedback from Charles. If their work is sufficient, he takes their paper and directs them to complete a self-directed assignment using their Chromebooks for extra practice. Several students appear to be playing games on their computer once they've reached that point, but some go to the assigned website. The off-task students aren't redirected unless they are loud or distracting. Charles cycles students through sessions at the small group table at the front of the room in between answering questions, checking work, and managing behavior.
- The vibe in the room is comfortable. It is not quiet, but it isn't overly loud either. Most students appear to be on task at any given point, although there are two that need consistent attention from the para and Charles.

Figure 3.4. The descriptive narrative generated from the first observation of Charles.

In summary, the data collected for this study were derived from interviews, participant object elicitations, reflective journal entries, and observations. They were appropriate sources of data for this study, yielding valuable information and facilitating a deeper look into the daily experiences of the teachers as they adopted 1:1 student technology into their practice.

Data Management

Qualitative studies involve the gathering, managing, and analyzing of multiple sources of data. As illustrated in the data inventory, the data that were collected, organized, managed, and handled during this study were audio recordings of interviews, transcripts of the interview recordings, member checks, peer debriefings, and my own researcher's journal.

All interviews took place after participants gave verbal consent, and they were recorded using an electronic recording device. The recording device was positioned in a manner that deemphasized its presence in an attempt to help the participant feel at ease. Upon completion of each interview, the recorded session was uploaded to my password-protected Google account, and the unsecured original was deleted from my recorder. Interviews were transcribed by the researcher using the web-based app oTranscribe. After transcription occurred the text was copied into a Microsoft Word document and member-checked with the participants. This is an important step, as Glesne (as cited in Patton, 2002) notes that obtaining the reactions of the participants to your working drafts may verify that you are reflecting their perspectives and help develop new ideas and interpretations.

I had anticipated using NVIVO data management software to help manage the volumes of data collected for this study. However, due to the high learning curve required for the software, I opted instead for a more improvised approach.

I coded, labeled, dated, and electronically organized each piece of data as it was collected and finalized. The originals of all files were kept, along with any edited versions. Pseudonyms were assigned to the participants early in the study, and I referred to them using such names in all transcripts and in my researcher journaling in order to further maintain confidentiality.

Data Analysis

The data analysis process started for me, as suggested by Weiss (1994), right at the moment when I began to listen to the interviewees' words, and perhaps maybe even from an earlier point of conceptualizing the study. From that point forward, my goal remained to understand the material and to try to gain clarity about what I was listening to, what I was learning, and what questions I still had, which helped me shape future interviews.

The data collection and data analysis processes overlapped throughout this study. Creswell (2007) states, "data analysis can be conducted as an activity simultaneous with data collection, data interpretation, and narrative reporting writing" (p. 217). Throughout this analysis, I examined and distilled the information to note patterns, and develop categories and themes. The data collected from participants' experiences and perceptions were then examined to ultimately identify prominent themes.

Informed by insights gathered from a prior pilot study I conducted (Richmond, 2015), I analyzed the data using inductive analysis techniques. Inductive analysis "involves scanning the data for categories of phenomena and for relationships among such categories, developing working typologies and hypotheses on an examination of initial cases and then modifying and refining them on the basis of subsequent cases" (LeCompte, Preissle, & Tesch, 1993, p. 254). As the name implies, inductive analysis relies on inductive reasoning, in which themes are developed from the raw data through repeated examination and comparison. Developing salient themes requires working closely with the data in order to maintain familiarity and obtain in-depth understanding. In doing so, I started with what, to me, was the more concrete components of the data and progressed until I achieved more abstract units of information.

This process includes at least two rounds of qualitative data analysis, during which the researcher analyzes and chunks the information while working to ultimately develop salient themes that could inform the study's research purpose and questions. These two rounds are described below as first cycle and second cycle (Saldaña, 2013). Figure 3.5 summarizes an overview of the process in a visual manner.

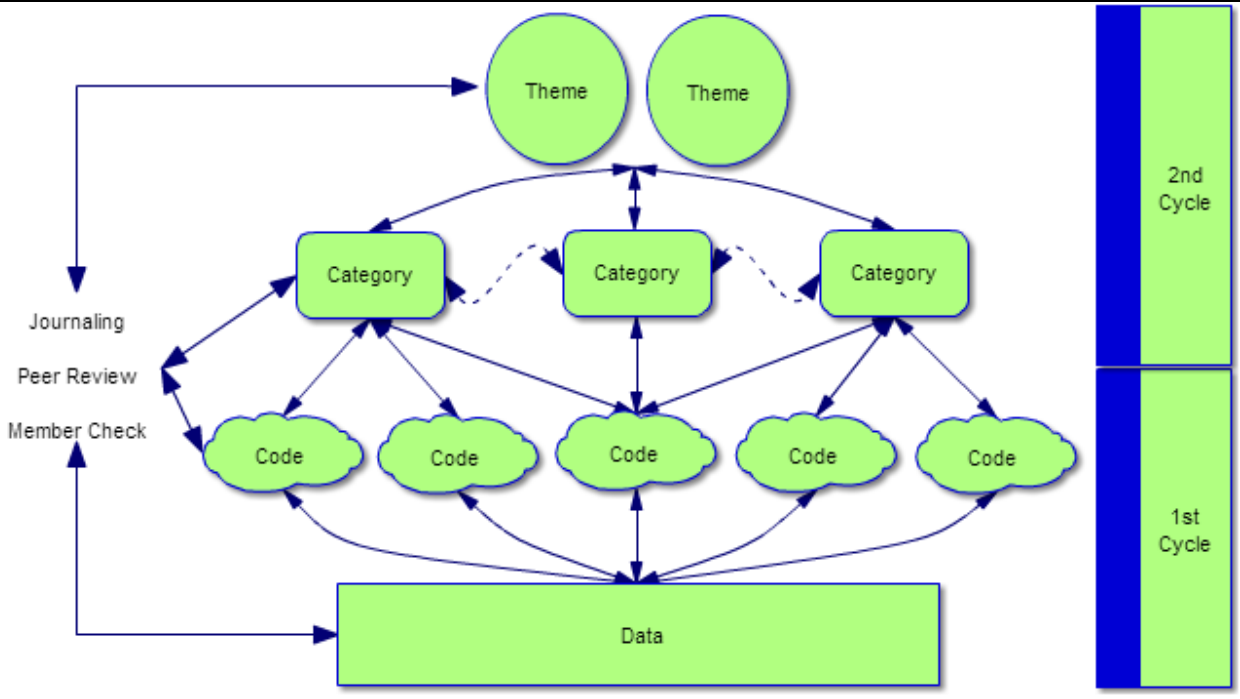

Figure 3.5. A visual representation of the inductive analysis process.

I began conducting my inductive analysis by organizing the raw data through a multi-step process known as coding. This process often requires repeated reading of the material, during which the researcher applies codes to the data in an effort to organize and interpret the information (Given, 2008). Saldaña (2013) defines a code in qualitative research as a word or short phrase "that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (p. 3). As mentioned earlier, coding for

this study was divided into a first and second cycle. First cycle coding consisted of familiarization and broad chunking of the data. Second cycle coding was then more focused as I developed cross-cutting ideas and themes.

I opened my analysis with in vivo coding as my chosen first cycle coding method. In vivo coding is the practice of assigning a label to a section of data, such as an interview transcript, using a word or short phrase taken from that section of the data (Schwandt, 2007). This particular method of coding involves selecting a significant word or short phrase from a participant's actual words found in transcripts and noted during descriptive observations (Saldaña, 2013). The aim of creating an in vivo code is to ensure that concepts stay as close as possible to research participants' own words or terms because they capture a key element of what is being described. In vivo coding is appropriate for researchers wishing to "prioritize and honor the participant's voice" (Saldaña, 2013, p. 264). I decided to use in vivo coding as my first cycle coding method (Appendix I), as I desired to honor my participants' words as much as possible since my study is about the experiences and perceptions of individuals. Also, this was a method that I was most comfortable with in light of my limited experience.

I completed this process by transcribing each interview and my notes from each observation into a Microsoft Word document. I then identified codes by highlighting them. Once I had transcribed and coded all three interviews with and both observations of each participant, I compiled the files and saved the final product under a name that helped me easily identify the participant data and the cycle of coding.

Next, I employed descriptive coding (see Table 3.2). Descriptive coding condenses the basic ideas of a passage or document segment into a short word or phrase (Saldaña, 2013). This method of coding "provides an inventory of topics for indexing and categorizing" (Saldaña,

2013, p. 262). In a pilot study (Richmond, 2015), descriptive coding helped provide a deeper understanding and a solid basis for the next round of coding. Descriptive coding was appropriate for this study because it facilitated my process of attributing more significant meaning to the data.

Table 3.2
Descriptive coding

In vivo text	Descriptive codes
I think the biggest thing tech has done for me is that I keep more current on grades	benefit of tech
I'm scared this will be harder to do	apprehension
I use computers, but it's hard.	lack of agency
I'm concerned about kids being off-task	off-task behavior

Second cycle coding followed the first cycle phase. Second cycle coding methods are advanced ways of reorganizing and reanalyzing data coded through first cycle methods (Saldaña, 2013). These methods enable the researcher to more easily organize and group similarly coded data into categories because they share some characteristic (Saldaña, 2013).

During second cycle coding, I reorganized and reanalyzed the findings I obtained during the first cycle. Within the second cycle coding, I primarily used the pattern coding and focus coding methods (Saldaña, 2013). Pattern coding develops "the 'meta-code'—the category label that identifies similarly coded data. Pattern codes not only organize the corpus but attempt to attribute meaning to that organization" (Saldaña, 2013, p. 209). During focused coding the researcher "searches for the most frequent or significant

codes" (Saldaña, 2013, p. 213) to develop the categories of the utmost relevance in the body of data. Both pattern coding and focused coding fit effectively into the in vivo process and assisted in developing codes into categories, allowing me to organize the body of data and to make meaning of it as I placed the data into similar groups (Saldaña, 2013).

Before the final categories were assembled, many of the previously generated codes needed to be recoded with more accurate words or phrases, merged together because they were conceptually similar, or discarded due to redundancy or lack of utility. During this stage, I looked within and across categories to identify broad patterns in order to identify themes. While examining categories, I prompted myself with questions and engaged in free writing and reflection to gain insight and perspective. The primary objective during second cycle coding was to look for salient patterns that eventually could become themes (Saldaña, 2013). After free writing around the codes and categories, I was able to develop three overarching themes, along with numerous subthemes addressing the research questions. This was an intuitive process without any discernible steps other than engaging with writing as a form of inquiry and analysis. Once I began to write around and across salient categories, I then conducted an analysis of what I wrote, highlighted the most powerful statements and identified the patterns from my writing to determine the themes.

Ethics and Reciprocity

In any research, ethical concerns are of paramount importance. Regulations for research are established by the federal government to protect human subjects in all research, including biomedical, behavioral, and social issues common to social science research. These regulations protect subjects from harm, ensure the right to privacy, allow for informed consent, and confront

the issue of deception (Merriam, 2009). This study was guided by the procedures and policies in place at Kansas State University. Prior to beginning this study, I obtained approval from the Institutional Review Board at the university. Additionally, representatives from the participating school district were asked to grant permission prior to beginning. According to Creswell (2007), "permission needs to be sought from human subjects review board, a process in which campus committees review research studies for their potential harmful effect on and risk to participants" (p. 123). As the participants shared both the positives and the negatives of their experiences, there was a chance that they disclosed sensitive information that could negatively impact their careers if the information ended up reaching the wrong people. With this in mind, I conducted this study with the participants' confidentiality as a primary concern. The participating school district, school, and teachers remain obfuscated throughout this text. I utilized pseudonyms and fictionalized details when possible to help ensure participants' confidentiality. I also recognized that I needed to use discretion when discussing my study with others in order to protect the identities of the participants. Furthermore, I understood that my participants reserved the right to back out of the study at any point without penalty and made sure they were involved throughout the study. This provided an opportunity for them to review what was being written about them and also added a layer of trustworthiness and rigor to the study.

The researcher-participant relationship was as reciprocal as possible. This refers to a relationship in which each party contributes something the other needs. The participants devoted their time, effort, experiences, and insights to the study, while my interest and analysis introduced vulnerability to participants' lives and facilitated understanding (Harrison, MacGibbon, & Morton, 2001). Reciprocity involves give and take. One way researchers can

respect this dynamic is to be clear about their obligations, what it is they hope they have given or will to give to their participants, and what it is that they are taking.

Through the careful use of self-disclosure, my interviews became more like conversations. By asking the participants to examine field notes and early analysis, I shared some of my power with the participants and remained open to their feedback even if it meant challenging my perspective. By engaging them in member checks as a means of ensuring trustworthiness, I helped involve them in their own investigation of self. Through collaboration with my participants, it was possible to "both develop more and better data" and "advance emancipatory theory and empower the researched" (Lather, 1997, p. 286).

Data Representation

Reporting the findings of a qualitative study involves presenting a detailed description that takes the readers into the setting that is being provided (Patton, 2001). As such, my findings were reported as a thematic analysis (See Chapter Four).

Thematic analysis is the most common form of analysis in qualitative research (Guest, 2012). It emphasizes pinpointing, examining, and recording patterns or themes within the data (Braun & Clark, 2006). Themes are patterns across data sets that are important to the description of a phenomenon and are associated with a specific research question. Thematic analysis is performed through the process of coding, usually in several stages, to create meaningful patterns. These phases, though not necessarily linear, may involve familiarization with data and initial codes, developing themes, reviewing themes, refining and naming themes, and producing the final report (Braun & Clark, 2006).

My decision to present the data as I did in Chapter Four is due to the fact that case studies are traditionally presented based on the number of cases that are part of the study. In this

instance, I chose to use in-depth participant profiles, thematic narratives, and cross-unit comparison to present the data. Representing the data in this manner allowed me to portray the participants' experiences in a way that compared and contrasted their perceptions and accurately represented their perceptions as they negotiated the demands of teaching in a school during a 1:1 student computer adoption. In order to support my analysis, I integrated excerpts from the interviews and other data sources as evidence of the findings.

Trustworthiness and Rigor

Assessing the legitimacy of findings requires readers to make judgements about the trustworthiness and rigor of the research in relation to the appropriateness of the methods undertaken and the integrity of the final conclusions. Unfortunately, there is no universally accepted consensus about the standards by which such research is to be judged (Tracy, 2010). In fact, there are many different established criteria for qualitative goodness (Dadds, 2008; Lincoln & Guba 1985; Richardson, 2000b). The variety of concepts for qualitative excellence illustrates the complexity of the qualitative methodological landscape. Considering this complexity and lack of consensus, demonstrating trustworthiness and rigor when undertaking qualitative research can be particularly challenging for a novice researcher. Recognizing this need, Tracy (2010) presents eight criteria for considering qualitative quality. According to Tracy, high-quality methodological research exemplifies the following: a worthy topic, rich rigor, sincerity, credibility, resonance, significant contribution, ethics, and meaningful coherence. While not a comprehensive list, these eight criteria can provide a starting place when looking to evaluate the quality of qualitative research.

As highlighted by the previous eight criteria, a research study's topic of investigation is important. Good qualitative research covers a topic that is relevant, timely, significant,

interesting, or evocative (Tracy, 2010). Worthy topics can emerge from disciplinary priorities, societal needs, or personal events. In the case of this study, the topic was worthy because technology integration is a disciplinary priority in the field of education (Cuban, 2013a).

High-quality qualitative research is marked by a rich, descriptive abundance (Tracy, 2010). A good qualitative study uses sufficient, abundant, and appropriate theoretical constructs, data, samples, context, and data collection and analysis processes (Tracy, 2010). Weick (2007) notes that descriptions and explanations that are rich are "bountifully supplied, generous and unstinting" and that richness is generated "through a requisite variety or theoretical constructs, data sources, contexts, and samples" (p. 16). A thoughtful, transparent, and methodical study provides a solid foundation for deciding whether a study appears to be reasonable and appropriate. To this end, Tracy suggests that researchers provide evidence of their due diligence, exercising appropriate time, effort, care, and thoroughness. Rigor can be reinforced through care and transparency during the data collection and analysis procedures. In this regard, I engaged in rigorous data analysis by providing the reader with an explanation of the process by which the raw data were transformed and organized into the final research report. Qualitative research is a highly reflexive process that requires continuous scrutiny of and reflection on the data, the researcher, the participants, and their environment (Guillemin & Gillam, 2004). Therefore, journaling before, during, and after the study was tremendously important for establishing trustworthiness and rigor (Bhattacharya, 2007). By using a variety of data sources, spending the necessary time to gather significant data, and providing transparency throughout the research process, I ensured that this study had rich rigor in both its descriptions and in the chosen methods of data collection and analysis.

Sincerity means that the research is "marked by honesty and transparency about the researcher's partiality, goals, and foibles as well as about how these played a role in the methods, joys, and mistakes of the research" (Tracy, 2010, p. 841). According to Tracy, this is achieved in two ways: self-reflexivity and transparency. Self-reflexivity empowers researchers to be mindful of their strengths, weaknesses, and preconceptions, while transparency refers to honesty about the research process (Tracy, 2010). Opportunities to help establish a sense of honesty can range from providing clear documentation and delineation of context, engaging supportive colleagues, and declaring funding sources. I achieved a level of sincerity in this study by being mindful of my subjectivities and by being transparent in how I claimed to know what I know.

Credibility refers to the trustworthiness and plausibility of the research findings (Tracy, 2010). Schwandt (2007) defines trustworthiness in qualitative research as the research's credibility, transferability, dependability and objectivity. Lincoln and Guba (1985) suggest that for a study to be trustworthy, it must be dependable. This dependability "is to some extent a function of the amount of time and effort that a naturalistic inquirer invests in repeated and continuous observation" (Lincoln & Guba, 1985, p. 109). I used multiple sources of data, temporal separation, peer debriefing, member checks, and triangulation as techniques in my study to establish credibility. My data collection approaches of several semi-structured interviews, object elicitations, and other anticipated data sources afforded opportunities for triangulation through multiple perspectives. The peer debriefings gave me an opportunity to test my interpretations and findings with an outside perspective (Lincoln & Guba, 1985). Finally, the credibility of my study was enhanced by member checks that took place throughout data collection, data analysis, and dissemination of the findings. All of these techniques were necessary to produce a quality and trustworthy research study.

Resonance refers to the research's ability to meaningfully affect an audience (Tracy, 2010). The research has resonance if it influences, affects, or moves particular readers through naturalistic generalizations, transferable findings or aesthetic, evocative representations. Every qualitative study does not need to resonate in the same way, but all quality studies must have an effect on their audience (Tracy, 2010). One way a study can achieve resonance is through transferability. Transferability is achieved when readers feel as if the story of the research overlaps with their own life in some way (Lincoln & Guba, 1985). It was my intention that readers, through the rich descriptions presented, would be able to reflect on the role of change in their own lives and that the experiences of the participants in this study may help readers understand something about their own situations.

A good qualitative study contributes to understanding in some way (Tracy, 2010). The contribution could take the form of one or more of the following understandings: conceptual, practical, moral, methodological, or heuristic. Such contributions can offer new understandings, move people to further explore the subject, shed light on a contemporary problem, engage in a moral critique, or introduce new methodological approaches. I believe that this study is practically significant in the sense that the knowledge is useful and frames a contemporary problem. Pedagogical change brought about by technology integration in the classroom is a contemporary issue in education. The findings of this study could be useful in creating programs to help facilitate such change.

Ethics are not just a means to establish trustworthiness and rigor, but rather constitute a goal of qualitative inquiry itself (Tracy, 2010). A study is deemed ethical when the research shows evidence of consideration of the different elements of ethics, such as like procedural ethics, situational and culturally specific ethics, relational ethics, and exiting ethics (Tracy,

2010). I discussed many of the elements of procedural, situational, and relational ethics in the earlier section on ethics and reciprocity.

The final of the eight components of Tracy's (2010) conceptualization of qualitative quality is meaningful coherence. Studies that are meaningfully coherent interconnect their research design, data collection, and analysis with their theoretical framework and end goals. She specifically describes these studies as those that "(a) achieve their stated purpose; (b) accomplish what they espouse to be about; (c) use methods and representation practices that partner well with espoused theories and paradigms; and (d) attentively interconnect literature review with research foci, methods, and findings" (p. 848). In short, meaningfully coherent studies logically accomplish what they claim to be about. I worked towards meaningful coherence by being purposeful and taking care that my study hung together well. I ensured that the reviewed literature situated the findings, the findings related to the research questions, and that the conclusions and implications meaningfully interconnected with the data presented.

Although there is no universally accepted terminology and criteria used to evaluate qualitative research, I have briefly outlined some of the strategies that can be used to establish the trustworthiness and rigor of study findings. In order for qualitative research to be considered legitimate, it must have the elements of trustworthiness and rigor; or, at the very least, the researcher must be able to justify the quality of the study. I have provided an overview of Tracy's (2010) eight characteristics for considering the quality of a study, along with examples of how this study incorporates each component. In order to do good research, it is necessary that qualitative researchers consciously incorporate strategies to enhance the credibility of a study during research design and implementation.

Chapter Summary

In this chapter I reintroduced the purpose of this study, examined my role as a qualitative researcher, and situated myself in regard to my subjectivities. I argued that whole subjectivities are important to disclose in qualitative research, but acknowledged that doing so does not absolve me of critical interrogation of my positionality and interpretation of data. Following this, I unpacked symbolic interactionism, a methodological framework that guided the study and provided a lens through which I examined the findings. I identified 1:1 computing as the symbol with which the participants interacted and developed their meanings within the context of this technology integration intervention. Next, I summarized the research design of this investigative case study through the descriptions of data collection, data management, data analysis, and data representation. I argued that even though holistic case studies could be difficult to conduct, I identified some of the ways in which I attempted to be comprehensive in my inquiry, acknowledging the limitations of researcher access, time, and other resources. Additionally, I detailed processes of the inquiry to demonstrate both tangible and intuitive ways in which qualitative research is conducted. Thus, in my effort to remain transparent, I disclosed what sometimes cannot be expressed via language completely. Finally, I addressed the issues of ethics, trustworthiness, and rigor in consideration of conducting good, credible research, highlighting the varied thoughts and complexity of the terrain of qualitative research.

Chapter 4 - Findings

The premise of this study is that teachers can provide valuable understanding concerning 1:1 computer adoptions, as they are one of the primary instruments in its success (Ertmer, Ottenbreit-Leftwich, & York, 2007). Through their descriptions of past and present experiences, participants Charles and Ada made meaning of their work regarding the three knowledge domains: content, pedagogy, and technology.

This chapter presents the findings and thematic analysis stemming from the interviews and observations with the participants. The data were analyzed through the lens of the TPACK theoretical framework and in relationship to the research purpose and questions. Furthermore, the methodological framework of symbolic interactionism provided an additional lens through which I examined the data. Symbolic interactionism grounded my analysis as I explored how the participants created meaning, how they presented and constructed their identities, and how they defined their interactions with technology.

This study was conducted according to the single case study methodology. For the purpose of this study, the case was bounded by a single school's implementation of a 1:1 computer initiative and investigated through the units of two classroom teachers as they participated in the adoption.

This chapter represents the findings of the study in two broad ways. First, I provide a descriptive and analytical illustration of each of the two participants and situate their profiles and experiences using the TPACK framework. Note this mapping of the participants' experiences on the TPACK framework represents insights from data analysis, therefore, it is both a descriptive and analytic narrative. Additionally, these mappings are also informed through a symbolic interactionist perspective to yield analytical insights. Within this mapping I include, a broad

description of each participant, their training and duration in the field, and background information. Next, I offer pedagogical stance of the participants and map it onto the TPACK framework. Therefore, this section is both descriptive and analytical. I then proceed to map the participants' use of TPACK in the classroom and their evolution as framed by TPACK specifically, and symbolic interactionism broadly. To summarize analytical insights gained, I compare and contrast the participants' profiles to help situate the reader within their experiences. The second type of finding in this study includes composite thematic narratives of the participants, embedded with descriptive details, analytical insights, and discussion of key points as appropriate.

Site Description

The site for this study—Boolean Middle School—was purposely selected because of its ease of access. Boolean MS part of an ethnically diverse, urban school district. Approximately 80% of the students at Boolean qualify for the federal free and reduced lunch program. While the student population is roughly 60% minority, over 90% of the staff is white. Historically, the administration and staff at Boolean have had a large degree of building-level and grade-level autonomy in which to make decisions. This is beginning to change with the addition of the district's new superintendent, but largely still holds true at the time of this study. Finally, staff received little formal training and few opportunities for input prior to the 1:1 adoption. While the district leaders' preparations where likely in motion earlier, the staff learned of the adoption in the late spring with the student's getting devices the following fall.

Participants

The two participants for this study—Charles and Ada—were purposely selected because they occupied different ends of the spectrum in regard to career experience. They also matched

the other important selection criteria for this study, as both were classroom teachers at the time, worked in the same school, and were willing to actively participate in the study.

Participant Profiles

In this section I consolidated the participants' words and developed them into brief narrative profiles filtered through the lens of the TPACK framework and Symbolic interactionism. The purpose of these narratives is to provide context and insight into the participants' backgrounds, experiences, and orientation to technology as educators. The profiles are representative of the participants' range of pedagogical practices and technology integration. They are intended to illustrate each participant's pedagogical, content, and technological knowledge (three domains of knowledge), and the ways in which they describe that knowledge. The profiles provide a comprehensive picture of the intersection of the three domains of knowledge.

Symbolic interactionism is the guiding methodological framework for this study. Researchers using symbolic interactionism seek to answer how people create meaning, how they present and construct their identity, and how they define situations with others. Therefore, I chose to write each participant's narrative profile in first person because this enabled me to stay close to the data and to represent their experiences using verbatim excerpts from the interviews when possible. The profiles are structured into four units. The opening part of each narrative is a brief orientation of the participant. The next section, the participant's pedagogical stance as informed by TPACK, provides examples of the core beliefs and philosophy each participant holds about teaching and learning. Although the participant did not use the language or framework of TPACK specifically in their words, it is my analytic representation of the participants' relationship with the tenets of TPACK. However, the first-person narratives that are

presented are done with verbatim accounts of the participants while I draw from those composite narratives a mapping on the TPACK framework. This is significant, as many researchers have noted the importance of a teacher's pedagogical stance on his or her adoption and use of technology (Drayton et al., 2010; Ertmer & Ottenbreit-Leftwich, 2010; Silvernail & Pinkham, 2011). The third section, TPACK in the classroom, explores each teacher's beliefs and practices regarding integration of technology. The final section of each participant's narrative provides examples of the changes in practice identified by the participants as they became more proficient with technology integration.

Charles

Charles is an energetic, white teacher in his mid-twenties and is finishing his sixth year teaching at Boolean Middle School (pseudonym). Teaching is Charles's first professional career. Originally, he attended college to be an accountant, but then changed his focus his sophomore year after he was hired as an after-school tutor at the local high school. He holds an undergraduate degree in mathematics education from a local state university and has spent his entire career at Boolean Middle School. In addition to his teaching duties, Charles coaches girls' basketball and track. He represents his content area of mathematics on Boolean's school leadership team and is involved in different initiatives in the building, such as being the designated PBIS trainer and grade-level representative on the school improvement team.

Charles's pedagogical stance[4]. I don't remember middle school ever being anything like it is now. The resources we have access to are just so different than what was around when I was

[4] Written in Charles's voice using a composite of information shared from interviews.

in school. The way we're expected to teach is totally different than what I remember, too. I remember sitting in rows, listening as the teacher demonstrated three examples, and then silently working on my 25 practice problems every day. I think the kids would mutiny if I tried something like that.

I do think we're much more in tune with how the brain works than we used to be. There's plenty of research out there that says that ten minutes of me talking is a lot of time before we really need to change gears. It doesn't matter if I have them physically do something, talk about something different, or just change gears a little. I don't pass out papers anymore. Instead, I put piles down and the kids come up and get the papers just so there is a movement break. At least, that's what I do when I'm not handing the assignment out digitally.

We talk about that beautiful ten-minute window a lot at Boolean MS. Basically, I don't count on students paying attention to any one thing for more than ten minutes. For example, if I am going to have a 60-minute class, I'll break it up into five or six different things. It's not always the case—that clean, I mean—but it gives me something to shoot for. After ten minutes, you might have to talk to your partner about what we just learned, you might have to change gears and do some work on what we just talked about, or you might just need to get up and move.

There's a bigger emphasis on scores and performance than I remember in school. That said, we give fewer tests and graded assignments than we used to. We still have grades, of course, but our assessment is generally expected to be formative and *doesn't count*, as the kids like to say. So, we do a lot of check-ins. We correct homework and analyze it and we tell the kids that their job is to make corrections. If they can figure out where the mistake was, we're all

set. If they can't, their job is to come ask for help. We talk a lot about student responsibility in learning.

Too often, kids think you have to memorize everything, and that fast math is good math. This just isn't true anymore, I don't think. Information is cheap. The trick is in learning how to find what you need and use it. Technology has really changed the whole paradigm. I think sometimes this emphasis on memorization actually can really cause some fear and anxiety in students. Like, if they don't get all 60 of their math facts, or whatever it might be in that minute, then they'll never be productive adults.

We don't teach kids to cross multiply and divide anymore. That's how I learned to solve proportions. I mean, of course we do to some extent, but we try to go beyond that because when they do that, they just follow that rote process and they don't necessarily think about what they're doing. Now at the end of the year, we might say, "Here's a shortcut to do it based on setting up two equivalent equations" and explain mathematically why that works, but we don't teach them that shortcut first. So, like I said, making meaning is a big deal in my class. Some of the kids know that a negative number times a negative number is a positive number, but they can't explain why. I place an emphasis on proving why. I don't just want them to memorize it.

I think about all of this, and it is an incredibly interesting idea to me, because it's really built around understanding the process of math and working with others. Don't understand something? Look it up or work with someone who does. It's a totally different world than I remember. This is one of the reasons I got rid of my desks and eventually got tables. We just didn't do row work. The majority of our math is collaborative work. The kids are encouraged to talk through some of the stuff and work together. When I was brought up, you were in rows, and you did it as fast as you could. I'd memorize stuff. I knew I could solve a proportion by cross

multiplying and dividing. I didn't know why it worked. I couldn't really explain the concept to anyone else. Now, I try to stress *collaboration* and *the why* in class. Then, I use some websites I've found to do the drill and practice work at their individual levels. I do think that makes for a better understanding of math.

There have been some cool articles out there about today's generation not having as good of an attention span as ours did. I saw an interesting counter to that recently. Someone was arguing that they actually do. Maybe what's changed is what interests them and how they show it. It's funny, because if you saw when we did the Hour of Code, there's a half hour of laser-focused, quiet time. Bam, and they're on it. They're doing some good math. They're having a good time with that math, and they are focused as can be. So, I do think our students' attention spans are no different than any other generation. I think they're just used to different presentations and different mediums for all this stuff. They're looking for the thing that does get their attention.

I would agree that maybe it's sometimes harder to get and keep their attention than it used to be; but when you get it, their attention spans are every bit as powerful as ours were. Some teachers are always complaining about how students are misbehaving using their computers. I think the deal is that this off-task behavior has always just been on the inside. Now we can sort of see the evidence, as kids click around on the computers, what is going on in their heads. We just couldn't see it when they didn't have anything in front of them. So, they're busy thinking about their interaction with the girl on the bus. They're thinking about missing lunch. It was just not always so obvious, you know? They were bouncing from thing to thing already. Now, they're just bouncing from [browser] tab to tab, YouTube video to YouTube video, or email to email.

TPACK in the classroom for Charles[5]. The emphasis seems to be on making things less teacher directed and more interactive and more kid directed than it was years ago when I was in grade school. The easy access to technology helps a ton. There are certain methods that we do that are more visual than others, and with the computers, kids can put up on the screen what they're doing and what they're thinking.

I like the idea that the technology now allows us to get to those discussions I was talking about earlier because it helps give variety in how students can represent their learning and in how I can present things in such a vast number of ways at the same time. This is opposed to, maybe, the old way that was so time consuming to do that we never get to the discussions. That's probably where the technology has helped the most, in my opinion. It allows us to talk more. It's not the end-all-be-all, but it's a tool, for sure.

Technology has also made it easier for students to work collaboratively. Take Google Docs, for example. It has made it so much easier to get and give feedback, as opposed to having to handwrite or type something up, hand it to someone, have them write all over it, and then take it back and start working all over again. Now students share a Google Doc, and there's a feature in the app where their audience can just go in and make a comment or suggestion right there. Then, it is up to the student whether they choose to ignore it or not. Learning, to me, is all about revision, revision, revision, and the revision process has been made exponentially easier with these machines and applications. I think that we see how much our kids can do with this over time. I know my students are better learners with these tools, and that makes me want to use

[5] Written in Charles's voice using a composite of information shared from interviews.

them more. Again, it's not just about the word processing, but it's about the access to information, the exemplars, the revision, the sharing, and the feedback. It's exciting, and it's contagious!

Students, I think, are much better speakers and presenters than they ever used to be because they're so comfortable sharing stuff now, and they share it on a lot of multiple platforms. It might not always seem like this is the case, because they share in a much more casual way than teachers are used to, but I think that's part of our new responsibility. We need to teach students how to make a valid argument and how to present themselves and their ideas.

Technology has also provided some sense of safety to the less outgoing students. I've had students who don't want to get up and share something in class, but they'll go home and videotape themselves or they'll design something. It takes the pressure to perform off. If they mess up, they can just delete it and try again. That's a pretty cool middle step [to showing learning] that we never had before.

I'd definitely consider myself at least part way to innovator when it comes to using technology in my classroom. I can't call myself an innovator totally because I just can't always find a lot of the stuff that I'd like to on my own. There are just so many resources to sort through. Luckily, I have a great team to work with. I might get a text from someone saying, "Hey, check out this cool site." He doesn't have to show it to me. If [fellow math teacher] Fraley found it and likes it, I'm all in. We'll try it tomorrow. I don't even need to see if it works. I mean, I'm all in because of the level of trust. If someone on my team says it works, I'm going to run with it and at least give it a try. Besides, I don't always expect everything to work perfectly, anyway. Where would the fun in that be?

We have to kind of thin out what we want to use because we have a lot of things that are shared with us. I'm probably in that upper quarter of staff in relation to being tech savvy, but it's certainly a sliding scale depending on what we're doing. I'm a pretty good critic. I know what I like, and I have a pretty good idea of how it will work. I'm also not afraid to have something not work out exactly right. There's definitely a lens that I use. The first thing I consider is can I look at something and see how user friendly it would be for our students. For example, one of the biggest struggles we have in our school is that whole *reading for understanding* and *reading for comprehension* idea. One thing I consider when checking out a site is to look if it is user friendly and if they will understand what all the words mean because, in my experience, kids will scan and click. They'll scan and click without knowing why they're scanning and clicking. However, we want them to use this for understanding. So, one of the challenges is really getting kids to slow down.

Evolution of TPACK for Charles[6]. I think in the past three years, my lessons and my teaching, even my coaching, have become less teacher directed and more student directed. I mean, I've never been a huge lecturer, even in my first few years, but I've moved even more away from that recently. Technology has played a large role in supporting my shift. I haven't felt pressure to embed technology into everything I do, despite the computers. I think it's always been pretty clear that we *should* use it, and I think we've just gotten better at using it—though we've also gotten better at understanding why we need to.

[6] Written in Charles's voice using a composite of information shared from interviews.

I'm always reflecting on what I could've done differently. I guess the biggest thing I've noticed is that I have become more comfortable letting the students' interests inform the day's lesson. We were in a class the other day and a phrase came up. Without being asked, another student Googled it, and boom, had the answer. It made for a good conversation, and we went with it. That led us on another tangent. The students were interested, and I figured actually providing some context to what we were talking about couldn't hurt. It was a great teachable moment that wouldn't have been able to happen if we still had to visit the library to check out an encyclopedia. I like to think when I see something I like, I will use it; and because I see more things, I have a wider choice to pick from. I'm not sure if creative is the word that I would use, but I have more ideas to pick from and more ideas to stimulate what I might want to do. I'm much more willing to try more things because of the computers.

The problem is that the Internet is like a fire hose of information. You turn it on and you have to be able to not be washed away by it. I feel like we spend a lot of time now on this. It's hard for middle school kids to stay focused and use the powers of the Internet responsibly. It's really hard even for me. But the educators that are plugged in and turned on have helped me kind of realize that it's not as hard as it appears. You really can do it.

Originally, as with any new ideas, I think we tried to fit it in places where it didn't fit. We tried too much and we went overboard a little bit. And we realized that sometimes just having a book in your hands was okay. We're now really comfortable knowing this is a tool that's there. We don't need it if we don't need it. It's okay if we use it, and it's really fine if we don't use it. I don't feel the pressure to have to use it. I look at it as just another tool that I have in my tool bag. I think initially I tried to force it in places. It didn't make things more efficient. It didn't make the

learning better. At first, there were some math programs that it just took even longer to figure it all out than it did just to do it sometimes non-digitally.

Ada

Ada is an experienced, white teacher only a few years away from retirement. She has been teaching language arts at Boolean Middle School for seven years but has over 25 years of teaching experience. Ada actually began her career teaching music in elementary education, but eventually found her way to the middle school level and made the switch to language arts. She claims that the moody students are actually part of the appeal. Ada has a master's degree in theology in addition to her undergraduate degree in elementary education. She readily calls herself "old school" when discussing her beliefs about teaching and learning.

Ada's pedagogical stance[7]. I'm a strict disciplinarian. I believe in having a shared community of learners, but also in having rules that we all follow. That, to me, is a traditional teacher. It's more, "These are the expectations. We're here for a purpose. We need to do what we need to do."

I want to get better at what I do. I want to ask questions so kids have to work harder. So, I look at the kinds of questions that I ask to make sure I'm asking higher-level type questions. Sometimes it doesn't work. . . . the other thing that I constantly look at is, I didn't get the answers I wanted out of this question. Out of this test. What do I need to do? How can I perfect this? How can I change this, so that this is what I'm eliciting from kids?

[7] Written in Ada's voice using a composite of information shared from interviews.

I try to offer a variety of different assessments that appeal to different learning styles. My job, I feel, is to teach them to be able to interpret, to analyze, and to be able to convey that through writing. So, I do a lot of analysis in my teaching. Teaching them, modeling, reading it, doing some read-alouds, talking about how to do that, giving constructive feedback on responses so that they can see [their mistakes]. They're grade-driven, at this age. I hate it, hate it, hate it! I understand the standards much better than I do grades. But I know that they're two separate systems that I have to match, and I don't like that. I love to be able to say, "You're meeting the standard," because they all want to meet the standard. And when they don't, they're not there yet, that's really hard for them to hear. It's just developmental.

I'm not a real believer in tons of homework. I want them reading every night. If they do that, I'm really happy. I want them to follow through with something that I have introduced that needs to be practiced for the next day. But I would rather have them working in class so I can see what they're doing.

TPACK in the classroom for Ada[8]. I love that I can project something relevant, and I have the control and can ensure they are all engaged. I want to show them these cool things that I love. It's also great when kids are showing things, like projects and what they've done, and it's actually showing their learning.

I use the computers to give a couple kinds of feedback for writing conferences. They house their documents in their drive. When writing about reading, anything that has to do with the reading—a reading assessment, an analysis—they house it in their drive. My conferencing

[8] Written in Ada's voice using a composite of information shared from interviews.

with writing is usually through Google Docs, and I give feedback all the time that way. I wouldn't say it's easier, because I'm a paper-pencil person and I'd still prefer that. However, doing it this way is more efficient, I'd admit. It's also much more immediate for kids. They can make adjustments right there. I can chat with them while they're online. They will comment and make comments back to me. They can ask me specific questions. So, it's better for them, and I guess if it's better for them, then it's better for me. Whatever works for them that is going to get them to improve their practice works for me.

I still love the one-on-one conversations. I'm not going to tell you I don't. But sometimes, that's what they need. They need to be able to see things in writing. I know there are a couple of options online that kids can do that are auditory pieces that I have not practiced yet. But it's on my to-do list of ways to verbally communicate with kids. So those auditory learners can listen and not necessarily get caught up on the reading of feedback. Sometimes it's easier to have conversations.

I don't want to lose the essence of why this tool [Google Apps] is helpful. There's a lot of creativity that can be used with this. I like it all, but I want to see that there is an increase in the level of their thinking. And sometimes you're wowed by the presentation, but not the thinking. I don't really care about that. Do you know what I mean? The rigor isn't necessarily always there. Sometimes I don't know if they are actually engaged in the project that they're working on all the time that their screens are open. Are they flitting through other things? I don't know. It's that control piece for me. It offers too much unknown. There's just too many options tempting them to be able to see and utilize. I have to see their screens to be comfortable. I feel like I have to monitor all the time, and teachers aren't good at that when there are so many other things we could be doing.

You'd like to think that kids are honest in their work. It's not malicious, but they're kids. They might even think that what they told you is true, even though it's not. Early on, I got three emails from the tech people [student computers can be monitored remotely by the technology staff] saying this child was on this [site] and this one was on this [site], and this one here. It's nearly like it's personal. I feel disrespected because you're giving this tool to a child, and he's still a child.

Technology is great and has its place, but I definitely see some downsides. The time needed to use it effectively is definitely one. The constraints of the day mean that I only have so much time to try new things, and the amount that is required doesn't always pay back. Part of it is me and the kind of person that I am. I spend so much time looking at student work and preparing for class. Part of it is just who I am and the fact that I spend a lot of time just being a teacher.

It's also the distractions. It's not that I don't think that they're learning. I just have to build that trust, and that trust is a hard thing for me to do, because I understand how tempting all of this [technology] is. The management piece is big to me. Everything that we do is online, practically. I mean, when the Internet goes out, we're all like, "Oh my gosh! What do we do?" I mean, how sad is that? I'm like, "Wow! Wow! We can't do the assignment, because guess what? It's online research." It's just too funny and kind of sad. I mean, I like the access to the computers. What a tool they can be for kids! But it's a challenge. No question. It is a challenge.

I've noticed in years past that kids' focus seems to be decreasing. I don't think it's their ability. I think that they're just unwilling to focus. I say that because there are just rapid shifts of attention at all times. I don't think they read as comprehensively as they used to. I think they're used to skimming things. I think they have an appetite for endless entertainment and that

computer screens provide that. I just find that kids are not as willing to stay focused as they used to. I don't know if it's the 1:1 initiative, or it's just the generation now. I guess it's probably a variety of different things, but it seems that we identify more and more students with attention-deficit disorders.

Evolution of TPACK for Ada[9]. The whole experience [of school] is so much more advanced now than what it was when I first started teaching. I mean, what we expect kids to do and what teachers know how to do. How we manage our classes. We're moving to being able to do everything online. I never envisioned that. Yes, it has changed. I'm not so fearful of it. It's part of our culture, our society.

I have collected hundreds of files in cabinets over the years. One of my goals was to go through these and to pitch things that I didn't use. Turns out I could toss just about everything. It's not a tool where I store things anymore. So that piece is different; everything's online.

There's a lot that's different. The parental demands are different. We are constantly sending emails, mass emails home to parents about what we're doing in class. They can access our teacher page. They can find out exactly what kids have to do. There's no question what's expected for the next day anymore. I've been really trying to keep up with using technology to make my teaching more transparent for the families. I don't want to be one of these teachers that people talk about, saying she needs to hurry up and retire.

I can communicate with students more easily now, and they can communicate back. I can see a detailed history of their revision process. When I first started teaching writing, that was

[9] Written in Ada's voice using a composite of information shared from interviews.

harder. I can see the feedback and whether or not they've made the changes. I do love that piece. I didn't think I would at first. I kept printing everything and making my own copies. But then I realized I can't really keep doing that anymore. I have to be able to communicate with Google so I can see what I've written down. That piece would be something that I feel is a huge, huge advantage.

I'd like to get better at managing all of the folders and accounts. You attend workshops and you think, "This is cool." And I see it once. But again, I don't put time into practice like some people do. They go home and try it, and I'd rather garden, or things that I like to do, as opposed to explore and practice on those technology sites. However, I would like to better know all the tools that I have at my fingertips that could make my practice more organized and efficient. I'll look at other teachers and think, "Teach me that!" He's doing a Google Classroom, and he's doing all this cool stuff, and I think that'd be awesome. I am usually exceedingly well prepared for my lessons in what I'm going to do, but sometimes I'm into a class and think, "This would be great to try" or "I wish I could do this or that [technological integration]." I would have to spend time thinking of where do I go or how do I do this [integrate this technology in my teaching]. I wish I was better at that.

There have been some things [technological tools or strategies] that I come across and I think, "This would be kind of a neat idea." And my first reaction is to get my colleagues to buy into it, so that we all do it together. I just learn better that way. I could probably try it myself. I don't think I would get very far. I might get frustrated. Time might be an issue. But, if we said, "Okay, let's all meet on our next flex day—let's get together and talk," then I can see what other people think about it. It helps me a lot to have a common plan of how we're going to do this [integrate new technology] and how we're going to present this to the students. I'm just kind of

not necessarily gifted at all of that stuff; but there are certain things I can do, and by doing and learning with others, it makes me I feel I have something to contribute.

Profile of Ada and Charles: Similarities, Differences, and Contributions

Charles and Ada were purposefully selected as participants for this study because they, among other reasons, self-reported as being on opposite ends of the spectrum with regard to feeling comfortable using student computing devices in their practice. I made this decision because I believed that this dynamic could result in widely dissimilar perceptions of their reality of the 1:1 adoption, which would be fertile ground for discussion. Through the data analysis process, I found that their choices of emphasis, professional development needs, and general expectations throughout the experience were markedly similar, with the exception of feelings of control and self-efficacy relating to that initial level of comfort with integrating technology.

Ada referenced her own self-awareness of her lower level of ability and comfort, which marked her as an *other* by those in the district supporting and driving the 1:1 initiative:

> I realize that I'm not as good as they [the more proficient teachers] are. But we're all in the same building with the same expectations. We work with the same kids. We have the same goals. We're basically two sides of the same coin. I want to know the same things. Just talk to me a little slower and start at the beginning.

This illustrates her belief that, while her low personal comfort level placed her in a different stratum compared to more technologically proficient teachers such as Charles, it did not exclude her from being able to develop proficiency with the appropriate supports.

Charles similarly referenced this idea of going through the adoption, referencing an *us* and a *them*. When asked about district support, Charles responded that much of the provided professional development was "targeted at one side [of proficiency] or the other." He recalled

that often during whole-staff professional development he and the other tech-proficient teachers would be bored while the less tech-savvy teachers were looking overwhelmed.

Thus, for Charles and Ada, their 1:1 implementation journey was markedly similar. This is noteworthy because Charles and Ada appeared that they would have brought vastly different personal context to the experience. Both participants were dedicated, competent teachers and seemingly open to adopting new methods and tools, along with other student-centered practices, into their classroom. Each participant believed that using student devices in their instruction opened up new possibilities for learning and was vital to adequately prepare their students with the skills needed to be successful in the future. Additionally, Ada and Charles identified formal and informal professional development and collaboration as being integral to their experience. However, this is not to say that their narratives were completely homogenous. One instance in which the participants differed was in their comfort level and sense of agency in regard to incorporating technology into their pedagogy. I investigate these similarities and differences further in the following section.

Thematic Narratives and Cross-Unit Comparison

In this section I explore my chosen case through comparing and contrasting the experiences that Ada and Charles shared about their journeys through the first two years of a 1:1 student computing device adoption in their school. Recall the case was bounded by the 1:1 implementation of computers in a middle school with Charles and Ada being the units of analysis.

Based on the information they provided in their interviews and I gathered through observations, and my journal reflections, I summarize the recurrent details which I analyzed and coalesced into themes for consideration. While it is customary in traditional qualitative research

to offer a synthesized thematic narrative that identifies patterns across and within categories, I have chosen to describe the thematic narratives slightly differently from this traditional practice. Although I engaged in constructing themes by examining patterns across and within categories, I felt it would be important to demonstrate how specifically those categories informed the broad thematic narrative. Therefore, for each thematic narrative, I explain the overarching theme first, then demonstrate how each categorical analysis contributes to the thematic narrative. Finally, I offer a summary which discusses the thematic narrative in relation to the categories that inform the narrative and presents/summarizes analytical insights. One could easily have written the thematic narratives without the subtitles of the categorical descriptions; however, the delineation was important to demonstrate my thought process and how patterns from each categorical description were integrated into the broader thematic narrative. The thematic narratives and their summaries are at once descriptive and analytical. In other words, I offer both analysis and description of thematic narratives in an entangled manner. I also engage in discussion of critical analytical insights. Therefore, embedded within the thematic narratives are data that support the thematic narratives and the analytical discussion of the data, instead of the traditional practice of separating description and analytic discussion. For me description and discussion were intertwined heavily, and thus I integrated them in the writing to stay congruent with my analytical processes. In Chapter Five, I offer detailed discussion about how the thematic narratives specifically offer insights to respond to the research questions and the existing literature.

Two Sides of the Same Coin: Support Me as Such

Prior to this study, I held preconceived notions that later career teachers are likely less comfortable with technology integration and, therefore, are less willing to engage in pedagogical

change spurred by access to technology. This belief led me to expect that Charles and Ada would have a divergent view of their experiences during the 1:1 adoption and that their desires for professional supports would be starkly different. In fact, their own words seemed to support my early expectations that their experiences would be markedly dissimilar. When asked to reflect on his impression of the ability level of his peers regarding technology at the start of the 1:1 adoption, Charles shared, "I thought, 'This is going to be totally unfair. There are some teachers that are older than I am. I would assume that maybe those ladies might not like using it or that they wouldn't be willing to buy into it.'" This is not an entirely unsurprising position. After all, it seems reasonable to expect that more experienced teachers are not always as open to new things due to the fact that they have seen so many ideas come and go throughout their long careers. Echoing Charles's sentiment, Ada also communicated during an early interview her own conception that her age or experiences would make her less successful in the adoption:

> Maybe you should be talking to somebody who is 25 . . . you know, the digital natives! I'm not a digital native. Are you going to be talking to any 20-somethings? That would be interesting. I'd like to see how their mindset is different from mine. I bet they'll be doing all sorts of great things while I'm over here just trying to get by.

While clearly occupying opposite ends of the technology self-efficacy spectrum as might be expected, both Ada and Charles reinforced, even if unconsciously, this perception of career stage playing a role in a teacher's level of self-efficacy and ultimately their success in integrating new technology into their classroom.

However, this is where many of the differences in their journey end. Ultimately Charles and Ada remained markedly similar in how they approached the 1:1 adoption. Despite their clear differences, they represent two surprisingly similar profiles of technology integration. It became

evident that both participants placed a high value on the role that student-centered technology can have on their practice. Both saw the value in adapting their teaching, and both came from a pedagogical perspective and operated within a particular school culture that lends itself well to the student-centered, constructivist paradigm that research has shown supports effective 1:1 device integration (Cuban, 2013b; Ertmer & Ottenbreit-Leftwich, 2010; Lee et al., 2015; Stanhope & Corn, 2014).

It became clear that Charles and Ada were more alike than different with regard to their disposition and in their need for a supportive administration and sustaining school culture. Perhaps it is possible that the participants' reactions were homogenized, in spite of their differing perspectives and experiences, because they were similarly orientated to start with and were operating in a culture that further incentivized integration. Charles and Ada both taught in the same school, but on different grade levels. Even though school cultures are not monolithic, both of them bought into similar aspects of the school culture at large, despite working in different functional groups. As such, both participants expressed corresponding desires for support and credited comparable organizational structures for their success.

This theme dealing with the false dichotomy of Charles's and Ada's career stages and prior lived experiences can best be described within and across four categorical perspectives. They are self-efficacy, professional development and collaboration, administrative support, and voice. In the next sections, I describe these categorical perspectives in detail.

Self-efficacy. As referenced previously, perhaps the largest divergence in Charles's and Ada's perceptions of practice were in their individual feelings of control as revealed through their sense of self-efficacy. Neither participant explicitly addressed self-efficacy as a conscious consideration regarding their use of technology for instructional purposes, but they both

expressed feelings related to their technical proficiency or lack thereof. Ada noted, "I guess I never thought at the end of my career I'd feel like a first-year teacher sometimes." Her hesitancy and lack of agency was also evident when she discussed her abilities in relation to her students' abilities:

> Well, I think sometimes the fact that I know that my students are sometimes more proficient with, you know, more of the modern technology than I am. I mean, these kids have grown up on touch screens and I feel—like I remember when the first iPads came out and when phones were not computers—a little out of touch. So these kids already know so much. Meanwhile, I'm like, "Okay, I'm going to give this a try." But I think I'm getting better at it and I like trying. I'm getting more confidence and comfortable with things. But I still do feel like our students are more knowledgeable with a lot of this tech. I used to feel especially comfortable because I'd taught long enough to be able to pull a lot of things out of my hat, saying, "Oh, this could work."

While Ada reported that she generally felt confident as a teacher and has typically been secure in trying varied instructional strategies in the past, her belief in her abilities did not carry over to confidence with technology. Later in the same interview, she divulged,

> I need to have more knowledge. Like, for this whole technology thing. I feel like I could usually take risks on different strategies because I feel like after teaching for so many years, I can pull a lot of things out of my hat. With technology though, I don't feel nearly as comfortable because I just don't have the background information.

This sentiment is a prime example of how Ada's confidence did not match with her beliefs and usage. Though she often spoke from a position of uncertainty, it was clear through our other conversations and the classroom observations that she really did embrace using the 1:1 devices in

a student-centered manner, albeit in a more limited way than did Charles. Perhaps her experience in the pedagogical and content domains of TPACK allowed her to mitigate the effects of her lesser-developed technology and technological pedagogical domains (Koehler & Mishra, 2006). In other words, Ada was able to still teach somewhat effectively using technology despite her lack of familiarity with it because her overall teaching experience empowered her with a strong understanding of effective teaching practices in general, along with a solid understanding of her subject matter.

Ada had confidence in her pedagogical skills, as she had developed many strategies over her long career including methods for supporting struggling learners and non-confrontational ways to redirect off-task students. However, Ada perceived that technology and its integration is somehow different, separate, and disconnected from her pedagogies. Rather than shifting gears and applying contingency plans as Charles often spoke of doing, Ada reported "freezing" along with the machines she was helping her students to use. These technological agents were not her friends. Freezing implies an apparent sense of paralysis, so clearly to Ada, there was something that was paralyzing about these unfriendly, badly behaving technological agents—so much so that she put her pedagogy on the back burner. Perhaps technological struggles caused her to lose a sense of who she was as a teacher while she had to fight with unfriendly equipment. Rather than seeking contingencies, she dwelt on the machines as thwarting her efforts to carry out specific plans. She also tended towards blatant attributions of human agency to the computing devices: "The printer was not behaving" or "The software that day was being particularly temperamental." This is in keeping with an earlier study where the researchers found that experienced classroom teachers who were new to technology tended to attribute the *doing* and *learning* to the machine, not to themselves or to their students (Meskill & Swan, 1999). In my

experience, her behavior was also in keeping with the more obvious tendency to assign computers human agency typical of the discourse of novice users of technology. Nothing went as planned in Ada's classroom with respect to technology, and while Ada expressed being adaptable in other spaces, with technology, it often seemed like these challenges were the end of the world for her.

By contrast, Charles' speech was almost completely devoid of anthropomorphic references to the computers. Agency was clearly and consistently expressed and was often referred to as residing in himself and his students. Rather than talking about what machines do, Charles clearly reflected a conceptual locus for learning as residing with the learners, not the computers: "We did a lot **with** [emphasis added] the computer with making posters and writing out our learning and that type of thing. It's a wonderful tool." Charles's innate comfort with technology is evidenced in how he seemed more at ease with not knowing or doing it all and was not discomforted by the possibility of technology failing him or him appearing unknowledgeable in front of his students. Charles recounted, "Some of my botched lessons have ended up being some of my best lessons. I think that's because I'm thinking, on the fly, 'What could we do from here?'" Charles's sense of being in control was further illustrated when I asked where he got his ideas from. Charles reported, "I find out about the majority of the ideas from like-minded colleagues or through my own personal exploration. YouTube, Pinterest, places like that are a really great place to learn from people that are doing innovative things." His confidence was reflected consistently through his word choice and in the tone in which he told his story. In fact, his overall high comfort level using technology as a tool in his lessons was apparent throughout our time together. One example of his high comfort level was when I observed him run into a problem during his lesson. He had planned on having his students utilize a particular website

which ended up being blocked for his students. Upon being informed about this by his class, he quickly located another similar site and adapted his instructions to work with this new tool. After class he informed me that he hadn't had any experience with the alternate site, but that he had heard about it before and was confident that he and his students could make it work. He was exploratory with his use of technology rather than being afraid of it. He generated expansive pedagogical possibilities such as engaging in a collaborative activity with a class from the elementary school. Charles's students meet with the younger students through asynchronous video messages and co-created a choose your own story adventure playable on their student devices. Unlike Ada, Charles wasn't freezing. He was reinventing himself and expanding his craft with the aid of technology.

Ada, according to the high value she placed on technology despite having a lower sense of overall technological self-efficacy, made a conscious point to regularly attempt to use technology for personal use in order to gain experience. She made the following statement in passing:

> We're doing our students a disservice if we are not teaching them how to use [technology] correctly. Because they're going to use it. This is their world now. They need to know how to use it correctly. They understand how to play games or watch YouTube, but they need to understand how to search for something correctly and find the correct information.

Despite her own discomfort, Ada's student-centered philosophy made her see value in technology; even though she felt frozen at times, she still tried to work through those challenges because she was driven by her need to be helpful to her students and prepare them to be successful using technology.

Thus, there is an account of Charles, who expressed fearlessness with technology and has reinvented himself, versus Ada, who described being paralyzed with fear or uncertainty about technology and tended to separate technology and pedagogy. Yet, despite these differences, both educators appeared to make every effort at integration. This effort could be explained by how each participant perceived the value of each individual TPACK domain— technology, content knowledge, and pedagogy—as well as the manner in which they interacted with the students and other educators. While Ada and Charles both clearly valued technology, Ada's tendency to view it as something separate and removed from the rest of her expertise may have led to her increased level of anxiety compared to Charles, who viewed the TPACK domains as more of an integrated whole and was better able to utilize his strengths in each area despite having a less developed grasp of pedagogy and content knowledge in relation to Ada (Figure 4.1).

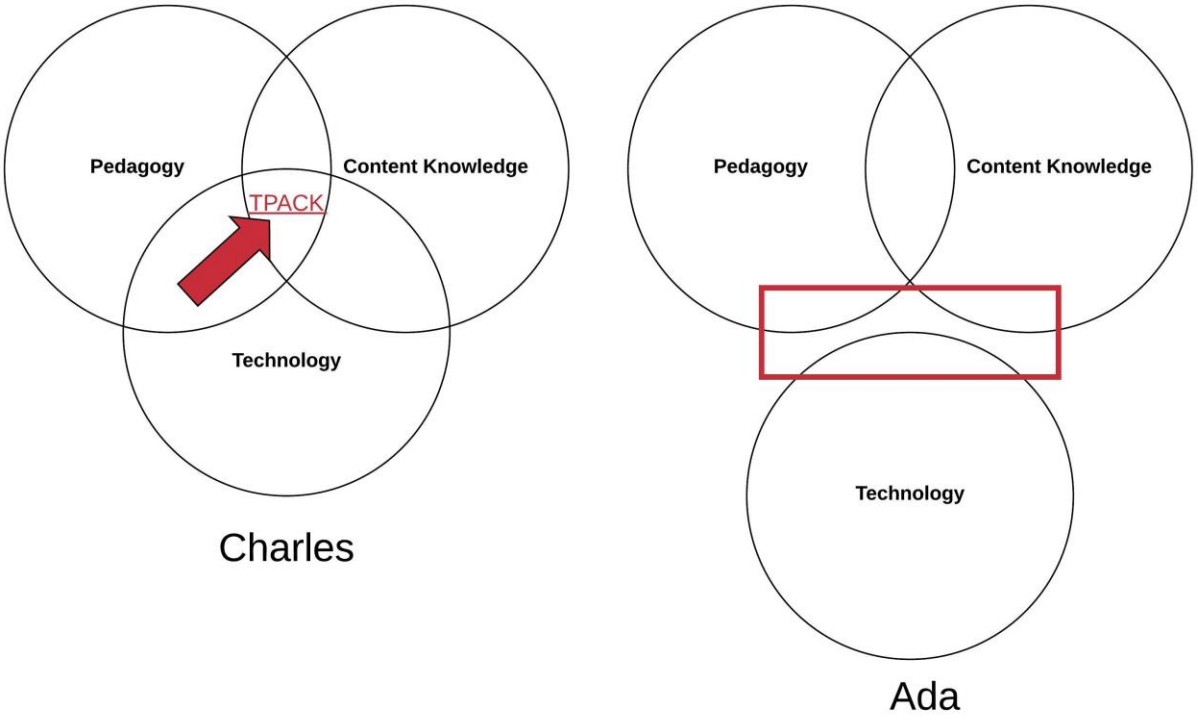

Figure 4.1. Visualization of Ada's disconnect between her technological knowledge and the other TPACK domains in which she was more grounded.

The incongruence in Ada's thinking between her comfort and knowledge regarding technology compared with her belief in its necessity in the classroom is evident throughout Ada's narrative. A possible explanation for how Ada reconciles the dichotomy between her technological proficiency and overall positive beliefs about educational technology is her desire to act as an ethical teacher trying to help her students stay focused while at the same time not seeing technology as permanent as no doubt she has experienced many tech fads over the course of her longer career. Conceivably, it may be for that reason that she just does not invest the time to figure out pedagogy-driven technology integration.

Professional development and collaboration. Access to high-quality professional development, delivered at the appropriate level and targeting a specific, applicable need, was

noted by both Ada and Charles as a significant element in their experience. When asked to describe the importance of professional development during their implementation of the 1:1 initiative, both participants noted sustained professional development support as being key in helping them learn how to use the technology as a tool in their classrooms. Charles reflected, "Just the district putting out all of the options has been so helpful in sending us where we need to be." Both Charles and Ada frequently used the words *choice* and *options* when speaking about their most meaningful technology professional development experiences. This could reflect their desire to be met at their differing comfort levels. To this end, they both found professional development particularly relevant when it targeted a perceived need and was delivered at an appropriate level for the learner.

The participants specifically identified the ongoing nature of their training as a beneficial condition following the initial introduction of computers to the students. Ada explained that following the introduction, the school district began offering workshops covering various topics for teachers. Professional development was offered during designated professional development days, staff meetings, and on specific days during team time. Charles described these meetings:

> During our faculty meetings, we'd have a chance for a staff member to briefly present something that they had found or were using for the rest of the group—things that they thought were very helpful or that we could use. Sometimes I'd pick up some real gems from these sessions. Then, on PLC days, we'd have time as a team to dive into whatever we wanted to focus on.

Optional workshop sessions were offered to teachers before and after school hours, in addition to the previously mentioned mandatory learning opportunities, and were often targeted at different ability levels depending on the session. These optional workshops allowed the participants to

maximize their time and agency by selecting training that they felt was personally relevant and applicable to their needs.

Both participants shared that another issue that contributed to their ongoing professional development was the presence of informal teacher networks. While neither participant could describe any formal networks or teacher forums having been established or organized within their school by administrators, they both espoused the value and importance of informal networking among teachers. Ada explained how these networks formed:

> We mostly just talk to each other whenever we have time. We talk during hallway duty. We talk during lunch. Many of us don't teach the same subjects, but we still totally share ideas. You can still learn things from people and pick up some things to use in your classroom from there.

Ada described her experiences during the sharing and collaboration sessions primarily in the context of her being on the receiving end of information, for which she was usually grateful. These networks formed organically, through her fellow educators' desire to improve their practice. If these informal networks are indicative of the school culture at large, it is possible that this change-tolerant culture played a role in helping Ada overcome her lack of confidence and agency.

Charles described a similar situation, although he was more of a giver than a receiver of knowledge:

> We get together whenever we can. Obviously, there's not a lot of spare time during the day, but you can make the most of the small moments. It's kind of limited, but if there is something that I want to share, I definitely do that. Sometimes I'll even send emails at seven or eight o'clock at night if I have an idea or come across something worth sharing.

Like much of Charles' commentary, his description of his collaborative experiences was told with more of a sense of control and ownership, which contrasted with Ada's remarks. Charles mentioned on several occasions sharing information with others, but he rarely discussed being on the receiving end.

Both Charles and Ada indicated their professional networking was informal and organic, primarily due to time constraints. Yet, Charles seemed to be deeply invested in these networked relations, so much so that he would make time outside of his working hours at the school to stay connected to his network via emails. Furthermore, both participants actively recognized a need to develop their teaching and credited both the formal and inform opportunities for professional development as playing an important role in their positive integration experiences. However, they did differ somewhat in their perceptions of the informal networking that arose within their school. Charles positioned himself as more of an expert, sharing and learning from others, while Ada described the network more in terms of the opportunity for her to learn from others. Their individual dispositions might stem from their construction of self-efficacy regarding technology use and integration. Additionally, both participants appeared to have their technology integration practices incentivized by a school culture that valued collaboration, reflection, and educational change in regard to technology use in the classroom.

Administrative support. Administrative support was conveyed by both teachers as being essential to their efforts to effectively integrate the student computers into their practice. One aspect of this support was in encouraging, and working out logistically, the teachers' participation in the formal professional development opportunities mentioned previously. Another aspect of their support was in their active encouragement to teachers to experiment and take risks with different approaches in the classroom utilizing technology. Charles said, "I have

people in the administration saying, ‘Go for it,’ ‘Who wants to try this?’, ‘Will you show others?’” He described the importance of this encouragement:

> I think the biggest thing that allowed me to get to this point is that, at every level, I’ve had an administrator or other influential teacher that was like, “Go ahead and do that. Go ahead and take the risk. It’s worth a shot. If it doesn’t work, it’s not a big deal.” They were happier that I was taking the risk at trying something different that wasn’t in the norm. It allowed me to feel comfortable to be more creative, and I was able to share what I learned with my team. It’s allowed me to find different ways to do things that I probably wouldn’t have been able to if I’d been boxed in.

Without this freedom to take risks, it is unlikely that Charles would have been as eager to push the boundaries of his classroom instruction. However, given his affinity for and belief in the positives that teaching with technology could bring to his instruction, he likely still would have embarked on at least limited integration. As important as the encouragement was to Charles, trust was equally important to Ada, as evidenced in these comments:

> It definitely gave me space. Evaluations were always my biggest fear. If this thing bombs, what’s that going mean for my evaluation? I’ve been teaching for a long time, so worrying about evaluations was something new for me. But knowing I wasn’t necessarily going to be judged on one failed lesson made me feel like I could try things out in the beginning. That’s helped me a lot with using it and gaining exposure to interesting ways of doing things.

Of the two participants, Ada would have been less likely to expand her pedagogy to include technology without the explicit support from her administration. Given the lack of incentive to take risks at her stage in her career and the ease with which she could rest on her vast experience,

it would have been easy for her to just continue with the status quo until retirement. Thusly, administrative rhetorical and systemic support, along with the ubiquitous trust that the participants had in their administrators, were all noted as being key elements in Charles's and Ada's respective journeys.

Voice: A distinction between participation and power. One prominent challenge to the use of computers in the classroom expressed by the participants was the degree to which the teacher's voice and perspective were included within the framework of how decisions were made regarding computer use and implementation. Significantly, while this challenge was determined by influences predominantly outside of the teachers' locus of control, they played a part in affecting the teachers' pedagogical beliefs with regard to the 1:1 implementation. For example, Charles expressed that the school and his department played an important role in helping him feel prepared. He enthusiastically extolled the time, workshops, and staff-directed PD opportunities that the administration provided:

> They brought in some other people; they've brought in outside experts and made them available at various times, either during summer or through the school year. If you were interested in signing up for that opportunity, the administration was supportive. If you found a conference you'd like to attend, they'll do their best to make it happen.

Yet, even as Charles indicated an eagerly supportive administration that listened and responded to the requests of teachers, he also expressed disappointment with the lack of communication with regard to policy on classroom implementation. In one interview, he described an early misunderstanding regarding whose responsibility it would be to teach the students how to use school-assigned email. Charles explained that while teachers thought that the media specialist would address this lesson, the administration assumed that teachers would take care of it. In the

confusion, the lesson was missed, and the students, failing to receive direct guidance, mishandled their use of email by using it to *chat* during class time, and in several instances, to bully other students.

Likewise, Ada wondered whether her own feedback and opinions on integration were heard at the top levels of administration. For instance, the decision to use Chromebooks for the 1:1 implementation put the staff—especially the veteran teachers—in the difficult position of having to learn a completely new operating system and suite of productivity programs. Ada's frustration was apparent:

> We don't make decisions . . . the administration does . . . and the technology team. They will announce it a meeting: "Hey, it was discussed and we're getting Chromebooks in six months. We'll give you a week's training on it, and then you'll be expected to use it as soon as you feel ready." So, long story short, we're basically told how it's going to be, and sometimes they ask for feedback.

The decision that the district would be purchasing computing devices with a 1:1 ratio for students was ostensibly made without many of the teachers' input, and Ada's comments are suggestive of the fact that she felt she was not given sufficient opportunity to provide feedback. Her early frustration was echoed by Charles:

> There really wasn't a lot of teacher input about either using Chromebooks or even being a 1:1 device school, regardless of platform, programming, or company we were going to be using. And so that kind of created, I don't want to say friction, but people were questioning why we were doing this. They were questioning why we were doing this and what was driving it. People were wondering why it is good for our school.

It is clear throughout their narratives that both Charles and Ada did not feel involved in the decision-making process, despite their overall satisfaction with the level of support and creative freedom they experienced during the 1:1 adoption.

Although there had been opportunities for teachers to discuss their professional development needs with those in the administration, there seems to have been no effective path for teachers to have any actual decision-making power regarding the 1:1 initiative prior to implementation. Additionally, the participants' criticism and general frustration with the administration highlighted an underlying feeling of lack of control over the nature of their work in the classroom during the early stages of the execution, even if these feelings had been mitigated through more responsive behavior as time progressed.

For some teachers, possessing any combination of relevant knowledge, confidence, or beliefs is enough to empower them to integrate technology into their lessons in a meaningful way. We are all probably familiar with teachers, such as Charles, who perceive themselves as successful users, despite facing multiple barriers, such as the lack of direct experience. Yet, for the vast majority of teachers—those like Ada, with a strong belief that technology integration can improve instruction and an equally paralyzing sense of being underprepared—this may not be enough, as research indicates that innovative teachers are easily overpowered by their lack of confidence (Roehrig, Kruse, & Kern, 2007). However, as demonstrated at Boolean Middle School, it is still possible that meaningful technology uses can be initiated and supported by the culture to which a teacher belongs.

One way in which the culture of Boolean Middle School supported Charles and Ada was through fostering collaboration and professional learning opportunities. As demonstrated by the participants' narratives, the opportunity to learn and grow professionally can play a significant

role in how the overall experience is perceived. While both participants had somewhat differing opinions on the general quality of the formal professional development opportunities, both acknowledged the significance of these occasions for increasing among the staff a greater understanding and willingness to experiment. Furthermore, these sessions helped cultivate a common vision for how the student devices were expected to influence classroom practices.

In summary, it is not unreasonable to expect two people in different states of their career to have dissimilar dispositions, yet Charles and Ada did not seem to fit into that common-sense mold. Counterintuitively, both teachers showed that they eagerly desired to integrate technology, and attempted to do so routinely, but they differed in the fluidity of their comfort level and sense of agency with expected outcomes when using technology. While both participants expressed generally positive sentiments as they reflected over the past few years of implementation, it was apparent that they felt they had lacked a voice during the change as they weren't able to provide input during the planning phase or feedback during the implementation. Additionally, they differed in the amount of agency they possessed. As described above, Charles tended to describe the experience from a position of control, whereas Ada often focused on her perceived lack of technological knowledge and seemed to project more of a feeling of the 1:1 implementation as something that was happening to her rather than something she controlled. Still, a sound knowledge base and strong self-efficacy for teaching with technology do not always result in meaningful technology uses (Ertmer et al., 2015). Ertmer, et al. (2015) noted the strong influence of teacher confidence and of the perceived value of technology on educators' decisions about technology integration. This combined influence suggests that a lack of self-efficacy by itself may not be enough to discourage use and may actually be overshadowed by strong positive beliefs when making implementation decisions as illustrated through Ada's implementation

experience. Given this, it is important to investigate how teacher beliefs underlie and support meaningful technology integration.

Although personal beliefs can influence knowledge acquisition regarding and use of technology, as shown here, the context of one's school culture can also play a substantial role in teachers' meaningful use of technology. As Charles and Ada illustrate, teachers' beliefs have proved to be heavily influenced by the school culture to which they belong. In fact, Windschitl and Sahl (2002) found that a teacher's technology uses were strongly influenced by beliefs, but that their beliefs were ultimately shaped by the context of their institutions:

> The ways in which those teachers eventually integrated computers into classroom instruction were powerfully mediated by their interrelated belief systems about learners in their school, about what constituted "good teaching" in the context of the institutional culture, and about the role of technology in students' lives. (p. 575)

In this case, it is evident that Charles and Ada were heavily motivated and empowered by their environment to explore outside their comfort zone. This enabled them to make progress towards adopting technology in pedagogically meaningful ways. Two sides of the same coin then refers to the similarities in Charles' and Ada's attitude towards technology integration, commitment to good pedagogy, and working through the challenges of adapting to new teaching and learning modalities. The inference that can be drawn for such similarities are both grounded in personal and cultural aspects of their experiences. Personally, they are invested educators, who are student-oriented, and believe in enhancing their skills to help their students. Professionally, the culture of their school and its support system also contributed to their similar disposition and approach to the new technology integration initiative.

Going with the Flow: Transformation and Perseverance

Research has shown that the integration of 1:1 computing has the ability to influence the teacher's role in the classroom (Bebell & O'Dwyer, 2010; Cuban, 2013b; Ertmer & Ottenbreit-Leftwich, 2010). Fleischer (2012) found that 1:1 technology enables teachers to work with more flexibility relative to the existing curricula. In fact, the objectives of 1:1 initiatives frequently underlie a hidden or explicit expectation of changing teaching methods (Cuban, 2013b). For the most part, the attitude towards this change is described as the adoption of more student-centered teaching practices with a focus on higher-order thinking skills. This is a representation of transition from existing pedagogies to new ones. In this study, the participants were both high achieving teachers, and wanted to do the best for their students and meet the benchmark of what was expected of them. While they might have had some apprehension about the technology integration, either in terms of technology use, pedagogical transformations, and content relatability, they also knew that the transition to integrate 1:1 adoption was going to occur regardless. Therefore, given their disposition of being high achieving and student oriented, they chose to "go with the flow" and engage in transforming their practices through varied forms of perseverance.

It was clear that both Charles and Ada perceived that the 1:1 adoption was encouraging a profound change in their pedagogical beliefs and teaching practices. Charles described this shift in his pedagogy using the educational cliché of "moving from the sage on the state to the guide on the side." While Ada, with her additional experience that possibly led to more entrenched practices, did not display quite as radical a shift as Charles, it still was obvious that she had moved her classroom interactions towards a more student-centered approach. Moreover, throughout our interviews, she did express a desire to move even further in that direction.

Additionally, both teachers noted that while they mostly felt supported by their peers and school culture during the transition, they also felt pressured to adapt their teaching styles. This occurred despite the fact that the adoption was "at your own pace," as Charles put it, and "however it fits into your classroom," according to Ada. Charles shared, "I know what the administration is wanting us to do and is hoping will happen. They've never said anything, but it's pretty obvious." This illustrates Charles's often astute perception of the regularly implicit expectation of using technology to drive pedagogical change. Ada described a similar feeling with her characteristic lack of control. She equated it with a time her family visited a beach that had a riptide warning. She recalled reading a sign with her husband that advised "swimmers caught in a riptide should swim along with the current rather than trying to fight it. Ada's decision to "go with the flow" and "jump in with both feet," as she would describe it—aside from sticking with aquatic metaphors for her pedagogical choice to so whole-heartedly embrace the 1:1 adoption—was a result of her pragmatism combined with her deep desire to do what is best for her students. Below are the categorical descriptions and analytical insights that support the thematic pattern of *Going with the Flow: Transformation and Perseverance.*

Then and now. Both teachers looked back and reflected on their teacher preparation programs and previous experience in the classroom throughout their shared narratives. Interestingly, their reflections were communicated as if any time spent before the 1:1 initiative was a totally different part of their career. Those experiences tended to be grouped together and spoken about in comparison to the experiences that occurred after the students all received devices. It was as if the participants had erected a definitive wall between the time periods. Phrases referencing this delineation, such as "after the Chromebooks," appear frequently

throughout the interviews. This was true for both Ada and Charles, despite their vastly different number of years of teaching experience and dissimilar comfort levels with technology.

Reflective of her longer teaching career, Ada described a larger gulf than did Charles regarding the technology she has access to now versus when she first started in the profession:

> Early in my career, technology was only teacher focused. I started off with an opaque projector. It was like a big MRI machine, and you could put a book in there and it would project. When I was in college, I had an AV class and it was about how to put the film in a movie projector and film strips and doing opaque projector. Now every student has a device that can do things that were only possible in science fiction back when I first started teaching.

Ada is clearly bewildered with the sheer amount of contemporary educational technology at her and her students' disposal. However, despite her almost paralyzing sensation of being overwhelmed, she feels the pressure of her school culture and personal beliefs to persevere and adapt her practice well beyond what I would expect of someone so close to retirement.

Charles's story stands in stark contrast to Ada's, likely owing to his more contemporary education. He describes having the benefit of being exposed to technological pedagogical knowledge in his teacher preparation classes: "We were taught all sorts of student-facing technology, even if what I was specifically shown is different than what's available now". Charles elaborated on this point about exposure to technology:

> Technology has been a part of teaching for me since the beginning [of my career]. Even during college, I took a class specifically on how to integrate technology into my classroom. Now, we were shown things that don't exist anymore, and I'm [currently] using things that weren't around then, but the idea is the same. I guess if it's done right,

technology is really a frame of mind and not the specific program. Actually, I had access to less when I first started teaching here than when I was taking my technology class. It's probably taken these five years to catch up with what I was being shown was out there.

Charles's narrative paints a picture of being exposed to more technology related-pedagogy during the early parts of his training and career. This would be expected, given how quickly technology changes and the scale of change since Ada was in college. The technology present in a modern classroom could not even have been conceived of during Ada's formal teacher training. It also highlights one of the most challenging issues present, in my opinion, in adapting educational practices to technology—that trends come and go at such a rapid pace that it is difficult to pick out those worth embracing and those that should just be allowed to pass by.

This difference in exposure is evident in the divergence between how Charles and Ada perceived their control over their technology integration experiences, as was discussed earlier in this chapter. Charles was enabled to exhibit a much higher threshold for the unknown fueled by his higher sense of self-efficacy. Conversely, Ada struggled more, having had more of her pedagogy shaped during a "different era," as she put it.

Thus, *Then and Now* focuses on Charles's and Ada's perception of their teaching and learning experiences before and after the adoption. Both of them perceived things to be vastly different than what they were able and expected to do before and after the adoption. After the adoption, they were able to enhance their need to be student-centered, create agentic student learners, and engage them in collaboration and project work where they are not feeding information to the student. As a result of the adoption, the students could use the technology to search for their own information to complete individual and collaborative tasks. Therefore, the adoption catalyzed the ways in which their investment in teaching became transparent, and their

commitment to be responsive, student-centered educators. *Then and Now*, a way in which the participants reflected on their experience of the adoption demonstrated the role of the adoption in creating transformations in the participants' teaching and the students' learning experiences. However, such transformation was not always easy or self-evident because the participants had different strengths and weaknesses that created potentials and problems simultaneously. Working through these issues required perseverance as they learned to reframe their pedagogical strategies as well as meaningful technology integration.

A catalyst for change. A powerful influence that laptop integration had on the participating teachers regarded their willingness to be flexible, give up control, give students more freedom, and "fly blind," as Charles put it. Both teachers made a particular point about how laptop integration has pushed them to cede control of both content acquisition and interpretation to the students.

Although they clearly began at different places and felt varying degrees of control, it was evident that both participants credited the 1:1 adoption with pushing their teaching towards a more student-centered, constructivist approach over the past three years. Charles verbalized this shift in his respective thinking with regard to his role in the learning processes:

> I'm much more willing to give up my own spot where I'm giving them the information all the time. . . . I feel more open to allowing them to explore their own ways that it is impacting them. I feel more open to allowing them to explore their own ways that is impacting them rather than me always being the one bringing, "Look, this affects you because of this." They can find that out, and giving up that control factor that so many teachers love, you start to feel more comfortable with . . . they're going to come up with something. Maybe someday I'll be like, "I have no control!' and it'll be a good thing.

This was one of the rare occasions that Charles, normally very at ease with taking things as they come, expressed unease with the process. It is possible that Charles's nervousness stemmed from his relative lack of classroom experience, thereby giving him fewer strategies to fall back on when lessons did not work out exactly as planned. Ada echoed Charles's concerns in her sense of initial discomfort with shifting her teaching style toward more student-centered practices:

> It's so nerve-racking to be that open ended with things. That is the big thing that happened with the 1:1. You start to let go of the reins. It's not all about "Yes, I want to get to certain parts of the lesson that day and there are some things I want to informally check in with you about daily," like a *do now* or a small quiz on what we just did, but not feeling like you need to know when something's going to end all the time. Because when you get into projects . . . it's about them figuring out what the important material is and how to get the important material from here to there.

A clear shift occurred, pushing them to find ways to provide students with opportunities to make meaning for themselves. Both teachers reported that the past two years had resulted in much more open-ended types of projects that require students to develop their own approach and interpretations. Charles revealed this by saying, "Sometimes I keep it so wide open, where you have an essential question and you've got your guidelines and give them, 'Here's your proposal plan. You guys make the decisions. You have to hit these certain criteria, but . . . you have the freedom to show me what you know in whatever type of way you want to.'" This pedagogical shift has also had an influence on the mindset that students must employ with regard to their own learning that will be discussed below.

Each teacher discussed the reality that, with the ever-changing applications and programs available to students, they have embraced the idea that it is acceptable for them to not know the

technology going into an activity. The understanding of the technology is in the hands of the students. In both cases, the participating teachers embraced the idea that, in many ways, they are, as Charles phrased it, "flying blind." He reflected on both of these points:

> The projects . . . I didn't know how they were going to turn out. I didn't know enough about the software myself, I didn't feel like, to help them. And they figured it out or knew it on their own. So assigning something that I wasn't going to be a great resource on, they knew how to either find the tools or use the tools to make it effective for them. But if they didn't know how to use it, I wasn't a great resource for them. . . . But they were so quick about it that it wasn't long. They knew it from other classes, or they knew how to figure it out. They were also great at helping one another. Someone would ask a question aloud, and someone else would tell them how to do it before I could even pretend to know what I was talking about.

Ada encapsulated a similar perspective with regard to her not needing to be an expert in the technology applications. In discussing her use of an application called LucidChart (a tool that allows students to create concept maps that can be customized and shared), she pointed out that she had discovered the application on a blog and decided to try it out with her classes without really knowing how to use it herself. She left that to the students, stating, "My new thing is 'All right, we're just trying this out. Don't need to use it forever. Let's stick with it, and tell me if you figure it out. I don't have an answer right now. You might need to start over. See if you figure it out. You problem solve because we're not masters at all of this stuff. We're just trying it. We're learning how to, when something goes wrong, fix it to accommodate whatever the assignment is.'"

A consistent change regarding the teaching practices of the participants was the need to develop a flexible approach to their instruction that allowed them to take instructional risks and experiment with assignments, activities, and technology applications for which they did not know the outcome. While each teacher discussed the freedom that this outlook had given them, they both characterized it as being "nerve-racking" or "unsettling."

Hence, *A Catalyst for Change* focuses on Charles's and Ada's perceptions that the 1:1 initiative in their district put into motion the evolution of their pedagogy. Having access to 1:1 devices freed the teachers to use more student oriented practices in their class. Furthermore, this freedom catalyzed the growth of Charles's and Ada's own comfort level with technology, content knowledge, and pedagogy. This development altered Charles's and Ada's fundamental beliefs and therefore modified how they engage their students. The participants belief that the computer was expected to transform their teaching was informed through professional development sessions and the general building culture. The participants' belief in the transformative possibilities afforded through the technology required them to enhance their skill set if they were to perform to what was expected of them and both were compliant in this endeavor despite their individual areas of struggle. Finally, Charles's and Ada's undertaking was not without its hardships. Yet, the participants persevered and figured ways to negotiate the adoption that played to their strengths and capitalized on their existing beliefs.

Perseverance. The past two years of the 1:1 initiative were not without hardship for Charles and Ada. This was reflected in their narratives which contained the struggles they faced. Each participant felt that integrating individual student devices into their instruction presented challenges as well as benefits. Yet, they felt their only choice was to continue on in the face of occasional adversity. Ada, possibly due to her lower confidence levels as discussed in earlier

sections, felt it was of particular importance to stress the significance of content, curriculum knowledge, and up-front planning by the teacher. Charles, with his more developed technology domain, still felt the need for up-front planning, but to a lesser extent than Ada. He embraced what he called the "controlled vagueness" that came with his now more student-centered lessons. This seemed to reflect his belief that he still needed to provide careful planning, introduction, and scaffolding for his students, but that the actual direction of the learning would be dictated by his students.

Ada best described the participants' success through flexibility and grit by equating it with the character of Dory from the Disney-Pixar film *Finding Nemo*. If there's one thing to be learned from Dory after her first appearance in film, it was to just keep swimming when life gets you down. As such, Ada described feeling defeated many times throughout the adoption, but then she would remind herself: "Just keep swimming. Just keep swimming. For the good of my students, I can't give up." Charles's and Ada's perseverance is a testament to their commitment to their students. Both Charles and Ada would be considered experienced educators, and it would not be surprising for them to be more resistant to the forces of change around them. This is especially true for Ada, who at that point in her career had little external incentive to persevere.

Having 1:1 access to computers for students removed one of the primary barriers to ICT adoption cited in the research—that of regular and predictable access to reliable devices (Cuban, 2013b). However, both participants expressed that they quickly realized that easy access also had its drawbacks. This meant new procedures and a change in the status quo for how both teachers structured their classrooms, in both routine and the physical space. Ada succinctly described the issue: "It's a huge distraction as well as a wonderful tool. Solid classroom management [strategies] are something that you have to build in. Otherwise, they [students] run amok."

Likewise, Charles explained how he had to develop procedures for transitioning to and from the devices:

> There were kids who can't just get off of them, and it keeps the transitions between activities or classes from happening smoothly. They're so sucked in by it. It can make those transitions really difficult. It wastes time and creates stress for everyone. I've tried a couple of different ideas. It's gotten better, but I don't think I've hit on one that works 100% of the time yet.

Each participant described creating new methods for classroom management and then adjusting them through the adoption. For example, when students have their computers with them all day, it creates a need for teachers to specify procedures for transitioning. This is another example of the same willingness to adapt and be flexible that both participants exhibited throughout our time together.

Interestingly, and possibly due to the participants' varying strengths of their corresponding TPACK domains, Charles and Ada approached the classroom management issues from different angles. Charles tended to focus his attention on helping the students use the devices more effectively and responsibly. If they were off task, it was because there was a problem with the design of his lesson or they needed to develop a better procedure or set better expectations. Conversely, Ada tended to focus on the technology itself, much as I discussed earlier with her giving it personal agency. For Ada, if the students were off task, it was because the technology was inherently distracting and she would need to polish her lesson to compete.

Charles believed that teachers need to take responsibility to ensure that the computers were used responsibly and that the rules and expectations were rigorously enforced. He indicated

that students know the rules but will test the system until the rules are enforced, as the following illustrates:

> I think, too, there's a distraction feature that I have had to work with my students, in that some students who have a lack of impulse control, they have a difficult time, even when they know the rules, to stay on task. They deviate to a website that has a game or something. So, I've had to come down pretty hard with logical and consistent consequences.

Charles's approach towards adjusting his procedures for handling new misbehavior is one facet that did not line up as well with his usually flexible nature and existing pedagogical predilections. Whereas in other examples he tends to be more relaxed and flexible, this was one aspect of his teaching where it seemed like he felt the need to address the needs with more rigidity and expediency.

Contrasting Charles, Ada had a somewhat more sympathetic view towards her students' misbehavior. She viewed their behavior as a lack of understanding. She recognized a need for students to learn how to manage themselves both in the real world and in cyberspace. This need added to her normal teaching of how to get along:

> They need to learn boundaries . . . the parameters, and to be good discerners of information. . . . Even just last week, we had a horrible situation with cyber-bullying, and it was this nasty string. It got larger and larger, and we were able to print it out and use it as part of the conversation with the kids that got suspended. It was sad, but it really was as good of a learning experience as you could get in that situation. They need guidance. They need those parameters set up before we give them these wonderful tools.

Ada's tendency to give students the benefit of the doubt might stem from her additional years of teaching. This extra experience may have provided Ada with a confidence she was normally lacking when dealing with the technology itself.

In summary, both participants embraced the pedagogical changes that came with adopting the use of student-directed 1:1 technology and attributed their overall comfort with the implementation to their willingness to adapt. For significant change to happen in schools, evidence has shown that teachers need to be able to take risks and experiment with how they design different learning tasks and classroom interactions (Apple Computer, 1995; Cuban, 2009; Ertmer et al., 2015). Through this process of exploration, they begin to figure out which digital technologies can support the learning they want to see in students. Charles and Ada would easily be characterized as already having been open to the idea of student-centered methods and had already incorporated aspects of this belief into their pedagogy prior to the start of their school's 1:1 initiative. However, there was a clear sense of a demarcation in time in their narratives, with the appearance of the student devices marking a boundary where they perceived a distinct change had occurred. Charles's and Ada's language tended to focus on how the 1:1 implementation resulted in changes in their thinking and within their classroom, while mostly not making any mention of personal difficulties one would expect with such change. One could conclude that both participants value flexibility as a pedagogical strategy even when they might be unfamiliar with something in their teaching context. Therefore, a veteran teacher like Ada and a newcomer like Charles, could embrace pedagogical changes to adapt to contemporary demands in the classroom. As is often the unstated goal behind a 1:1 adoption, they both described a shift from teacher-centered practices to more student-directed ones within their classroom. Whereas

Charles and Ada demonstrated this shift to varying degrees, both teachers expressed similar sentiments about walking the walk, so to speak, in their classrooms.

It would be expected that some individuals will find change less risky, while others would perceive higher risks for the same thing. Studies have found that teachers having an openness to change, as Charles and Ada demonstrated, are more likely to experiment and integrate digital practices and believe that student learning is enhanced through the use of these tools (Ertmer et al., 2015; Lee et al., 2015; Spires, Oliver, & Corn, 2011). While some researchers have attributed risk-taking and an openness to change as a personal trait, sociological perspectives have demonstrated that these can be fostered at a cultural level to support individuals to engage in change (Stanhope & Corn, 2014).

When considering change, it is necessary to think about what teachers are putting at risk when they are asked to do new things. Regarding digital technologies, teachers feeling less confident or unsupported may be embarrassed about having problems such as not understanding computer errors or being unsure about how to best use a new tool. Small problems such as these can make teachers feel out of control and that their professional competence is being compromised. While neither Charles nor Ada reported feeling embarrassed about any shortcomings with their technological knowledge, they did describe a feeling of being out of control, a state that Charles referred to as, "flying blind." However, Charles's use of the phrase seemed to reflect his giving control in the learning process to the students rather than losing control of the situation. Both participants agreed on the idea of the 1:1 implementation as serving as a catalyst for their pedagogical change and give the impression that they viewed their careers through the lens of then and now with the arrival of the 1:1 initiative marking the division in time. The participants already possessed student-centered pedagogical philosophies prior to the

start of 1:1 adoption so it seems that the new technology tools were able to amplify and empower their existing beliefs.

Finally, Charles and Ada described the importance of perseverance in their journey. They expressed that they faced challenges during the 1:1 adoption such as having to adjust their classroom management skills to their new reality. However, despite the adversities, they felt their only choice was to continue. Ada, possibly due to her lower confidence levels, as discussed in earlier sections, frequently leaned on her content and curriculum knowledge to help overcome her challenges. To address classroom management issues, they developed various procedures for managing the computers and had to realign their foundational beliefs with their evolving pedagogy. This whole-student approach is yet another reflection of their shift towards more student-centered, constructivist pedagogical beliefs.

The thematic findings of this study came from the experiences of two practitioners in a single middle school across two grade levels. Both participants similarly discussed the influences that were a part of their implementation journey. These influences included:

- their own philosophical approaches to teaching and learning,
- seeing where education is going and how technology integration presents many opportunities for changes in how the art of teaching is approached by educators to increase learning and engagement,
- how both formal and informal learning networks influenced their progress, and
- how strong administrative support and a conducive building culture empowered them.

The participants spoke strongly about the effect that technology integration has had on their respective teaching practices, spurring changes in their philosophical approaches to teaching,

especially in terms of ways that students can demonstrate their learning and mastery, so they can avoid being the *sage on stage* and instead be the *guide on the side*. Both participants shared how they became more willing to cede what has been traditional control held by the classroom teacher in order to take more risks, allowing students the freedom to take ownership of and dictate the direction of their own learning.

Charles and Ada identified advantages and benefits of technology integration, nevertheless both participants encountered struggles with the new classroom management issues brought about by students having easy access to Internet-connected devices. Additionally, Charles and Ada expressed a feeling of pressure to adopt a more student-centered pedagogical stance. However, the severity of this change was possibly softened by the participants' existing fundamental beliefs being consistent with student-centered pedagogical practices.

Charles and Ada felt supported by their administrators and peers throughout their implementation journey. They valued the formal professional development opportunities, although Charles sometimes felt bored and Ada sometimes felt overwhelmed. However, the informal learning opportunities, more so than the formalized professional development, were where the participants expanded their understanding. Through collaborating the more technology-proficient teachers like Charles and the less technology-proficient ones like Ada could share resources and tips at their own level and at their own pace. This allowed Charles to seek out more advanced knowledge while Ada could focus more on the fundamentals. It also allowed teachers of all comfort levels to have a voice and participate in the learning. Additionally, the participants were communicating a shared vision for student-centered instruction and further cultivating an exploratory culture through the informal collaboration process.

Chapter Summary

I began this chapter by providing a detailed overview to reintroduce the participants. Next, I provided rich profiles of the participants and situated their stories within the TPACK framework. Finally, I introduced the three overarching thematic narratives of the study. As described in the Two Sides of the Same Coin section, Charles and Ada expressed a strikingly similar experience of the transition to teaching with 1:1 student computing devices, as well as their similar desires and thoughts on professional development and other aspects that either supported or hindered their journeys. This was noteworthy because Charles and Ada were at markedly different places in their careers and were at polar ends of the spectrum with respect to their comfort with technology. As such, I had entered this study expecting that their experiences would be much more divergent. In Going with the Flow, I described both educators' beliefs that needing to adapt their pedagogy was inevitable in order to utilize the new classroom resources to their full potential. Both participants felt pulled to shift their teaching styles to a more student-centered and exploratory approach. They also described simultaneously feeling pressured, as well as supported, by their peers, administration, and building culture at large to undergo this pedagogical change. Lastly, I elaborated on the challenges that Charles and Ada expressed and their drive to overcome these roadblocks and improve their teaching. Both teachers described the necessity of perseverance when faced with the discomfort of undergoing change and credited the support from their administration, the formal and informal professional learning and networking opportunities, and the overall culture of their school with empowering them to feel comfortable to take risks.

Chapter 5 – Conclusions and Implications

The purpose of this case study was to explore how two middle school teachers in a Midwestern city described the effects of ubiquitous computer access for students on their instructional practices and overall student learning as they participated in a district-wide 1:1 computer initiative. Recall that the two participants in this study—Charles and Ada—were purposely selected because they occupied different ends of the spectrum with regard to career experience. They also matched the other important selection criteria for this study—both were classroom teachers at the time, worked in the same school, and were willing to actively participate in the study.

Grounded in the methodological framework of symbolic interactionism, this study addressed three research questions:

1. What were the participants' experiences during the early phases of a 1:1 computer initiative?

2. What were the participants' perceptions of the effect that transitioning to a 1:1 computer environment has on their pedagogical practices?

3. What were the participant's perceptions of the effect of a 1:1 computer environment on overall student learning?

Technology integration in education has been studied extensively; consequently, there is an abundance of literature on the topic (Cuban, 2013b; Ertmer et al., 2015; Harris & Hofer, 2011; Lee et al., 2015). However, most of this literature tends to focus on the *effectiveness* of the educational intervention in regard to various quantitative measures (student scores, attendance, discipline, frequency of teacher use, etc.). There is far less scholarship focused on how

educators, specifically those at differing stages in their careers, experience the journey of integrating technology.

Just as the research supports the assertion that teachers play a key role in the success or failure of any 1:1 initiative, issues of teacher change are central to any discussion of technology integration (Cuban, 2013b). In general, when teachers are asked to use technology to facilitate learning, some degree of change is required along any, or even all, of the following dimensions: beliefs or attitudes, content knowledge, pedagogical knowledge, and knowledge of instructional resources and technologies (Fullan, 2007).

When thinking about technology as an innovation, Fisher (2006) cautioned against viewing technology as an agent of change in and of itself. Rather, he argued that teachers must assume the role of change agent. Cuban (2013b) noted that using technology as a *Trojan horse* for educational reform has succeeded in only a minority of K-12 contexts. In this study, I have followed Cuban's lead and taken a close look at change through the lens of the individual teachers as the agents of change.

This study was informed through the framework of constructivism. This theory around learning and development has helped to provide a lens through which one can view the participating teachers' individual and collective experiences and perspectives with regard to the effective integration of technology in the classroom. A key aspect of constructivism is the idea that learning is a dynamic, adaptive process that entails a reciprocal link between the learner and the environment (Baviskar et al., 2009).

Kolb (1984) posits that knowledge is not transmitted. Rather, learning is the result of the interplay between the continuity of experiences, how one interacts with those experiences in physical and social settings, how one then integrates prior experiences and interactions, and

ultimately, experiences self-organization, adaptation, and emergence (Schmidt et al., 2009). This cyclical interaction does not occur through the delivery of isolated blocks of information and content; instead, it is a creative process that defines learning as something that is made by the learner, not received from the teacher.

The above-described cycle applies directly to the shared experiences of the participants of this study, who discussed their respective journeys towards effective technology integration and the influence that such integration had on their teaching and on their perception of student learning and engagement. Both teachers' journeys reflected their respective interactions with their environment, where they applied past learning and experiences to a new situation. Charles's and Ada's understanding is rooted in the shared experience of teaching a classroom full of students; both teachers had to integrate their individual content knowledge and personal educational experiences with what they had learned in their respective educational programs and apply their knowledge to the dissonant situation where they had to relate those past individual experiences to a classroom environment. They continually revisited their past and current experiences with students and colleagues to develop and articulate a general pedagogical philosophy around their teaching pedagogy and student learning.

In this chapter, I unpack the study questions in regard to the theoretical framework, TPACK, the literature, and educational change; present the significance of this study; address the implications for stakeholders; and discuss study limitations and opportunities for future scholarship.

Unpacking Research Questions

Often in qualitative research, the answer to one research question is intertwined with the answer to another. My analysis and interpretations of Charles's and Ada's lived experiences,

viewed through the lens of symbolic interactionism, is deeply interwoven and dependent on context and on their own interpretations of their experiences. As such, attempting to produce simple, linear responses addressing each research question in turn would rob the experience of its particular nuances and context. Therefore, I examine the three research questions collectively throughout this chapter. To do so I discuss assertions from thematic narratives, TPACK-driven response, the findings and relationship to the literature, and the findings and relationship to ICT-related educational change. These sections specifically represent domains of knowledge from which I draw information to respond to the research purpose and questions.

Assertions From Thematic Narratives

Through a thorough review of the analyzed data, I developed thematic narratives and cross-unit analysis. I then identified the following three assertions to address the research questions. These assertions are:

- Teachers need a supportive building culture with multi-faceted non-formal support systems to effectively integrate technology.
- Meaningful technology integration with 1:1 computing enhanced and elevated the participants' student-centered pedagogical practices.
- Responsibility for teaching and learning was explicitly shared with students to create agentic, engaged learners.

Both Charles and Ada discussed that a key ingredient to their respective abilities to effectively embrace the integration of technology was the support they received along the way. This support had many layers, but both participants had surprisingly similar needs and desires for support, despite being at different stages of their career and diverging levels of personal comfort with technology.

An area of support specifically identified by the participants as being a key influence in their journey was the culture of their school. Both participants found it supportive and encouraging. The culture included aspects such as informal peer networking, supportive and understanding administration, and an overall acceptance with taking risks. This supportive culture encouraged (and possibly pressured) Charles and Ada to stick with the adoption, even when things were not going so well. It also enabled the participants to feel comfortable taking risks without fear. The participants reported that these types of supports were essential.

Viewing effective technology integration as conducive to student-centered teaching approaches was a constant across both Charles's and Ada's experiences. In the discussion of their respective teaching approaches, they cited the importance of student-centered activities geared to create learning experiences that allow students to better understand the content. While each participant's articulation and level of fidelity to his or her own changing pedagogical beliefs were not exactly the same, they centered on building a classroom environment that focused on collaboration, interaction, independence, and creativity. This approach allowed the teachers a number of options to push students towards the ultimate goal of deep levels of engagement and active learning.

An important overarching idea relating to the successful integration of technology into teaching and learning practices is that teachers and students have to be willing to move away from the traditional roles and mindsets ascribed to them. As mentioned above, the participating teachers both discussed that giving up control was essential to their successful integration of technology. Specifically, they discussed that they had to get used to the idea of not knowing exactly how to use the technology or where students would go with open-ended assignments. Additionally, they pointed out the need to accept a certain level of trial and error with regard to

the discovery of effective methods of utilizing technology to actively engage students. Last, both Ada and Charles noted that the unfiltered student access to information reduced their role as a fact-giver and "sage on the stage" and increased their role as a facilitator and coach. This mindset of "flying blind," as Charles described, is fundamentally different from the traditional role and view of teachers as being the content experts who control a lesson from bell to bell.

For students, the mindset shift was the opposite of what teachers had to navigate. Rather than giving up control, students had to acclimate to the fact that they were given control by the participating teachers. This control allowed them to, depending on the teacher, use technology tools to gather information and sources, navigate activities at their own pace, work collaboratively, and develop their own products to demonstrate mastery. All of these adjustments were the result of, as Charles and Ada reported, more open-ended assignments that did not provide them with a clearly delineated and articulated set of step-by-step directions. As the teachers discussed, students who were accustomed to a traditional, passive style of learning and who desired specific directions and a clear articulation of what answers the teacher wanted from them were needing to shift their mindset. Thus, for both teachers and students, the integration of technology forced a redefinition of traditional teaching and learning roles and mindsets and a sharing of responsibilities.

Finally, Charles and Ada independently agreed that the presence of ubiquitous access to computer technology in and out of the classroom has resulted, from their perspective, in elevated engagement for their students and themselves. For the teachers, the ability to develop open-ended and inquiry-based activities for students that actively challenge them to gather and assess information and develop creative products to demonstrate their learning pushes them to become more creative as teachers both in how they present and assess content. The presence of a variety

of technology-based methods to share information differently, engage all students in discussion, encourage collaboration, provide instant feedback, and allow for a variety of student-created products has pushed each participant to, as Ada put it, "go with the flow" and expand, enhance, and elevate their repertoire of teaching and assessment practices and tactics. To each participant, this reality is intensely challenging and professionally engaging. From the participants' perspectives, the level of student engagement has increased as they have increasingly been empowered to be creative in how they determine the demonstration of their learning individually and collaboratively. To the participants, the students are more engaged and find the subjects being taught to be more relevant without sacrificing rigor.

TPACK-Driven Response

The TPACK model, used as the substantive framework for this study, became a useful guide for interpreting and analyzing the instructional decisions by Charles and Ada regarding their individual technology integration. Harris and Hofer (2011) state that the intertwining and overlapping of the three main components of TPACK in a flexible way that could lead to effective teaching with technology. With that in mind, using the TPACK provided a lens through which to interpret how Charles and Ada negotiated their personal strengths and weaknesses as they adapted their practices to their new instructional reality.

The themes that I identified in this study related to the technological knowledge (TK) component of TPACK. Technological knowledge was described as an understanding of the constant changes in technology and the variety of ways that technological resources and tools are used to meet goals (Koehler & Mishra, 2009). Participants discussed their use of technology to support student learning, differentiate instruction, and provide enriched learning opportunities. In their responses, they discussed many different tools and technical capabilities

of the tools, thus demonstrating their TK. At the same time, Ada, in particular, expressed the need to learn more about technology and the ways in which it can be used in instruction, as well as the need for more technical support. So, while there were signs of technical knowledge from both participants, there was also an indication of a need to continue to learn more in order to better understand the variety of educational technology applications.

Much as with TK, the themes that I identified in this study are also connected to the PK component of TPACK. Koehler and Mishra (2009) described PK as knowledge about teaching models and learning models that teachers possess. The participants provided many examples of how they used the technology to support collaborative projects and peer mentoring, as well as facilitate demonstrations of learning. In other words, the technology was used to support specific pedagogical needs, a combination of technological and pedagogical knowledge that Harris et al. (2009) identified as TPK. Both participants demonstrated a varied degree of confidence with their pedagogical knowledge and used it towards their advantage when working with technology integration in their classroom. This would be especially true for Ada, because she continuously relied on her pedagogical knowledge, especially when she complained that the technology was "behaving badly." Charles was a proficient teacher, with strong pedagogical background. However, due to his comfort with his technological knowledge, he relied on his TK to enhance his PK. Thus, they both used different domains to supplement their weaknesses, while they demonstrated their strengths differently in each TPACK domains.

Last, the participants' deep understanding of their content knowledge was apparent. Koehler and Mishra (2009) define content knowledge (CK) as the knowledge teachers possess about the subjects that they teach. Having a solid grasp of their subject matter was important for both participants. Both Charles and Ada described how they would start with the material they

needed to teach when planning their lessons and evaluating a new use for their students' 1:1 devices. However, of the two participants, Ada arguably had the strongest command of her particular subject content, but this was often overshadowed by her weaker TK.

This study was predicated on my belief that experience in the profession, as represented by years teaching, would likely yield a decreased eagerness to adapt to a 1:1 student device environment and therefore lead to a contrasting experience when compared with a peer with less experience. I had expected this outlook as the outcome of any number of influences relating to teaching experience, including an entrenched mindset or a lack of incentive to change due to impending retirement.

Interestingly, the results of this study did not support this expectation and diverged from much of the existing scholarship proposing that teachers who had more technological knowledge are more inclined to endeavor to implement such technologies on a consistent basis than are those with less technological knowledge (Cuban, 2013b; Ertmer et al., 2015; Ertmer et al., 2007; Harris et al., 2009). As noted, the participants provided rich examples of their technological knowledge, their pedagogical knowledge, and their content knowledge. The previous examples, as well as the findings from Chapter 4, demonstrated the overlapping nature of these forms of knowledge and, in many cases, exemplified the key intersection of technological, pedagogical, and content knowledge (TPACK). The results of this study revealed that a proficiency in one domain of TPACK can help mask a deficiency in another. This tendency to compensate for weaknesses in one TPACK domain with strengths from another was demonstrated by both Charles and Ada. Charles relied heavily on his content knowledge and technological knowledge to supplement his pedagogical knowledge, while Ada relied on the depth of her content knowledge and pedagogical knowledge to augment her technological

knowledge. The end result of this overlap was that Ada, despite her lesser technological knowledge, was not a less eager adopter of 1:1 computing when compared to Charles.

Besides the compensation of overlapping TPACK domains, Charles's and Ada's existing pedagogical beliefs provide another possible explanation for their similar adoption experiences. Ertmer and Ottenbreit-Leftwich (2010) aimed to understand the relationship between teachers' pedagogical beliefs and classroom practices related to technology and found that effective integrators of technology were those teachers whose beliefs aligned with practices that were focused on student-centered learning. In this study, both Charles's and Ada's teaching practices appeared to be aligned with student-centered learning and reflected the belief that these teachers had in the ability of technology to enhance their practice.

Thus, TPACK provided a lens through which to interpret how Charles and Ada navigated their personal strengths and weaknesses as they adapted their practices to their new instructional reality. Charles and Ada demonstrated knowledge in all three of the TPACK domains. However, the depth of their knowledge varied from domain to domain. The results of this study revealed that a proficiency in one domain of TPACK can help compensate for a deficiency in another.

The Findings in Relationship to the Literature

The findings of this qualitative study have a number of strong connections to the literature discussed in Chapter Two in relation to responding to the research questions. Specifically, the findings of this study were consistent with the literature around effective implementation of 1:1 initiatives, addressing first- and second-order barriers to change, the importance of varied and targeted professional development, and the significance of teacher attitudes and beliefs about technology, pedagogy, and learning.

The findings of this study support the importance of 1:1 student device programs in reducing and eliminating the first-order barriers of access and reliability when attempting to get teachers to adopt ICT in a meaningful and transformative manner (Ertmer et. al., 2015). These barriers have been identified in the research as access to reliable hardware and software, dependable class-wide access to the Internet, and consistent access to devices as needed (Cuban, 2009). Once these obstacles were reduced or eliminated, Charles and Ada were able to focus their energies on the use of the technological tool. The participants of this study, teaching within a 1:1 environment, tended to focus more on second-order barriers such as their technology and pedagogical beliefs.

Early models of educational change implied that if teachers had access to enough equipment and training, classroom integration would follow (Apple Computer, 1995; Cuban, 2006; Labbo & Reinking, 1999). Although this may have been true for earlier educational innovations, computer and ICT technology is not as readily assimilated into teachers' existing routines, typically requiring change along multiple dimensions of practice (e.g., personal, organizational, pedagogical). Ertmer et. al. (2010) identified significant extrinsic and intrinsic barriers to the successful integration of technology in the classroom. External influences are tied to accessibility, training, and ongoing support. Internal elements include the level of confidence teachers have in their ability to integrate the technology, their beliefs about pedagogy, student learning, and the overall value that technology integration adds to the teaching and learning process. As mentioned in previous chapters, "The teacher frequently has the most influence on the quality and characteristics of the product: innovative use of ICT" (MacDonald, 2008, p. 197). Thus, the success of 1:1 laptop technology initiatives is at least partially dependent on the

teachers' faithful integration of technology at a higher level into the teaching and learning experiences (Murphy, King, & Brown, 2007).

The experiences of Charles and Ada demonstrated that a 1:1 adoption can clearly transition teacher focus to second-order reform challenges, such as developing a new framework for managing student computer use, integrating ICT tools into instruction, and reconciling beliefs with new pedagogical practices. Some researchers have supposed that second-order barriers cause more difficulties than first-order ones (Bebell & O'Dwyer, 2010; Ertmer, 1999; Park & Ertmer, 2007). The danger of this assumption is that educators and administrators may be led to assume that overcoming second-order barriers is enough. However, as noted by Zhao and Frank (2003), most of the current effort to prepare teachers to use technology takes a very narrow view of what teachers need—"some technical skills and a good attitude" (p. 511). While the results of this study do support that technical skills and a good attitude play a role in a teacher's experiences during an adoption, it is unlikely that those are the only components to a successful 1:1 initiative. I argue that first- and second-order barriers are often inseparably linked together. For example, trying to change teachers' attitudes and beliefs (second-order) toward using technology is likely to be unsuccessful in the long run if one does not also consider changing the way students are currently assessed through multiple choice exams (first-order) that discourage using 21st-century skills. It is also possible that while 1:1 programs may eliminate the first-order barrier of access, they might introduce new, unforeseen barriers like necessitating new classroom management requirements or philosophies.

The participants were unanimous in discussing the significance of multi-layered, formal and informal systems in their professional development. They credited building, departmental, and content specific professional development opportunities that helped them to build their

capacity with regard to the use of different technology tools in the classroom setting. Additionally, the teachers cited the significance of formal and informal collaborative structures (in-service professional development, PLCs, and informal collegial discussions) as providing ongoing support as they experimented with different integration tactics in the classroom. This supports the literature that cites the importance of a multi-layered and differentiated process that is tailored to address teacher needs and concerns (Holcombe, 2009; Koehler, Mishra, & Yahya, 2007; Lawless & Pellegrino, 2007).

Charles and Ada both mentioned the importance of the content-based PD opportunities and informal peer consultations in moving them beyond a basic understanding of the functionality of the technology and to the utilization of the technology tools to transform or redefine the educational activities in their classrooms. The collaborative and supportive building culture allowed the participants to identify and experiment with specific applications of the technology to their respective content areas. The presence of these types of supports, along with the trust of the teachers that experimentation, and possible failure, would not be penalized or be viewed pejoratively, supports the literature that identifies the importance of making connections with teachers between the technology and the specific grade and content areas when such technology tools are expected to be integrated (Luo, 2011). Muir et. al. (2004) even notes that when teachers are shown useful applications through a variety of modalities for technology in their subject areas and how these applications benefits students, most of them will take the time to learn and integrate it.

The scholarship is abundant in linking the level of sustained and differentiated professional development and the extent to which teachers adopt ICT in a meaningful way (Apple Computer, 1995; Ertmer et al., 2015; Penuel, 2006). With the participants, this link was

reflected in their discussion of their respective journeys to effective integration of 1:1 laptop technology in their practices. They made the connection between ubiquitous access to reliable technology and a multi-level professional development plan that gave them the ability to learn, experiment, and incorporate technology into their practice at a high level. For example, recall when Charles directed the students towards researching a topic that emerged organically during class discussion and when Ada utilized the computers to facilitate collaborative feedback on a writing assignment.

Penuel (2006) discusses the findings of numerous studies indicating that many teachers who have access to 1:1 laptop technology employ teacher-centered strategies, but do not incorporate or integrate such technology in a transformative manner. Thus, a number of studies note that the predominant teacher use of technology in the classroom is centered on the incorporation of productivity tools (word processing, presentation creation, Internet searches, etc.) as opposed to the utilization of the technology as a thinking tool or a tool to demonstrate mastery (Cuban, 2013b; Maninger & Holden, 2009; Penuel, 2006). Additionally, Hennessey et. al. (2005) found that teachers' willingness to integrate technology is heavily influenced by their own beliefs about technology, the amount of support they receive, and their skills in marrying the technology with their instruction (p. 156). Ada and Charles were both clear in their conceptualization of technology as a teaching and thinking resource as opposed to a productivity tool meant to convey information to and from students. This difference between how the participants have integrated technology and the uneven implementation by teachers found in the literature is connected to the participants' sustained access to quality professional development to build their capacity and confidence, their willingness to experiment and learn by "flying blind," and their predisposition towards student-centered approaches to teaching and learning. Charles

and Ada expressed that they were provided with numerous positive experiences with regard to technology that increased their willingness to incorporate laptop technology in a meaningful way. This is consistent with Mueller et al.'s (2008) assertion that "teachers need to see positive outcomes and successful practice—they need to actually experience positive events" (p. 1535). The participants both had a number of positive exposures to content-specific integration tactics and experienced positive success, which, in turn, influenced their continued pursuit of higher-level technology application.

A key trend in the literature that was confirmed by the findings of this study related to the importance of teacher attitudes and beliefs about learning and pedagogy. Such beliefs are key to the type and level of laptop integration that occurs in the classroom (Ertmer et al., 2015; Mueller et al., 2008; Penuel, 2006). Penuel (2006) found that teachers who espoused student-centered or constructivist beliefs and methodologies and who had higher confidence in students' ability to complete tasks individually and collaboratively were more likely to utilize student computing devices with students. This finding suggests that a significant influence on the depth of ICT integration that occurs is connected teachers' beliefs about learning and pedagogy (Stanhope & Corn, 2014). The experiences of Ada and Charles underscored the above findings from the literature in their respective discussions about their beliefs and attitudes regarding pedagogy and student learning. Both participants were clear in expressing their respective student-centered beliefs and how those beliefs played out with regard to the pedagogical tactics they employed in their classrooms. Researchers found that teachers often will utilize instructional technology in ways that fit into their pre-existing pedagogical beliefs (Bebel & O'Dwyer, 2010; Topper & Lancaster, 2013; Windschitl & Sahl, 2002; Zhao & Frank, 2003). Mueller et al. (2008) also found that teachers' pedagogical beliefs can change as a result of positive experiences and

outcomes with respect to computer integration. The participants reflected these key findings, as they all espoused student-centered beliefs, while also discussing how they have shifted their practices as they have increasingly integrated laptop technology into their practices. This shift was reflected in the teachers' discussion of how their respective mindsets have undergone a shift that had them relinquishing more control in order to give students more open-ended and project-based inquiry opportunities.

The existing scholarship is inconclusive with regard to measurable gains in student learning and achievement. Much of the data utilized to measure student gains as a result of ICT integration have centered on student attendance, discipline, GPA, subject grades, and standardized assessments (state and national), and such data has been inconsistent from a causal-comparative standpoint (Barros, 2004; Cuban, 2013b; Ertmer, 2015; Holcomb, 2009). Other measures of student learning gains connected to laptop integration have related to student reading and writing (Penuel, 2006). Schrum and Levin (2009) get closer to what, in my opinion, is a more realistic interpretation pertaining to assessing the influence of 1:1 student device integration on student achievement by pointing out that the quality of student interaction with the technology in the context of the activities, the content area, and the teacher's pedagogical beliefs is paramount to the determination of the overall effect on student achievement and engagement. This last point from the literature is key when examining the responses of the participants with respect to their perceptions of the influence of effective integration of laptop technology on student learning and engagement. How they went about integrating student-centered activities that leveraged the functionality that laptop technology affords students in connection with access to information, interacting and collaborating, and using different platforms to demonstrate their understanding was key to informing the influence of such activities on student learning and

engagement. For Ada and Charles, the outcome of endeavoring to adapt their practices to the technological realities in their classrooms has been to shift their mindsets away from a passive learning frame to one where students are pushed agentically to gather, assess, and connect the material to their own assumptions and experiences. Within the approaches discussed above by the participants, their perception is that the effect of ICT on student learning is gradually leading towards greater independence, creativity, and personalization of the learning experience, where students are empowered to take the subject matter and concepts and apply them in new ways that were, heretofore, impossible. Thus, the gains discussed by Ada and Charles do not refute the inconsistent results in the literature, as they are connected to aspects of student learning that are difficult, if not impossible, to measure statistically. From their perspective, the participants were clear in their perception that their integration of 1:1 technology resulted in perceived gains in student creativity, independence, and depth of understanding of the content.

Based on situating the findings from this study within the existing literature to respond to the research questions, the following can be stated. Comfort, self-efficacy, knowledge, and the existing foundational beliefs of educators play a role in the eagerness in which they will engage in a 1:1 computing initiative. Support for teachers such as targeted professional development, opportunities for collaboration and networking, and a building culture which encourages and values risk-taking, is crucial for successful integration. Additionally, teachers with existing student-centered pedagogies will more easily integrate technology in meaningful ways. Lastly, the findings from this study demonstrate student agency and engagement will increase as teachers utilize 1:1 technology in student-centered ways

The Findings in Relationship to ICT-Related Educational Change

Issues of teacher change are central to any discussion of educational technology integration. In general, when teachers are asked to use technology to facilitate student learning, some degree of change is required. When thinking about technology as an innovation Fisher (2006) cautioned against viewing technology as an agent of change. Rather, he argued that teachers must assume this role. However, teachers are frequently hesitant to adopt curricular and instructional innovations (Cuban, 2013a). This is especially true of technology-based innovations because unlike curricular changes which occur only periodically, technology tools and resources are constantly changing (Lee et al., 2015). Although teachers might believe that technology helps them accomplish professional or personal tasks more efficiently, they may be reluctant to incorporate the same tools into the classroom for a variety of reasons including the lack of relevant knowledge, low self-efficacy, and existing belief systems (Lawless & Pellegrino, 2007). Additionally, the environment in which teachers work can also constrain or, as demonstrated by Charles and Ada, further the individual efforts (Lawless & Pellegrino, 2007).

In the context of education, a 1:1 computer adoption is an organizational change process affecting both the staff and the underlying structures of schools. Planning, developing, implementing, and sustaining organizational changes is a complex endeavor. For any major educational change effort to be successful, school leaders need to consider two main dimensions of the change process: (a) the technical aspect and (b) the adaptive aspect (Heifetz & Linsky, 2002). It is important to understand what each component is and how to provide the kinds of leadership support that enable each dimension to succeed. Technical change involves people implementing solutions to problems for which they know the answers. Solving specific problems that arise in implementing these various logistical components of a 1:1 adoption is a “technical”

problem that must be solved (e.g., determining how to provide wireless access or how to deal with needed repairs). While solving technical problems can be difficult, they are not as difficult as the adaptive aspects of change.

Adaptive change involves changing more than routine behaviors or strategies; it involves bringing about changes in people's beliefs, values, and attitudes (Ertmer et al., 1999). When a new instructional tool requires educators to embrace a new philosophy of education or to define the role that they will now be expected to perform in a dramatically different way than they have previously, resistance may emerge (Ertmer & Ottenbreit-Leftwich, 2010). Successfully dealing with the changes that educators are expected to make requires sophisticated leadership strategies. Alternatively, Knight (2007) suggests the use of "partnership principles," which is an empowering alternative to more common top-down models of human interactions. The partnership principles include equality, choice, dialogue, voice, reflection, reciprocity, and praxis.

The pedagogical change in a technology-enhanced classroom may occur as a first order change or a second order change. A first order change is a behavioral change within the limits of the existing pedagogical principles, while in a second order change boundaries are breached, pedagogical principles change, and, as a result, behavior changes as well (Watzlawick, Weakland, & Fisch, 1974). In a technology-enhanced classroom, a first order change can be manifested as the development of the prevalent teaching methods by using various technology tools to support what they otherwise would be doing. This use of technology does not change the pedagogical perceptions of the teacher, but rather serves their teaching method. The integration of technology in the processes of teaching and learning can also bring about a second order change. Such a change is suggested by Ertmer et al. (2015) if reflected by those teachers who

stop viewing the student as a consumer of content and the teacher as the supplier, but rather to see the two of them as partners in a learning community that is building new knowledge. According to this approach, the school needs to change from a supplier of services into a place of knowledge construction, in which the input of students is acknowledged and valued.

Educational reform efforts of the 2000s have consistently purported student-centered practices as the most effective way to prepare students for the 21st-century (Cuban, 2013b). These reform efforts are based on a new definition of "good" teaching, one in which teaching facilitates student learning by leveraging ICT resources as meaningful pedagogical tools. Implementing this new definition of effective teaching requires changes in teacher knowledge, teacher beliefs, and teacher culture.

Teachers need to see examples of what this kind of teaching looks like in practice. Although some may have built relevant knowledge and beliefs from previous experiences (Ertmer et al., 2007), they may not understand how these ideas translate into practice. Although teachers may wholeheartedly accept this new definition of good teaching, they may be unable to implement it without concrete examples of what it looks like. Therefore, examples become an important strategy to facilitate both teacher knowledge and belief change (Zhao & Lei, 2008).

Continuing with this idea, it is critically important that teachers believe in their own abilities to implement these changes within their schools and subject cultures (Ertmer, 2005). Even if teachers change their pedagogical beliefs to adopt this new notion of good teaching and gain the knowledge to implement it, they still need confidence to implement it within their specific contexts. Providing opportunities for teachers to both experiment and to succeed is important. Schools can support this initiative by creating a culture that allows teachers to try out new practices, while making technical and pedagogical support readily available (Cuban, 2013b).

This idea of a supportive culture played an important role in Charles's and Ada's narratives. Both Charles and Ada were empowered by the culture of Boolean MS to take risks and explore methods and tools outside of their comfort zone. I argue that without this supportive culture Charles, and especially Ada, would have been impeded in their efforts to adapt their practice.

Perhaps one of the best ways to support teacher change is by providing opportunities for them to witness how the change benefits their students. Borko and Putnam (1995) indicated that professional development cannot, on its own, make teachers change: "The workshops alone did not change these teachers. It was listening to their own students solve problems that made the greatest difference in their instructional practices" (p. 55). Research by Ertmer et al. (2007) also demonstrated that when teachers witness the effect of technology on their students' learning, they are motivated to experiment with additional technologies in their teaching.

Charles and Ada demonstrated a positive disposition towards adjusting their pedagogy. One aspect of this was their fundamental belief that technology can amplify student-centered teaching practices. This understanding of the possibilities for technology to enhance instruction led them to actively seek out informal learning opportunities and to engage fully in formal professional development. Thus, as demonstrated by Charles and Ada, possibly the most important feature of a professional development program is a strong focus on helping teachers understand how students learn specific content and how specific instructional practices support that learning (Borko & Putnam, 1995). Specifically, educational leaders must focus change efforts on helping teachers understand how student-centered practices, supported by technology, affect student learning outcomes. This has the potential to effect substantial changes in knowledge, beliefs, and culture. Once teachers' mindsets have changed to include the idea that

teaching is not effective without the appropriate use of ICT resources to achieve student learning outcomes, a significant milestone will have been achieved.

In summary, as long as the integration of technology in the school is perceived as a technical issue, it will only achieve a first order pedagogical change. As soon as this integration is seen as an opportunity for changing the pedagogical paradigm and the relationship between the teacher, students, and content, it can produce a second order change. This kind of change, as reflected in Charles's and Ada's narratives, requires a change in teachers' beliefs and a compatible school culture in which they operate (Ertmer & Ottenbreit-Leftwich, 2010). As the findings of this study demonstrated, a school culture conducive to flexibility and professional growth along with a system of strong formal and informal supports can lead to the eager adoption of more student-centered teaching practices facilitated through technology. This is especially true if, as in the situation with Charles and Ada, the teachers understand the power and necessity of undergoing such a pedagogical change. The lessons learned from educational leaders' efforts to successfully implement 1:1 initiatives clearly underscore the fact that the enormity of the change process is not reduced simply because it is technology-centric. Educational change is a big deal regardless. Thus, the probability of a successful change effort increases significantly when school leaders give serious attention to *both* technical and adaptive influences.

Therefore to conclude and respond to the purpose of the study, participants in this study demonstrated an eagerness to adopt the new technology based on how they were supported within their school culture, their professional development support, their informal support system leading them to engage in adoption of this technology, and acceptance of risk and failure. Further both participants used their technological, pedagogical, and content knowledge in ways where

they could draw strength from and rely on each domain to compensate for areas of weaknesses. Additionally, as was found in the literature, the participants demonstrated that comfort, self-efficacy, knowledge, and existing foundational beliefs all play a role in the readiness in which teachers approach technology-driven change. Targeted professional development, opportunities for collaboration and networking, and a building culture conducive to risk-taking is critical for teachers to feel the support they need to feel comfortable when faced with the need for pedagogical change. Finally, fundamental beliefs conducive to flexibility and professional growth along with a system of strong formal and informal supports can lead to the meaningful adoption of more student-centered teaching practices and an accompanying increase in student agency and engagement in learning.

Implications and Recommendations

The findings from this study provide insight into the pedagogical journey of one experienced and one early career educator as well as the influences of their school culture and various supports structures on their experiences while involved in a 1:1 computer initiative. Evidence from this study raises questions and implications for various stakeholders. In the following section I elaborate on these implications and associated recommendations.

Policymakers

As Cuban (2013a) has argued, technology for the sake of technology is rarely the goal of a school or state's decision to requisition funds to provide and support computers for education staff and students. Policymakers must be sure that the desired transformation is truly taking place in the classroom as they assess the implementation success of their 1:1 program. Though decision-makers would like to believe that increased use of computers will automatically lead to improved teaching and learning, it is critical to have a mechanism in place to routinely evaluate

the efficacy of these programs to rationalize the continued investment in funds. It is for this reason that it is imperative for districts considering a 1:1 initiative, and the policymakers funding them, to communicate with all stakeholders to develop a shared vision for the adoption in which to frame the success of the program.

In addition to lacking a mechanism for evaluation, schools and school systems have struggled to keep up with the cost of technology integration and have sometimes rushed to purchase hardware and software without sufficient planning (Cuban, 2013b). I argue that professional development for teachers integrating technology is frequently an afterthought and is routinely considered an add-on to be worried about at a later date.

Teachers typically feel that they need more time to effectively integrate technology into the curriculum (Lee et al., 2015). As a general rule, successful school systems are using approximately one-third of their technology funding for teacher development (Higgins & Spitulnik, 2008). If teacher development is funded in this manner, then what Ertmer and Ottenbreit-Leftwich (2010) say becomes possible:

> Effective integration of technology into education calls for a new vision of professional development—not one that attempts merely to add technology to an established system but one that takes a fresh look at teaching and learning in general. Professional development composed of a few days of in-service workshops every year must be replaced by ongoing programs that are tied to your school's curriculum goals, designed with built-in evaluation, and sustained by adequate financial and staff support (p.21).

Unfortunately, if it is not planned for, professional development will not receive the attention it needs and all too often ends up just as Ertmer and Ottenbreit-Leftwich (2010) described. School systems are slowly starting to realize that that money spent on school technology is wasted

without a proportional effort to help teachers with its use and integration into the curriculum (Ertmer et al., 2015). This attitude needs to change, and decision makers need to stop thinking about technology first and then education later. For example, according to Cuban (2013a), 5.6 billion dollars was spent on instructional technology in the United States in 2010-2011, of which only 17% was on training. In fact, Cuban found that when asked to supply figures associated with technology integration, 50% of the states that were asked to provide figures for teacher training could not.

Building and District Educational Leaders

Simply placing devices into the hands of students with the expectation that teachers will begin to effectively incorporate them into their pedagogical practices is not an effective approach for school districts (Cuban, 2013b). Prior to a systemic change taking place, an organization must have the capacity to react productively to that change. As Fullan (2011) states, any change process needs a starting point before moving ahead. Ertmer and Ottenbreit-Leftwich (2010) explain that the concept of capacity building can be incorporated into the implementation of 1:1 computing programs, as it is hard to change existing learning and teaching practices even when there is broad agreement on what the new practices should be.

District leaders need to be aware of their school's culture and the preparedness of the staff to embrace the initiative. Planning and communication involving multiple stakeholders should have taken place prior to the program implementation to ensure that all voices are heard and expectations are clearly defined. Developing a culture for change is critical to the success of any educational movement. Fullan (2011) states that in order to accomplish this, leadership must possess the appropriate knowledge to provide guidance through the process. November (2010)

posits that the weakest area of the typical 1:1 initiative is the absence of leadership development for the administrative team.

Prior to implementing a 1:1 program, the leadership of a school needs to be prepared to provide guidance in these technology-rich environments. Bielefeldt (2006) points out that effective leadership is one of the most important predictors of a successful technology implementation. It is recommended that prior to introducing a 1:1 program, districts need to determine whether school leaders are prepared to lead in these technology ubiquitous environments.

Fullan (2011) revealed some key leadership behaviors, dispositions, and competencies foundational to successful change efforts. Key behaviors include hands-on involvement in all implementation aspects, such as providing regular coaching, modeling, support, and feedback to staff; listening to staff concerns; and scheduling and participating in formal and informal on-going professional development. In their study, school leaders built in time and opportunities for the "human sense-making" process to play out by allowing their staffs to reformulate how they thought about and approached their work. Administrators also provided opportunities for staff members to discuss the new interaction patterns staff were expected to implement through the use of role playing, describing the way the ideal model would look in their school, allocating time during faculty meetings to explicitly engage the topic, and prioritizing communicating information about the changes to others (e.g., parents, school boards, and students).

Teachers and Professional Development Organizers

The experiences of Charles and Ada support the assertion that both formal and informal professional development is integral for achieving the intended shift in pedagogical practices during a 1:1 adoption. As Ertmer and Ottenbreit-Leftwich (2010) note, teacher professional

development activities are a source of information about how and what to teach; these activities also prepare teachers to use technology effectively. In my experience, professional development regarding technology integration is especially important, as it often raises fundamental questions about the intersections of content and pedagogy that can overwhelm even experienced instructors.

From analyzing the data in this study, I have generated the following professional development related considerations when implementing a 1:1 program:

- Teachers need to understand how technology will change their pedagogy and curriculum.
- Teachers need to consider how their classroom procedures and structure will change in a 1:1 classroom environment.
- Districts need to provide ongoing professional development related to curriculum support and development and media and information literacy.
- Teachers need to participate in professional learning communities for peer support and collaboration.
- Districts benefit from providing a technology integration specialist to provide daily support for pedagogy and curriculum needs.

Professional development should show teachers how to engage their students and reflect on their own practices. Teachers would need to know how to transform their curricula by rethinking their content to engage students. Professional development would need to continue beyond preparatory and early phases of an implementation so that teachers can continue to develop and hone the skills and abilities to necessary to sustain the initiative.

Participants expressed that they not only want professional development that aligns with the content that they teach, but they also desire opportunities to collaborate with colleagues and

time to practice newly developed skills. As such, it would be necessary for administrators to realize that informal learning takes place during the school day and works well when embedded in relevant activities and should not always be considered as something *extra*. To this end, I recommend that administrators work to build collaboration time and space into the regular workday to provide opportunities for informal learning.

The results from this study help bring the power of formal and informal learning to the forefront of educational technology integration. Therefore, it is important for both teachers and administrators to ensure that all stakeholders are valued as learners and to provide them with opportunities to improve their craft through learning experiences centered around a common vision for what technology integration can look like.

In summary, the outcomes of this research suggest avenues for policy makers, administrators, teachers, and professional development organizers to increase the influence of 1:1 initiatives. It is necessary for all involved stakeholders to understand the importance of profession development in affecting technology-related change and to include training in any 1:1 adoption plan. It is equally important for teachers to understand that they will need to leverage formal and informal avenues of professional development to further their professional learning. Professional development organizers need to be cognizant of the needs of the staff and provide targeted, content-specific training in a timely manner. Last, district and building leaders should be aware of their organizational culture and the underlying goals for their 1:1 initiative and keep these in mind as they lead their staff through the change process.

Significance of the Study

Many of the individual aspects of the findings of this study are not new or particularly insightful by themselves and largely confirm existing findings in the scholarship. There has

been extensive research into many of the individual findings of this study: the navigation of TPACK domains, the importance of a supportive building culture in facilitating change, and the importance of existing foundational beliefs when approaching ICT integration as a whole (Cuban, 2013a; Ertmer et al., 2015; Koehler & Mishra, 2009). However, the significance of this study lies not in the corroboration of existing scholarship, but instead in illustration of the anatomy of change. In the end, this study investigating ICT integration wasn't about technology at all. It was about illuminating the experience of transition.

This study, with rich detail and context, shows the anatomy for the transformation of Charles's and Ada's pedagogical practices and beliefs from the start of the process to the end. It provides insight into how things come to be and the way in which they come to be. It provides insight into how and why participants moved back and forth across the TPACK domains as they assimilated their fundamental beliefs with their lived experiences.

The TPACK framework used in this study addresses the issues related to ICT integration from a knowledge perspective. It implies that if teachers develop associated TPACK, many issues can be resolved. To a certain extent, it is true that technology integration issues can be resolved if teachers possess strong TPACK capacity. However, this study illustrated how TPACK is associated with teachers' beliefs and how teachers overcome contextual challenges through rebalancing of their individual domains of knowledge and through the creative restructuring of their pedagogical beliefs. This study highlighted that the key essence of TPACK lies in the dynamic creation of knowledge and practice by teachers when they are confronted with the advancement of ICT and its associated pedagogical affordances.

With the explosion of 1:1 computing initiatives in school districts and states across the country, it is imperative to maximize the positive effects these huge capital expenditures have

on teaching and learning. As mentioned in Chapter Two, the scholarship has shown that the ways in which initiatives are conceived, implemented, and supported can have a deciding influence on the effectiveness of the program. Additionally, as shown in this study, teachers' attitudes and beliefs about technology and student learning, along with their pedagogical beliefs in general, are key considerations that can either contribute to or diminish the success of such initiatives. Further, the findings demonstrated that the ways in which teachers choose to utilize new technology in classrooms is based on their confidence and level of self-efficacy, their access to a supportive peer network in addition to district-sponsored professional development, the culture of the site in which they work, and their willingness to embrace change in their philosophical approach to teaching. While the research has provided mixed results in relation to the success of these initiatives based on which measures are selected for evaluation, the potential for catalyzing organizational change through meaningful integration of 1:1 student devices remains appealing for districts seeking to improve student performance and demands further investigation.

Study Limitations and Opportunities for Further Research

Although this study adds to the literature on technology integration and teacher perceptions of the experience through the lens of TPACK, it is not without limitations. The current study involved documenting the experiences of educators in an urban setting. While I attempted to provide a rich data set, it does represent a single school building and that building's particular circumstances and provides a deeply contextualized view of the teaching and other professional experiences of two representative teachers in this community.

It is important to point out that portions of the data were collected through teacher self-reporting. My status as an *insider* helped me develop trusting relationships with teachers. They

often noted that they felt comfortable being honest and speaking freely with me. However, there is always a danger that when individuals self-report, they express what they think someone else would want to hear. In order to account for variation in human interpretation and reflection, and to triangulate data collected, I conducted temporally separated multiple interviews, attempted to collect written artifacts, and conducted classroom observations.

As this qualitative case study was bounded by a single school with two teachers as units of analysis, there are several opportunities for expanding such a study for future research. While a small sample size is not necessarily a limitation in qualitative research, since the purpose of such inquiry is an in-depth investigation and context-driven analysis, resource permitting, a larger sample size that can be treated with rigor, thoughtfulness, and in-depth analysis could add more to this area of study. However *more* does not always mean better in qualitative studies; rather, more can mean superficial handling of data if the researcher is limited in resources. Therefore, future studies with more participants would require thoughtful consideration of and engagement with resources. Including more educators across different schools could provide a richer set of data, possibly allowing for a more nuanced cross-unit analysis, if there were resources to handle a larger sample size with thoughtful and in-depth engagement. Another logical opportunity would be to expand the scope of the research to include student voices. At the receiving end of instruction, student input would be invaluable in providing insight into a teacher's pedagogical practices. Another research avenue to explore would be the perspectives of building and district administrators. The convergence of data yielded from including additional educators across different schools or school systems and the voices of both students and administrators would add additional points of view from which to triangulate the experience.

Since both participants specifically discussed the importance of professional development in their experience, another consideration for future study would be to investigate teacher outcomes from formal and informal professional development. Historically, research evaluating teacher professional development has used survey data asking for teachers' opinions and attitudes that measure their satisfaction (Lawless & Pellegrino, 2007). However, the research base on the effectiveness of professional learning experiences needs to grow so that it can inform educational practices in this area.

An additional area for further study involves educational change and the intertwined nature of the barriers to 1:1 implementation. These programs were designed to overcome first-order change barriers, such as access to hardware, software, and Internet (Cuban, 2013a). As with any educational change, there are many barriers that can cause any innovation to be less than substantially realized. Technological change is no different. One of the most alarming facts is that some the same barriers for educational change seen in this study have existed for a dreadfully long time without much success in overcoming them, regardless of the technology being applied. For example, during the post-World War II era, video film became one of the world's prominent technologies of the time. This new technology was alleged to transform not only the way we lived, but also the way students would learn at school. However, according to Leggett and Persichitte (1998), there were several barriers to its implementation as a transformative teaching tool, such as lack of training, lack of time to find the right match for the curriculum, and cost. More than fifty years later, the literature describing barriers to technology integration looks strikingly similar. Several researchers (e.g., Cuban, 2013b; Ertmer et al., 2007; Lee et al., 2015) note that the most commonly cited barriers are not that different from the ones from several decades ago: time, cost, training.

Perhaps one of the reasons why the same barriers persist today is that they have been dealt with in isolation. For example, a simple strategy to overcome such barriers might be to just focus on them individually and remove them. However, historically, that has not always resulted in the appropriate or increased use of technology in schools (Cuban, 2006). Hence, new strategies may need to be formulated to overcome these new barriers. Future research should therefore examine the relationships between first- and second-order barriers related to technology integration in greater detail and how these relationships change over time.

Another limitation for this study was the focus on building culture throughout the findings and conclusion. In this instance, building culture was a limitation because it was not initially set out to be studied. Instead, the importance of building culture to the experiences of the participants emerged through the data analysis. As such, the sense of the building culture reflected in this study was built entirely from the narratives of the two participants. Although Charles and Ada independently provided insight into their individual perceptions of Boolean MS's culture, the impression developed is still limited in scope and bounded by their interpretation of events. Future studies would benefit from providing mechanisms for studying building culture beyond the lens of the individual participants in order to develop a richer context for the experience. However, while culture was a limitation for this study, its inclusion was appropriate given its importance to the participants' narratives.

Last, further investigation about how TPACK is associated with teachers' beliefs and how teachers overcome contextual challenges through creative restructuring of classroom learning environments is needed. Additional research could move beyond the TPACK knowledge perspective, which tends to be associated with codified beliefs and knowledge, and into a mode of thinking that values flexibility and creative thinking.

In recent years, research efforts have been devoted to exploring teachers' technological pedagogical content knowledge (Mishra & Koehler, 2006). The TPACK framework, however, addresses the issues related to ICT integration from a knowledge perspective. It implies that if teachers develop associated TPACK, many issues can be resolved. I believe instead that, to a certain extent, the technology integration issue can be resolved if teachers possess stronger TPACK capacity.

Conclusion

Within discourses of ICT and education, it has often been with the idea that new technologies will revolutionize education, and more specifically, that teaching and learning will fundamentally change for the better (see Chapter Two). Over the past century, this revolution has not happened, despite the continued reduction in first-order change barriers (Cuban, 2013a). Cuban (1986) reports on this historical trend, from film (1910's) to radio (1920's) to television (1950's), wherein each emerging technology was expected to revolutionize the educational landscape. These technologies were encouraged in schools and made widely available, yet they resulted in limited and often superficial classroom use. Furthermore, this usage was generally as a form of providing a break from normal class activities and hence, not meaningfully used for learning or integrated into the curriculum (Cuban, 1986). Nonetheless, there is an increasing sentiment that ICT technology is a culturally significant phenomenon, with the power to help shift educational practices towards more contemporary methods.

Teaching and learning are human-centric endeavors, and with that comes the opaque "black box" between the inputs and outputs (Cuban, 2013a). Through sharing the implementation journey of two participants in a single urban school district, I have attempted to provide a glimpse into a specific instance of Cuban's metaphorical black box. The data gathered

throughout the study demonstrated just how many internal and external aspects influence the individual educator's translation of 1:1 student devices into the ultimate goal of meaningful, long-lasting pedagogical change. Bebell and O'Dwyer (2010) note that, "it is impossible to overstate the power of individual teachers in the success or failure of 1:1 computing" (p. 48).

Furthermore, much of the success of technology-based initiatives has been dependent on implementation strategies, pre-existing attitudes about technology integration, student learning, pedagogy, professional development, and ongoing support for teachers (Penuel, 2006). Both participants stressed the importance of multi-faceted formal and informal supports for building their capacity and encouraging their adaptive learning and evolving practice. However, as demonstrated in this study, simply working to develop the requisite teacher technology knowledge does not seem adequate to lead to meaningful technology integration. Instead, administrators can support meaningful adoption by viewing technology integration through the lens of first- and second-order change within the overall context of the building culture. Further, it became evident that with increasing comfort with the available technology, the participants found that the tools were conducive to student-centered pedagogical approaches and felt a pressure to adapt their pedagogy in relation to a supportive and conducive culture. Last, the participants agreed that the possibilities and application available due to the ready access to student computer devices were highly motivating and engaging for them professionally as teachers and for their students. Thus, the experiences of the educators in this study underscore the above statements, and the various perspectives offered in relation to the research questions are significant for policy makers, school administrators, and any other stakeholders as they investigate and undertake 1:1 adoption initiatives and seek models of what effective integration entails at the system, building, and individual teacher levels.

References

Abbitt, J. T. (2011). Measuring technological pedagogical content knowledge in preservice teacher education: A review of current methods and instruments. *Journal of Research on Tehcnology in Education, 43*(4), 281-300.

Adams, A. (2004). Pedagogical underpinnings of computer-based learning. *Journal of Advanced Nursing, 46*(1), 5-12.

Adler, P. A., & Adler, P. (1987). *Memership roles in field research*. Beverly Hills, CA: Sage.

Al-Awidi, H. M., & Alghazo, I. M. (2012). The effect of student teaching experience on preservice elementary teachers' self-efficacy beliefs for technology integration in the computer use among teacher education students. *Journal of Technology and Teacher Education, 93*(3), 321-347.

Allan, W. C., Erickson, J. L., Brookhouse, P., & Johnson, J. L. (2010). Teacher professional development through a collaborative curriculum project - an example of TPCK in Maine. *Tech Trends, 54*(6), 36-43.

Andrade, A. (2009). Interpretive research aiming at theory building: Adopting and adapting the case study design. *The Qualitative Report, 14*(1), 42-60.

Apple Computer. (1995). *Changning the conversation about teaching, learning and technology: A report on 10 years of ACOT research*. Retrieved from http://imet.csus.edu/imet1/baeza/pdf%20files/upload/10yr.pdf

Applebee, A. N. (1996). *Curriculum as Conversation*. Chicago, IL: University of Chicago Press.

Azevedo, R., & Hadwin, A. F. (2005). Scaffolding self-regulated learning and metacognition - implications for the design of computer-based scaffolds. *Instructional Science, 33*(5), 367-379.

Bakia, M., Means, B. M., Gallagher, L., Chen, E., & Jones, K. (2009). *Evaluation of the enhancing education through technology program*. Retrieved from Washington, DC:

Ball, A. L., Knoblock, N. A., & Hoop, S. (2007). The instructional planning experiences of beginning teachers. *Journal of Agricultural Education, 48*(2), 56-65.

Bandura, A. (1993). Perceived self-efficay in cognitive development and functioning. *Educational Psychologist, 28*(2), 118-148.

Barrios, T. (2004). Laptops for learning: Final report and recommendations of the laptops for learning task force. Retrieved from http://etc.usf.edu/L4L/Report.pdf

Barron, A., Harmes, J., & Kemker, K. (2006). Technology as a classroom tool: Learning with laptop computers. In R. Subramaniam (Ed.), *Handbook of research on literacy in technology at the K-12 level* (pp. 271-286). Hershey, PA: Idea Group Reference.

Barron, A., Kemker, K., Harmes, J., & Kalaydjian, K. (2003). Large-scale research study on technology in K-12 school: Technology integration as it relates to the national standards. *Journal of Research on Technology in Education, 35*(4), 489.

Baviskar, S. N., Hartle, T., & Whitney, T. (2009). Essential criteria to characterize constructivist teaching: Derived from a review of the literature and applied to five constructivist-teaching method articles. *International Journal of Science Education, 31*(4), 2009. doi:10.1080/09500690701731121

Bebell, D., & O'Dwyer, L. (2010). Educational outcomes and research from 1:1. *Journal of Technology, Learning, and Assessment, 9*(1). Retrieved from http://www.jtla.org.

Bebell, D., O'Dwyer, L., Russell, M., & Hoffman, T. (2010). Concerns, considerations, and new ideas for the data collection and research in educational technology studies. *Journal of Research on Technology in Education, 43*(1), 29-52.

Becker, H. J. (2000). Who's wired and who's not: Children's access to and use of computer technology. *The Furture of Children, 10*(2), 44-75.

Behrens, J., Mislevy, R., DiCerbo, K., & Levy, R. (2010). *An evidence centered design for learning and assessment in the digital world*. Retrieved from http://www.cse.ucla.edu/products/reports/R778.pdf

Bhattacharya, K. (2007). *Introduction to Qualitative Methods: A Student Handbook*. Texas A&M University - Corpus Christi. Corpus Christi, TX

Bielefeldt, T. (2006). *Teaching, learning, and one-to-one computing*. Paper presented at the National Educational Computing Conference, San Diego, CA.

Blumer, H. (1986). *Symbolic interaction: perspective and method*. Berkeley, CA: University of California Press.

Blumer, H., & Morrione, T. J. (2004). *George herbert mead and human conduct*. New York: Altamira Press.

Bonner, A. (2002). Insider-outsider perspectives of participant observation. *Nurse Researcher, 9*(4), 7-19.

Borko, H., & Putnam, R. (1995). Expanding a teacher's knowledge base: A cognitive psychological perspective on professional development. In T. R. G. M. Huberman (Ed.), *Professional development in education: New paradigms & practices* (pp. 35-66). New York: Teachers College Press.

Braun, V., & Clark, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2).

Breg, S., Benz, C., Lasley, T., & Raisch, C. (1998). Exemplary technology use in elementary classrooms. *Journal of Research on Computing in Education, 31*(2), 111.

Callaway, H. (1992). Ethnography and experience: Gender implications in fieldwork and texts. In J. Okely & H. Callway (Eds.), *Anthropology and autobiography* (pp. 29-49).

Cengiz Gulek, J., & Demirtas, H. (2005). Learning with technology: The impact of laptop use on student achievement. *The Journal of Technology, Learning and Assessment, 3*(2), 1-38.

Chauncey, C. T. (2010). *Strategic priorities for school improvement*. Cambridge, MA: Harvard Education Publishing Group.

Collins, A., Brown, J. S., & Holum, A. (1991). Cognitive apprenticeship: Making thinking visable. *American Educator, 15*(3), 6-11.

Costa, J. (2012). *Digital learning for all now: A school leader's guide for 1:1 on a budget*. Thousand Oaks, CA: Sage.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches*. Thousand Oaks, CA: Sage.

Crotty, M. (1998). *The foundations of social research: Meaning and perspective in the research process*. Thousand Oaks, CA: Sage.

Crotty, M. (2003). *The foundations of social research: Meaning and perspectives in the research process* (3 ed.). London: Gage.

Cuban, L. (1986). *Teachers and machines: The classroom use of technology since 1920*. New York, NY: New Teachers College Press.

Cuban, L. (2006). The laptop revolution has no clothes. *Education Week, 26*(8), 29.

Cuban, L. (2009). *Oversold and Underused: Computers in the classroom*. Cambridge, MA: Harvard University Press.

Cuban, L. (2013a). *Inside the black box of classroom practice: Change without reform in american education*. Cambridge, Mass: Harvard Press.

Cuban, L. (2013b). Why so many structural changes in schools and so little reform in teaching practice? *Journal of Educational Administration, 51*(2), 109-125.

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal, 38*(4), 813-834.

Davies, C. A. (1999). *Reflexive Ethnography: A guide to researching selves and others*. New York, NY: Routledge.

Debell, D., O'Dwyer, L., Russel, M., & Hoffman, T. (2010). Concerns considerations and ideas for research in educational technology studies. *Journal of Research on Tehcnology in Education, 43*(1), 29-52.

Dede, C. (2007). Reinventing the role of information and communications technologies in education. *Yearbook of the National Society for the Study of Eduction, 106*(2), 656-667.

deMarrais, K. (2004). Qualitative interview studies: Learning through experience *Foundations for research: Methods of inquiry in education and the social sciences* (pp. 51-68). Mahwah, NJ: Lawrence Erlbaum Associates.

Denzin, N. K. (2009). The elephant in the living room: Or extending the conversation about the politics of evidence. *Qualitative Research, 9*(2).

Denzin, N. K., & Lincoln, Y. S. (2005). *The sage handbook of qualitative research* (3rd ed.). Thousand Oaks, CA: Sage.

Denzin, N. K., & Lincoln, Y. S. (2013). *Collecting and interpreting qualitative materials* (4 ed.). Thousand Oaks, CA: SAGE.

Drayton, B., Falk, J., Stroud, R., Hobbs, K., & Hammerman, J. (2010). After installation: Ubiquitous computing and high school science in three experienced, high-technology schools. *The Journal of Technology, Learning and Assessment, 9*(3), 1-57.

Dwyer, S. (2009). The space between: On being an insider-outsider in qualitative research. *International Journal of Qualitative Methods, 8*(1), 54-63.

EdTech Staff. (2017, February, 1). More than 50 percent of teachers report 1:1 computing. *EdTech*.

Elanmani, H. (2013). Evaluation of teachers for the 21st century training project. *International Education Studies, 6*(3), 48-54.

Ertmer, P. (1999). Addressing first and second-order barriers to change: Strategies to technology integration. *Educational Technology and Development, 47*(4), 47-61.

Ertmer, P. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research & Development, 53*(4), 25-39.

Ertmer, P., Addison, P., Lane, M., Ross, E., & Woods, D. (1999). Examining teachers' beliefs about the role of technology in the elementary classroom. *Journal of Research on Computing in Education 54, 32*(1).

Ertmer, P., Ottenbreit-Leftwich, A., & Tondeur, J. (2015). Teacher beliefs and uses of technology to support 21st century teaching and learning. In Erlbaum (Ed.), *International Handbook of Research on Teacher Beliefs* (pp. 403-418). New York: Taylor & Francis-Rutledge.

Ertmer, P., Ottenbreit-Leftwich, A., & York, C. S. (2007). Exemplary technology using teachers: Perceptions of factors influencing success. *Journal of Computing in Teacher Education, 23*(2), 55-61.

Ertmer, P., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42*(3), 255-284.

Fisher, T. (2006). Educational transformation: Is it like 'beauty' in the eye of the beholder, or will we know it when we see it? *Education and Information Technologies, 11*, 293-303.

Fleischer, H. (2012). What is our current understanding of one-to-one computer projects: A systematic narrative research review. *Educational Research Review, 7*(2), 107-122. doi:10.1016/j.edurev.2011.11.004

Flick, U. (2009). *An introducation to qualitative research*. Thousand Oaks, CA: Sage.

Fullan, M. (2001). *Leading in a culture of change*. San Francisco, CA: Jossey-Bass.

Fullan, M. (2007). *The new meaning of educational change* (4th ed.). New York, NY: Teachers College Press.

Fullan, M. (2011). *The six secrets of change: What the best leaders do to help their organizations survive and thrive*. San Fancisco, CA: John Wiley & Sons.

Gardner, H. (2006). *Changing minds: The art and science of changing our own and other people's minds*. Boston, MA: Harvard Business School.

Gardner, H. (2008). *Five Minds for the Future*. Boston, MA: Harvard Business Press.

Given, L. M. (2008). *The SAGE encyclopedia of qualitative research methods.* (Vol. 2). Thousand Oaks, CA: Sage.

Glesne, C. (2011). *Becoming qualitative researchers: An introduction* (4th ed.). Boston: Allyn & Bacon.

Gray, L., Thomas, N., & Lewis, L. (2010). *Teachers' use of educational technology in U.S. Public Schools: 2009* (NCES 2010-040). Retrieved from Washington, DC:

Green, H., & Hannon, C. (2007). Their space: Education for a digital generation. Retrieved from http://etc.usf.edu/L4L/Report.pdf

Grimes, D., & Warschauer, M. (2008). Learning with laptops: A multi-method case study. *Journal of Educational Computing Research, 38*(3), 305-332.

Guest, G. (2012). *Applied thematic analysis*. Thousand Oaks, California: Sage.

Hall, G. (2010). Technology's achilles heel: Achieving high-quality implemenation. *Journal of Research on Technology in Education, 42*(3), 231-253.

Hancock, R., Knezek, G., & Christensen, R. (2007). Cross-validating measures of technology integration: A first step toward examining potential relations between technology integration and student achievement. *Journal of Computing in Teacher Education, 24*(1), 15-21.

Hargreaves, A., & Shirley, D. (2012). *The global fourth way: The quest for educational reform*. Thousand Oaks, CA: SAGE.

Harper, D. (2002). Talking about pictures: a case for photo elicitation. *Visual Studies, 17*(1), 13-26.

Harris, J. B., & Hofer, M. J. (2011). Technological pedagogical content knowledge (TPACK) in action: A descriptive study of secondary teachers' curriculum-based, technology-related instructional planning. *Journal of Research on Technology in Education, 43*(3), 211-229.

Harris, J. B., Mishra, P., & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *Journal of Research on Technology in Education, 41*(4), 393-416.

Harrison, J., MacGibbon, L., & Morton, M. (2001). Regimes of trustworthiness in qualitative research: The rigors of reciprocity. *Qualitative Inquiry, 7*(3), 323-345.

Haydel, A., & Roeser, R. (2002). *On the linkes between students' motivational patterns and their perceptions of, beliefs about, and performance on different types of science assessments: A multidimensional approach to achievement validation* (573). Retrieved from Los Angeles, CA:

Hennessey, S., Ruthven, K., & Brindley, S. (2005). Teacher perspectives on integrating ICT into subject teaching: commitment, constraints, caution, and change. *Journal of Curriculum Studies, 37*(2), 155-192.

Hertz, R. (1997). *Reflexivity and voice* (R. Hertz Ed.). Thousand Oaks, CA: Sage.

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research. *Educational Technology Research Development, 55*(3), 223-252.

Higgins, T. E., & Spitulnik, M. W. (2008). Supporting teachers' use of technology in science instruction through professional development: A literature review. *Journal of Science Education and Technology, 17*(5), 511-521.

Holcomb, L. B. (2009). Results and lessons learned from 1:1 laptop initiatives: A collective review. *TechTrends, 53*(6), 49-55.

Howard, B. C., & Tomei, L. (2008). The classroom of the future and emerging educational technologies: Introduction to the special issue. *International Journal of Information and Comunication Technology Education, 4*(4), 1-8.

Hyett, N., Kenny, A., & Dickson-Swift, V. (2014). Methodology or method? A critical review of qualitative case study reports. *International Journal of Qualitative Studies in Health and Well-being, 9*.

ISTE. (2016). Nets for administrators. Retrieved from http://www.iste.org/docs/pdfs/20-14_ISTE_Standards-A_PDF.pdf

Jonassen, D. H. (1991). Objectivism versus constructivism: Do we need a new philosophical paradigm? *Educational Technology Research & Development, 39*(3), 5-14.

Joyce, B., & Showers, B. (1982). The coaching of teaching. *Educational Leadership, 40*(1), 4-10.

Kay, R., Knaack, L., & Petrarca, D. (2009). Exploring teachers' perceptions of web-based learning tools. *Interdisciplinary Journal of E-Learning & Learning Objects, 5*, 27-50.

Keengwe, J., & Onchwari, G. (2009). Technology and early childhood education: A technology integration professional development model for practicing teachers. *Early Childhood Education Journal, 37*(3), 209-218.

Kelchtermans, G. (2005). Teachers' emotions in educational reforms: Self-understanding, vulnerable commitment and micropolitical literacy. *Teaching and Teacher Education, 21*(8), 995-1006. doi:10.1016/j.tate.2005.06.009

Kereluik, K., Mishra, P., Fahnoe, C., & Terry, L. (2013). What knowledge is most worth: Teacher knowledge for the 21st century learning. *Journal of Digital Learning in Teacher Education, 29*(4), 127-139.

Koehler, M., & Mishra, P. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge. *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70.

Koehler, M., Mishra, P., & Yahya, K. (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy and technology. *Computers & Education, 49*(3), 740-762. doi:10.1016/j.compedu.2005.11.012

Kolb, D. (1984). *Experiential learning, experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice Hall.

Kvale, S. (1996). *Interviews: An interduction to qualitative research interviewing* (1 ed.). Thousand Oaks, CA: SAGE.

Labbo, L. D., & Reinking, D. (1999). Negotiating the multiple realities of technology in literacy research and instruction. *Reading Research Quarterly*, *34*(4), 478-492.

Lather, P. (1997). Drawing the line at angels: Working the ruins of feminist ethnography. *Qualitative Studies in Education, 10*(3), 285-304.

Lawless, K., & Pellegrino, J. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research, 77*(4), 575-614.

LeCompte, M., Preissle, J., & Tesch, R. (1993). *Ethnography and qualitative design in educational research* (2nd ed.). San Diego, CA: Academic Press.

Lee, J., Spires, H., Wiebe, E., Hollebrands, K., & Young, C. (2015). Portraits of one-to-one learning environments in a new learning ecology. *International Journal of Learning, 10*(3).

Lei, J., & Zhao, Y. (2007). Technology uses and student achievement: A longitudinal study. *Computers & Education, 49*(2), 284-296. doi:10.1016/j.compedu.2005.06.013

Levin, T., & Wadmany, R. (2006). Teachers' beliefs and practices in technology-based classrooms: A developmental view. *Journal of Research on Technology in Education, 39*(2), 157-181.

Lincoln, Y. S., & Guba, E. (1985). *Naturalistic Inquiry*. Newbury Park, CA: Sage.

Lowther, D. L., Inan, F. A., Ross, S. M., & Strahl, J. D. (2012). Do one-to-one initiatives bridge the way to 21st century knowledge and skills? *Journal of Educational Computing Research, 46*(1), 1-30.

Luo, H. (2011). Qualitative Research on Educational Technology: Philosophies, Methods and Challenges. *International Journal of Education, 3*(2). doi:10.5296/ije.v3i2.857

MacDonald, R. J. (2008). Professional development for information communication technology integration: Identifying and supporting community of practice through design-based research. *Journal of Research on Technology in Education, 40*(4), 429-445.

Makki, T., O'Neal, L., Cotten, S., & Rikard, R. V. (2018). When first-order barriers are high: A compasion of second- and third-order barriers to classroom computing integration. *Computers & Education, 120*, 90-97.

Maninger, R., & Holden, M. (2009). Put the textbook away: Preparation and support for a middle school one-to-one initiative. *American Secondary Education, 38*(1), 5-33.

Marzano, R. J. (2009). Teaching with interactive whiteboards. *Educational Leadership, 67*(3), 80-82.

Means, B. M. (2010). Technology and education change: Focus on student learning. *Journal of Research on Technology in Education, 42*(3), 285-307.

Merriam, S. B. (1988). *Case study in education: A qualitative approach*. San Francisco, CA: Jossey-Bass.

Merriam, S. B. (2009). *Qualitative research and case study applications in education*. San Francisco, CA: Jossey-Bass, Inc.

Metiri Group. (2006). 1 to 1 Learning. Retrieved from http://windhamsd.org/whs/1_to_1_Research_Metiri_Group.pdf

Mingers, J. (2001). Combining IS research methods: Towards a pluralist methodology. *Information Systems Research, 12*(3), 240-259.

Moore-Hayes, C. (2011). Technology integration preparedness and its influence on teacher-efficacy. *Canadian Journal of Learning and Technology, 37*(3), 1-15.

Morphew, C. (2009). Conceptualizing change in the institutional diversity of U.S. colleges and universities. *Journal of Higher Eudcation, 80*(3), 243-269.

Morris, D. (2012). E-confidence or incompetence: Are teachers ready to teach in the 21st century? *World Journal on Educational Technology, 2*(2), 142-155.

Mruck, K., & Breuer, F. (2003). Subjectivity and reflexivity in qualitative research. *Forum Qualitative Sozialforschung, 4*(2).

Mueller, J., Wood, E., Willoughby, T., Ross, C., & Specht, J. (2008). Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. *Computers & Education, 51*(4), 1523-1537.

Muir, M., Knezek, G., & Christensen, R. (2004). The power of one-to-one: Early findings from the Maine learning technology initiative. *Learning and Leading with Technology, 32*(3), 6-11.

Nelson, J., Christopher, A., & Mims, C. (2009). Transformation of teaching and learning. *Tech Trends, 53*(5), 80.

Niederhauser, D., & Lindstorm, D. (2006). Addressing the NETS for students through constructivist technology use in K-12 classrooms. *Journal for Computer Research, 34*(1), 91-128.

Niess, M. L., & Walker, J. M. (2010). Guest editorial: Digital videos as tools for learning mathematics. *Contemporary Issues in Technology and Teacher Education, 10*(1). Retrieved from http://www.citejournal.org/vol10/iss1/mathematics/article1.cfm

November, A. (2010). *Empowering Students with Technology* (2nd ed.). Thousand Oaks, CA: Corwin.

Oncu, S., Delialioglu, O., & Brown, C. A. (2008). Critical components for technology integration: How do instructors make decisions? *Journal of Computers in Mathematics and Science Teaching, 27*(1), 19-46.

Ortlipp, M. (2008). Keeping and using reflective journals in the qualitative research process. *The Qualitative Report, 13*(4), 10.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research, 62*(3), 307-332.

Park, S. H., & Ertmer, P. (2007). Impact on problem-based learning (PBL) on teachers' beliefs regarding technology use. *Journal of Research on Technology in Education, 40*(2), 247-267.

Partnership for 21st Century Schools (2009). P21 Framework Definitions. Retrieved from http://www.p21.org/documents/P21_Framework_Definitions.pdf

Patton, M. (2001). *Qualitative research & evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Penuel, W. R. (2006). Implementation and effects of one-to-one computing initiatives: A research synthesis. *Journal of Research on Technology in Education, 38*(3), 329-348.

Peshkin, A. (1988). In Search of Subjectivity. One's Own. *Educational Researcher, 17*(7), 17-21.

Piaget, J. (1972). *Psychology and epistemology: Towards a theory of knowlege*. London: Penguin Press.

Pillow, W. (2003). Confession, catharsis, or cure? Rethinking the uses of reflexivity as methological power in qualitative research. *International Journal of Qualitative Studies in Education, 16*(2), 175-196.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*(5).

Prensky, M. (2009). From digital native to digital wisdom. *On the Horizon, 9*(5), 1-6. Retrieved from

Prensky, M. (2010). *Teaching digital natives: Partnering for real learning*. Thousand Oaks, CA: Sage.

Puentedura, R. R. (2012). The SAMR model: Background and exemplars. Retrieved from http://www.hippasus.com/rrpweblog/archives/2012/08/23/SAMR_BackgroundExemplars.pdf

Pugh L, e. a. (2000). Insider/outsider partnerships in an ethnographic study. *Nursing Standard, 14*(27), 43-44.

Purcell, K., Heaps, A., Buchanan, J., & Friedrich, L. (2013). *How teachers are using technology at home and in their classrooms*. Retrieved from

http://www.pewinternet.org/2013/02/28/how-teachers-are-using-technology-at-home-and-in-their-classrooms/

Rallis, S., & Lawrence, R. (2018). Systems thinking to drive school turnaround. In H. Shaked, C. Schechter, & A. Daly (Eds.), *Leading holistically: How schools, districts, and states improve systemically* (1st ed.). New York: Routledge.

Richmond, G. (2015). *Beginning teacher retention: The experiences of educators that decided to stay*. Unpublished manuscript. Department of Educational Leadership. Kansas State University.

Rockman et al. (2000). *A more complex picture: Laptop use and impact in the context of changing home and school access*. Retrieved from San Francisco, CA:

Roehrig, G. H., Kruse, R. A., & Kern, A. (2007). Teacher and school characteristics and their influence on curriculum implementation. *Journal of Research in Science Teaching, 44*, 883-907.

Rotherham, A. J., & Willingham, D. T. (2010). 21st-century skills: Not new, but a worthy challenge. *American Educator, 34*(1), 17-20.

Russell, M., Bebell, D., O'Dwyer, L., & O'Connor, K. (2003). Examining teacher technology use - Implications for preservice and inservice teacher preparation. *Journal of Teacher Education, 54*(4), 297-310. doi:10.1177/0022487103255985

Saldaña, J. (2013). *The coding manual for qualitative researchers* (2nd ed.). Thousand Oaks, CA: Sage.

Schaefer, L., & Levin, B. (2012). *Leading technology-rich schools: Award-winning models for success*. New York, NY: Teachers College Press.

Schmidt, D. A., Bara, E., Thompson, A. D., Mishra, P., Koehler, M., & Shin, T. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education, 42*(2), 123-149.

Schrum, L., & Levin, B. B. (2009). *Leading 21st century schools: Harnessing technology for engagement and achievement*. Thousand Oaks, CA: Corwin.

Schunk, D. H. (2014). *Learning theories: An educational prespective*

Schwandt, T. A. (2007). *The sage dictionary of qualitative inquiry* (3 ed.). Los Angeles Sage.

Schwandt, T. A., & Denzin, N. K. (1994). *Constructivist, interpretivist approaches to human inquiry* (Y. S. Lincoln Ed.). Thousand Oaks, CA: Sage.

Senge, P. M., Cambron-McCabe, N., Lucas, T., Smith, B., Dutton, J., & Kleiner, A. (2000). *A fifth discipline resource: Schools that learn* (First Revised ed.). New York, NY: Doubleday.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22.

Shulman, L. S. (2004). *The wisdom of practice: Essays on teaching, learning, and learning to teach*. San Francisco, CA: Jossey-Bass.

Silvernail, D., & Pinkham, C. (2011). A middle school one-to-one laptop program: The Maine experience. *Maine Learning Technology Initiative*.

Spires, H., Oliver, K., & Corn, J. (2011). The new learning ecology of one-to-one computer environments: Preparing teachers for shifting dynamics and relationships. *Journal of Digital Learning in Teacher Education, 28*(2), 63-72.

Spradley, J. P. (1980). *Particpant observation*. Holt: Rinehart and Winston.

Stanhope, D., & Corn, J. (2014). Acquiring teacher commitment to 1:1 initiatives: The role of the technology facilitator. *Journal of Research on Technology in Education, 46*(3), 252-276.

Stryker, S. (1976). *Die theorie des symbolischen interaktionismus*. Frankfut, Germany: Suhrkamp.

Sturdivant, R. X., Dunham, P., & Jardine, R. (2009). Preparing mathematics teachers for technology-rich environments. *Primus: Problems, Resources, and Issues in Mathematics Undergraduate Studies, 19*(2), 161-173.

Thoman, E., & Jolls, T. (2005). Media literacy education: Lesson from the center of media literacy. In G. Schwartz & P. U. Brown (Eds.), *Media Literacy: Transforming Curriculum and Teaching* (Vol. 104, pp. 180-250).

Topper, A., & Lancaster, S. (2013). Common challenges and experiences of school districts that are implementing one-to-one computing initiatives. *Computers in the Schools, 30*(4), 346-358. doi:10.1080/07380569.2013.844640

Tracy, S. J. (2010). Qualitative quality: Eight "big-tent' criteria for excellent qualitative research. *Qualitative Inquiry, 16*(10), 837-851.

Turkle, S. (2007). *Evocative objects: Things we think with*. Cambridge, MA: MIT Press.

U.S. Department of Education. (2010). *Transforming american education: Learning powered by technology*. Retrieved from https://www.ed.gov/sites/default/files/NETP-2010-final-report.pdf.

Ubiquitous. (Ed.) (2015) Merriam-Webster.

Vongkulluksn, V., Xie, K., & Bowman, A. (2018). The role of value on teachers' internalization of external barriers and externalization of personal beliefs for classroom technology integration. *Computers & Education, 118*, 70-81.

Vygotsky, L. S. (1978). *Mind inf society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Warschaeaur, M., & Ames, M. (2010). Can 1 laptop save the world's poor? *Journal of International Affairs, 64*(1), 33-50.

Watzlawick, P., Weakland, J., & Fisch, R. (1974). *Change: Principles of problem formation and problem resolution*: WW Norton.

Weiser, M. (1991). The computer for the 21st century. *Scientific American, 265*(3), 66-75.

Weiss, R. S. (1994). *Learning from strangers: The art and method of qualitative interview studies*. New York, NY: The Free Press.

Weston, M., & Bain, A. (2010). *The end of techno-critique: The naked truth about 1:1 laptop initiatives and educational change* (Vol. 9).

Wetzel, K., & Marshall, S. (2011). TPACK goes to sixth grade: Lessons from a middle school teacher in a high-technology-access classroom. *Journal of Digital Learning in Teacher Education, 28*(2), 73-81.

Windschitl, M., & Sahl, K. (2002). Tracing teachers' use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics, and institutional culture. *American Educational Research Journal, 39*(1), 165-205.

Woolf, B. P. (2010). Roadmap for education technology. *National Science Foundation*.

Yin, R. K. (2006). Case study methods. In J. L. Green, G. Camilli, & P. Elmore (Eds.), *Complementary methods in education research* (pp. 111-122). Washington, DC: American Educational Research Association.

Yin, R. K. (2009). *Case Study Research: Design and Methods* (4th ed.). Thousand Oaks, C. A.: Sage.

Zhao, Y., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal, 40*(4), 807-840.

Zhao, Y., & Lei, J. (2008). One-to-one computing: What does it bring to schools? *Journal of Educational Computing Research, 39*(2), 97-122. doi:10.2190/EC.39.2.a

Appendix A - Timeline

Proposed timeline for the study

Date	Project Item	Participants' Role
Week 1	Identify Participants	None
	Contact participants in person and explain the project	Communicate with researcher
	Confirm participation	Decide whether to participate
	Journaling	None
Week 2 –Week 3	Meet with participants for first interview	Answer questions asked by researcher
	Observe the classes	Provide an opportunity for observation
	Journaling	None
Week 4 – Week 6	Transcribe Interview	None
	Member check with participants	Respond to transcription
	Journaling	None
Week 7 – Week 8	Collect other data sources from participants	Provide data sources
	Do preliminary coding from first interview	None
	Peer review of codes	None
	Observing the classes	

	Journaling	Providing opportunity to observe None
Week 9 – Week 11	Analyze other data sources	None
	Do preliminary coding from other data sources	None
	Peer review of codes	None
	Journaling	None
Week 12 – Week 14	Meet with the participants for the second interview	Answer questions
	Observing classes if needed	Providing opportunity to observe
	Journaling	None
Week 15	Journaling	None
	Observing classes	Provide opportunity to observe
Week 16 – Week 19	Transcribe the second interview	None
	Journaling	None

Week 20 – Week 22	Member check with participants from second interview	Respond to transcription
	Do preliminary coding from second interview	None
	Journaling	None
Week 25 – Week 26	Peer review of codes from second interview	None
	Journaling	None
Week 28 – Week 30	Meet with the participants for object elicited interview	Respond to the questions
Week 31 – Week 33	Transcribe the interviews	None
	Continue writing data analysis	None
Week 34 – Week 35	Member check with the participants	Provide Feedback
	Peer review for the themes	None
	Finalize write-up of study	None

Appendix B - Written Approval

[redacted]

[redacted]

Office of Assessment & Evaluation

[redacted]

Gary Richmond
[redacted]

Dear Mr. Richmond,

Your study, "Teacher Perceptions of Computer Access on Pedagogy and Student Learning", was approved. Your [redacted] School supervisor will be [redacted], Director of Assessment and Evaluation. If you have questions about conducting your study, please contact [redacted] at [redacted].

Approval by the district research committee means the researcher now has permission to approach the building level staff about participation in the study to secure their agreement to participate. The applicant should first contact the study liaison/supervisor and then the building principal. In some cases, the study liaison/supervisor may need to assist the researcher in identifying schools to approach about participation in the study. Building staff, unless otherwise noted, have the right to pass on participation and may negotiate the manner in which the study is implemented. If there are questions about this, please contact me. District policy requires the researcher to provide the district with a report of the research findings within six months of completion of the study.

If you have any future research projects involving [redacted] we can be reached at [redacted] for an updated research application.

Sincerely,

[redacted]

Director of Research and Evaluation
Research Committee

Appendix C - Email Solicitation

Subject: Request for Participation in a Doctoral Study

Please read for an opportunity to participate in a research study with a doctoral student at Kansas State University.

My name is Gary Richmond, and I am pursuing my Doctorate in Education through Kansas State University. I am working on a study as one of the requisites for my program and would like to invite you to consider being a participant in such research study. The purpose of this study is to explore how two middle school teachers in a Midwestern city describe the effects of ubiquitous computer access for students on their instructional practices and overall student learning as they participate in a district-wide one-to-one computer initiative. The information this study will produce will help inform present and future schools with in regards to meaningful and sustained technology adoption. This study has received Institutional Review Board (IRB) approval, Approval (358) for the use of human subjects.

Participation in the study is absolutely voluntary. In order to participate, you must be a certified classroom teacher, currently teaching at least one class, and working in a school district in which one-to-one computing is provided for students. If you are selected, you will be briefed to the study where you will complete an informed consent form. As the participant, you will be given the opportunity to select a pseudonym to protect your identity; however, if you do not, one will be assigned.

As the participant, you will be asked to complete two audio-recorded interviews with me and the length of these interviews will be between 30 and 60 minutes. The time and place of the interviews will be private, mutually agreed upon, ensuring that the times are convenient and the

locations comfortable for you. You will also be asked to allow me to observe your teaching in order to better inform my questions for you during the interview process. These observations will also be at a mutually agreed upon time and any notes or observations will remain private.

The data collected will be analyzed in a research context and your name will remain confidential at all times. Once the data analysis is complete, you will receive the findings and be asked to review and provide additional insight. You will be in complete liberty of removing yourself, or any of the information, from the study and may do so at any time and without penalty.

If you are interested in participating in this study, please contact me by as soon as possible so we can make arrangements to meet for an informational session where you will have opportunities to ask questions. If you are satisfied with the answers and feel so inclined, I would like to invite you to participate in the study. Please feel free to contact me at grichmo@ksu.edu, 913-219-4656.

Sincerely,

Gary Richmond, Student

College of Education, Department of Educational Leadership

321 Bluemont Hall

Manhattan, KS 66506

Appendix D - Kansas State University Consent Form

WAIVER OF INFORMED CONSENT: *There are limited instances where the requirement for a formal informed consent document may be waived or altered by the IRB.*

45 CFR 46 states that "An IRB may waive the requirement for the investigator to obtain a signed consent form for some or all subjects if it finds either:

1) *That the only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confidentiality. Each subject will be asked whether the subject wants documentation linking the subject with the research, and the subject's wishes will govern; or*
2) *That the research presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context."*

PROJECT TITLE: ONE-TO-ONE COMPUTING AS AN INSTRUCTIONAL TOOL: A QUALITATIVE CASE STUDY INVESTIGATING EDUCATOR IMPLEMENTATION EXPERIENCES AND PERCEPTIONS

APPROVAL DATE OF PROJECT: SPRING 2017 EXPIRATION DATE OF PROJECT:

SPRING 2018

PRINCIPAL INVESTIGATOR: Dr. Kakali Bhattacharya

CO-INVESTIGATOR(S): Gary Richmond

CONTACT NAME AND PHONE FOR ANY PROBLEMS/QUESTIONS: kakalibh@k-state.edu; (785) 532-1164; kakalibh@k-state.edu

IRB CHAIR CONTACT/PHONE INFORMATION*:*

- Rick Scheidt, Chair, Committee on Research Involving Human Subjects, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224.
- Cheryl Doerr, Associate Vice President for Research Compliance and University Veterinarian, 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506, (785) 532-3224.

SPONSOR OF PROJECT: Kakali Bhattacharya

RESEARCH STUDY: This study is research. Research is the systematic investigation into and study of materials and sources in order to establish facts and reach new conclusions.

PURPOSE OF THE RESEARCH:
The purpose of this study is to explore how two middle school teachers in a Midwestern city describe the effects of ubiquitous computer access for students on their instructional practices and overall student learning as they participate in a district-wide one-to-one computer initiative.

PROCEDURES OR METHODS TO BE USED:
If you agree to participate in this study, you will be asked to be interviewed and to review analyses of the data gathered during the interviews. You will be asked to bring photographs and artifacts based on the prompts provided. This study will take approximately 36 weeks during which you will be interviewed four times. You will also be asked to provide documentation for analysis in the form of lesson plans, meeting agendas and collaboration notes. Your participation will be audio/video recorded.

LENGTH OF STUDY: This study will last approximately 36 weeks.

RISKS OR DISCOMFORTS ANTICIPATED: There are no direct risks that can be anticipated. The participant might reveal struggles while adjusting their practice to incorporate ubiquitous computer access. However, nothing that the teacher reveals will be presented or published in any identifiable format. The participant will be able to review all materials and provide consent before any publication and presentation of the material. Because no identifiable details will be shared about the participant or incidents in which they were engaged, there is no anticipated risk or discomfort anticipated.

BENEFITS ANTICIPATED: There is no direct benefit for you to participate in this study. However, you may find your own reflection on your pedagogical beliefs insightful.

EXTENT OF CONFIDENTIALITY:
This study is confidential. Your name will not be used. The records of this study will be kept private. No identifiers linking you to this study will be included in any sort of report that might be published unless you specifically request otherwise. Research records will be stored securely and only the researcher, Gary Richmond, and the principal investigator, Kakali Bhattacharya, will have access to the records.

If you choose to participate in this study, you will be audio and/or video recorded. Any recordings will be stored securely and only Gary Richmond will have access to the recordings. Any recordings will be kept for three years and then erased.

TERMS OF PARTICIPATION: I understand this project is research, and that my participation is completely voluntary. I also understand that if I decide to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which I may otherwise be entitled.

I verify that my signature below indicates that I have read and understand this consent form, and willingly agree to participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.

Participant Name:

Participant Signature: **Date**

Witness to Signature: **Date:**

(project staff):

Appendix E - Document Analysis Protocol

In qualitative research, it is important to collect documents that will offer additional context to the study in order to gain a deep understanding of the participants' experiences. In this case, the participants will be encouraged to share relevant documents they feel might further explain their experiences. These documents will not be published in the study report if they have identifying information that cannot be concealed. However, if there is no danger to revealing the identity of the participants or any other associated people, if appropriate, some documents will be shared in the dissertation with the participants' written permission.

Example of documents could include but not be limited to:

- Correspondences with faculty or peers (identifying information, names, details will not be revealed)
- Researcher Reflection Journal
- Agendas (Collaboration)
- Lesson plans

In this study, documents will be analyzed and explored for common themes and patterns.

Themes and patterns will be investigated with the following analytical focus:

- What are the participants' experiences during the early phases of a 1:1 computer initiative?
- What are the participants' perceptions of the effect transitioning to a 1:1 computer environment has on their pedagogical practices?
- What are the participant's perceptions of the effect of a 1:1 computer environment on overall student learning?

Appendix F - Interview Protocol

There will be two open-ended, semi-structured interviews conducted in a conversational nature during the course of the study. The interview will be 30 to 60 minutes in length. Broadly speaking, the questions will be used for guiding other questions during the interview. It is the intent of the researcher to explore the responses in-depth for at least twelve open-ended questions. However, depending on how the participant elaborates each question, the interviewer will have to remain flexible. Due to the semi-structured, open-ended, conversational nature of the interviews, probes will be used based on participant's responses to further explore her answers after asking a broad open-ended guiding question. Probes will emerge as a result of the participant's answers. All probes and questions will be broadly informed by the following questions:

1. Walk me though a typical instructional day.
2. Describe your thoughts and feelings when you first heard that your school would be adopting a 1:1 ratio of computers for your students.
    a. How did you overcome feelings of _____?
3. Can you give me some examples of how you prepared for this challenge?
4. Tell me about the supports you receive at your building or district level.
5. Tell me about a recent professional development experience related to the 1:1 initiative.
    a. How did this professional development session compare with other professional development you have attended?
    b. How has the training aligned with your goals and needs specific to the 1:1 initiative?

6. Describe a lesson using the new computers that went particularly well.
    a. What were the conditions for creating this positive experience?
    b. To what do you ascribe the success of this lesson/activity/project?
    c. How do you plan to improve upon this success?
7. Can you tell me about a lesson using the new computers that didn't work out?
    a. What support helped you through the worst experience?
8. Share with me an experience in which your students produced something in your classroom using their laptop which left an impression on you.
    a. What impressed/disappointed you the most about the project or new learning?
    b. How did you prepare students for the project?
    c. How did this project compare with your students from previous years without laptops?
9. Talk to me about how you prepare for instructing with laptops. Take me through your most recent lesson from planning through implementation.
    a. Describe how you adapted to the change in instructional planning.
    b. How does planning for instruction with laptops differ from the way you planned before students had laptops?
    c. Where there any surprises you found when planning lessons for students?
    d. What changes do you foresee for yourself in the future as a result of planning for instruction with students using laptops?
10. What other information would you like to share with me about your experience with the 1:1 initiative?
11. If I were to walk in during instruction, what would I see/hear?

12. If I were to visit during lunch/PD/collaboration time, what would I see or hear teachers doing/saying about the 1:1 initiative?
13. Can you tell me about a time when you felt comfortable using computers in your instruction? (falsification)
14. Describe your attitude on using the Chromebook as a teaching and learning tool.
15. What was your position about going 1:1?
16. To what extend do you feel that Chromebooks can change the teaching and learning experience?
17. How frequently do you integrate Chromebooks into your lesson?
18. Do you feel like you're received enough professional development to effectively use Chromebooks in the classroom?
19. What additional training would you like to receive?
20. To what extent has the 1:1 implementation met your expectations?
21. To what extent has the 1:1 implementation failed to meet your expectations?
22. In your experience, what is going well with the 1:1?
23. In your experience, what could be improved upon?
24. What do you notice when students use Chromebooks in your classroom?
25. Describe any changes you've noticed with the 1:1 implementation in regards to…

    …student engagement.

    …student behavior.
26. Tell me about student activities that you incorporate into lessons/activities using Chromebooks.

27. Please respond to this prompt: The use of Chromebooks has improved student learning in my classroom.
28. Please respond to this prompt: The use of Chromebooks has improved the quality of my teaching.

Appendix G - Photograph and Object Elicitation Protocol

Because I want to further personalize the interview process, having the participants share objects and/or photos that have meaning to them within the context of the research topic will allow me to explore their experiences from a different perspective and, perhaps, a deeper and more personal level. For these interviews, I will ask the participants to do the following:

1. Take pictures or bring pictures/objects that you already have that demonstrate your understanding of what it means to meaningfully integrate technology.
2. Bring objects, documents, or whatever else you already have that demonstrate your understanding of what it means to teach in a 1:1 student device environment.

Appendix H - Debriefing Statement

Thank you for your participation in this study about the experiences educators teaching a school with one-to-one computer access. A set of two interviews were conducted with each participant in addition to asking that documents and/or artifacts directly related to the relevance of the interviews and the study be provided. The goal of the interviews was to gather information about the unique lived experiences of these participants. Through the information gathered in the interviews, themes about experiences were developed. The themes identified as a result of this research include: (insert themes from study).

Final results will be available from the researcher, Gary Richmond, by (DATE). I will send you a final copy of the findings and schedule a debriefing meeting with you to verify accuracy of findings. I will audio and or video record our conversation for the purpose of maintaining accuracy of recall of our conversation. Your participation, including your name and responses, will remain confidential and any identifiable markers will be fictionalized, even if the report is published.

If you would like to talk to someone other than the researcher, you are encouraged to contact my major professor: Dr. Kakali Bhattacharya at kakalibh@ksu.edu. Also, you may contact the Kansas State University Institutional Review Board: Dr. Rick Scheidt, Chair Committee on Research Involving Human Subjects or Dr. Cheryl Doerr, Associate Vice President for Research Compliance and University Veterinarian. Both of them are located in 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506 and the telephone number is 785-532-3224.

Appendix I - In Vivo Coding Sample

Highlighted text indicates in-vivo codes.

G: How'd you feel about that?

A: Oh that was awesome, but it didn't smell the same. I missed the scent of fresh mimeographed papers. By then, transparencies and overhead projectors were a thing. But, back in the day I'd take papers home in a bag and usually let the papers stack and stack until I was a desperate person and then I'd record all these grades. I think the biggest thing tech has done for me is that I keep more current on grades.

G: Why do you think that is?

A: It's easy.

G In what way is it easier?

A: #1 I don't have to get the calculator out and average the grades. Now I don't need the adding machine. I think this is something a lot of new teachers take for granted. #2 being able to show flocabulary, or other videos, or doing powerpoints for vocabulary along with the pictures and whatnot. Those things have changed. Made life easier.

G: Do you think having the technology has changed what it's like to be a student?

A: I think kids bore more quickly. You've got to put on a good dog and pony show to keep their attention. Now I'm doing it with visuals and technology. It hits some kids that are more visual learners. I think technology helps me hit a better variety of learning styles.

G: Think back to when you first heard your students were going to be getting Chromebooks. How did you feel?

A: I thought, what a waste of money. That was my first thought. Ask me this question again in 2 years and we don't have a real textbook. The next adoptions will be electronic. Then I'll have more opinions.

G: What do you think about that?

A: Right now it scares the snot out of me. I use computers, but its hard. Those kids are sneaky. If someone is back there and I'm over here I don't know what they're looking at or working on their screen. Even if I come over to check, boom they click 1 button and it's a mystery.

G: So you're concerned about?

A: I'm concerned about kids being off-task. That's my biggest worry. This is their learning experience and I expect them to do what I tell them to do. I'm scared this will be harder to do.

G: Have your feelings changed as you've taught in the 1:1?

A: Yes, because there are other teachers that are smart. They find things that I'd never find. [redacted] found readtheory which is just awesome. The kids sign up and then I can see what they've accomplished. They take a pretest and then it puts them at their instructional level. Then I can see what they've done and if they've improved. I rely on everyone else to find wonderful technology, and they do, and then they share it with me.