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By

Sandra Teresa Montes

December 2016

INTEGRATING ONE-TO-ONE TECHNOLOGY IN THE CLASSROOM:

THREE DIFFERENT APPROACHES

A Dissertation Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Education

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December 2016

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Mantras during dissertation: Todo lo puedo en Cristo que me fortalece. I can do all things through Christ who strengthens me. Filipenses/Philippians 4:13 and “Delight yourself in the Lord and He will give you the desires of your heart.” Psalm 37:4

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INTEGRATING ONE-TO-ONE TECHNOLOGY IN THE CLASSROOM:

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An Abstract
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Abstract

The purpose of this qualitative, multiple case study was to examine the decisions three teachers made while planning to integrate portable technology in technology-rich elementary classrooms. The three participants were selected by their district's Digital Learning Coordinator because of their high level of technology integration. The study investigated these teachers’ planning habits for instruction incorporating portable technology, such as Chromebooks. Observations, interviews, and lesson plan reviews constituted the qualitative data collected during approximately eight weeks. Peer debriefing, along with member checks, guaranteed that themes did not have a limited point of view, establishing credibility and dependability (Anney, 2014, Carspecken, 1996; Day, 2015).

The Technological Pedagogical and Content Knowledge (TPACK) model was a useful descriptor for each teacher’s technology planning level, and each used their own level of TPACK to drive their integration of technology in their classrooms and in their planning. The three participants utilized one-to-one (1:1) technology with varying degrees of effectiveness, and each planned differently for its use.

The cross-case analysis guided the formation of four assertions: a) Experienced teachers with technology at their disposal are unlikely to change their planning, but will

simply include technology when they deem it an appropriate and convenient tool to achieve their ends; b) Standardized technology does not necessarily lead to standardized uses or planning; c) Observable high and even skillful use of technology does not necessarily indicate strong planning; and d) Teachers are not motivated to change the way they plan when their students consistently excel at high stakes tests. The study findings have implications for teacher educators, teachers, and school and district leaders. Understanding how one's own level of TPACK and beliefs affect the choices teachers make during planning for technology integration can guide teachers and districts to identify teachers' specific needs in order to make a 1:1 initiative successful.

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Chapter I

Introduction

One-to-one (1:1) instructional technology (IT) is emerging as a viable and equitable option for ubiquitous technology in United States schools as IT becomes more affordable and accessible (Penuel, 2006; Warschauer, 2006). Teachers have a significant influence on the successful integration of technology in their classrooms (Chen, 2008; Wang & Reeves, 2004) and are the facilitators as students move into their roles as educational explorers (Blair, 2002). Although 99 percent of teachers in the United States reported they had at least one classroom computer and 95 percent of these computers had daily access to the Internet, the National Center for Education Statistics found that only 40 percent of the teachers used the computers often in their instruction (Gray, Thomas, & Lewis, 2010). Because the use of technology has the potential to support teachers' routine and facilitate innovative practices, teachers could benefit from incorporating more IT in their lesson planning and classroom teaching (Levin & Wadmany, 2006).

The development of global learners who can function in the twenty-first century requires the fusion of traditional reading, writing, and arithmetic with critical thinking, creativity, communication, and collaboration, which are at the very heart of the International Society for Technology in Education's (ISTE) Standards for Students (Blair, 2002). Teachers meet the learning needs of students in their classrooms by going beyond their own efficiency and productivity and focusing on the ways technology can support both content and its delivery (Groff & Mouza, 2008). Teachers often use computers to prepare lessons and communicate but seldom as instructional tools to

deliver a lesson or to assign activities that require technology (Russell, Bebell, O'Dwyer, & O'Connor, 2003) often because of their own lack of computer knowledge (Groff & Mouza, 2008). Effective technology-enhanced educational environments need to be more student centered, which, in turn, requires a paradigm shift from the traditional view of the teacher as the main supplier of knowledge to an environment in which students and teachers share the creativity and responsibility of promoting critical thinking (Groff & Mouza, 2008, ISTE Standards, 2007). A teacher's understanding of, and belief in, student-centered education should propel him or her to take advantage of the emerging wealth of technology to shape a classroom that is technology rich, and, thereby, enhances instruction and student development (Levin & Wadmany, 2006).

Teachers have the responsibility to plan specific, dynamic, and interactive lessons that maximize opportunities for collaboration, critical thinking, problem solving, and decision making (Corn et al., 2010; ISTE Standards, 2007). Teacher planning must center on using available technology, such as iPads, Chromebooks, laptops, desktops, and software, to establish meaningful instructional tasks that enable students to gain knowledge and experiences that are profound and connected and that can have real applications in everyday life (Ertmer & Ottenbreit-Leftwich, 2010).

Problem

A gap exists in the research on teachers' planning for technology integration in their classrooms. Some research discusses technology integration in all content areas (e.g., Hansen, 2008; Savage, 2007; Suhr, Hernandez, Grimes, & Warschauer, 2010; Yerrick & Johnson, 2009) and research on how technology helps diverse learners (e.g.,

Freeman, 2012; Hofer & Swan, 2006; Shaunessy, 2007; Watson & Watson, 2011). Some research focuses on factors that influence technology integration in the classroom (e.g., Ertmer, Ottenbreit-Leftwich, & York, 2006-2007; Levin & Wadmany, 2006; Palak & Walls, 2009; Park & Ertmer, 2007). Chapter II includes a discussion of this research.

A few studies discussed how teachers think about technology, instruction, and content when they are planning for technology integration (e.g., Beeson, 2011; Harris & Hofer, 2011; Hofer & Swan, 2006). More research is needed on how teachers plan for technology integration in technology-rich classrooms. For a classroom lesson, including one for technology integration, to have a higher chance for success, a teacher must plan with the end in mind (McTighe & Thomas, 2003). Teachers should welcome innovation and twenty-first century technological advances to make their tasks easier and more effective.

Purpose

The purpose of this qualitative study is to examine how three teachers in technology-rich classrooms in a Mountain Independent School District (pseudonyms have been used for the elementary school, the district, and the participants) school plan for the integration of regular student technology use—in the form of portable technology such as Chromebooks –in their teaching. The study will investigate the three teachers' planning habits for instruction using portable technology. Because teachers determine the instruction that takes place in their classrooms (Chen, 2008), I will focus on teacher planning. Teachers' knowledge as characterized in the Technological Pedagogical Content Knowledge (TPCK or TPACK) framework (Harris & Hofer, 2011; Mishra &

Koehler, 2006; Pierson, 2001) and their pedagogical theories will combine to influence every decision they make during their planning time. The TPACK framework represents the relationship between technology, pedagogy, and content as the teacher plans and uses effective teaching with technology (Harris & Hofer, 2011; Koehler & Mishra, 2009). This relationship includes "an understanding of how teaching and learning can change when particular technologies are used in particular ways" (Koehler & Mishra, 2009, p. 65). This investigation will study what a teacher's thought process is while planning for effective lessons that will integrate portable technology such as Chromebooks in their teaching.

Research Question

How do teachers in technology-rich classrooms plan to integrate technology into their teaching?

Significance of the Study

As more technological advances become readily available to children who are digital natives (Prensky, 2001) and school districts purchase and incorporate these technologies into the classroom, teachers must be prepared for the challenges (Chen, 2008). The classroom teacher has the most significant influence on the successful integration of technology (Chen, 2008; Wang & Reeves, 2004). Because teachers' beliefs and knowledge affect and inform the instructional decisions they make (Angers & Machtmes, 2005; Ertmer & Ottenbreit-Leftwich, 2010; Pajares, 1992; Penuel, 2006), those beliefs and knowledge will influence the decisions they make when planning for technology integration. If technology is underused despite being available to teachers and

students (Grimes & Warschauer, 2008; Zhao & Frank, 2003), one must look elsewhere when contemplating why teachers do not integrate technology effectively or consistently.

The TPACK framework characterizes the combination of technology, pedagogy, content, and knowledge and suggests that a teacher who understands the educational content but does not believe technological knowledge or technology will enhance student learning may struggle when trying to integrate technology during planning (Koehler & Mishra, 2009; Mishra & Koehler, 2006). Conversely, a teacher who enjoys using technology and has technological knowledge but lacks content knowledge may also struggle when trying to integrate technology during planning (Koehler & Mishra, 2009; Mishra & Koehler, 2006).

Summary

This chapter provided an overview of the study to investigate how three teachers in technology-rich classrooms plan for the use of portable technology within their curriculum. More complex and sophisticated technology has been integrated into classrooms as digitally native students, who easily learn how to use technology, are surrounded by smart, fast, collaborative technology in their daily lives, and they are eager to use it in school. Teachers who use the TPACK framework to plan lessons aid in their students' education. Chapter II will review the literature on instructional technology and teacher planning and how these two concepts can effectively come together.

Definition of Terms

The following definitions are provided to ensure standardization and understanding of these terms. The researcher developed all definitions not accompanied by a citation.

5E model: An instructional model where learners build new ideas on prior knowledge and experience and stands for the following phases of learning: Engage, Explore, Explain, Elaborate, and Evaluate (Barss et al, 2004).

Application: A computer program that enables one to use a computer as a tool to accomplish a task, such as playing an educational game.

Chromebook: A laptop that runs Google's Chrome operating system and browser and is designed to be used with an Internet connection with most of the applications and documents residing in Google Drive (Google's cloud storage).

Constructivist environment: A collaborative, authentic, learner-centered environment in which students focus on complex ideas and evaluate their own understanding (Becker & Riel, 1999).

Digital native: A person born or brought up during the age of digital technology who is very familiar with computers, smart technology, and the Internet (Prensky, 2001).

Edmodo: "Edmodo is an educational website that takes the ideas of a social network and refines them and makes it appropriate for a classroom (Cauley, 2012)." Through Edmodo teachers, students, and parents can connect and communicate to share assignments, ideas, and helpful tips. Edmodo is bully-free because the teacher can see

everything that is posted and can modify, delete, or allow it. Edmodo is also used to grade assignments and communicate with the entire class.

Game-based learning: An intentional teaching method to engage students in experiential learning using applications or software.

Global digital citizen: A person who is curious about the world and explores it digitally to be connected, contribute, and build community without limitations of space or time (Lindsay, 2016).

Google Classroom: A cloud-based digital learning platform for schools that simplifies creating, distributing and grading assignments in a paperless way.

1:1: One computer/Chromebook/laptop per student.

STEMscopes: Comprehensive online K-12 curriculum aligned to support math and science state standards. This paid online tool is based on the 5E model and has modules to help accelerate students and many resources to reteach.

Technological Pedagogical Content Knowledge (TPCK or TPACK): The Technological Pedagogical Content Knowledge framework represents the relationships among a teacher's knowledge about technology, pedagogy, and content (Pierson, 2001; Mishra & Koehler, 2006). In this framework, types of knowledge that teachers possess are content knowledge **(**knowledge about the material being taught), pedagogical knowledge (knowledge about the processes and methods of teaching), and technological knowledge (knowledge about new and old technologies) (Ertmer & Ottenbreit-Leftwich, 2010; Koehler & Mishra, 2009; Mishra & Koehler, 2006).

Technology rich classroom: In this study a classroom is classified as technology rich if there is evidence of the six International Society for Technology in Education's (ISTE) Standards for Students, which is what the state bases its standards on. These standards include creativity and innovation, communication and collaboration, research and information fluency, critical thinking, problem solving, and decision making, digital citizenship, and technology operations and concepts (ISTE, 2016; Texas Education Agency, 2016).

Chapter II

Literature Review

The purpose of this study is to research how four teachers in technology-rich classrooms plan for the use of portable technology in their teaching. This chapter will examine the research on how teachers plan for and integrate technology in their classrooms. First, this review examines the importance of teacher planning and what factors influence a teacher to plan efficiently for instruction. The second part involves technology integration and how a teacher plans for the integration of available technologies, like Chromebooks.

Teacher Planning

A lesson plan is indispensable for novice teachers and useful for expert teachers because it is a road map, guide, and resource and reflects the educator's teaching philosophy, student population, resources, and goals for his or her students (Jensen, 2002). The basic components of planning are deciding what to teach and how, in what order, and for how much time (Jensen, 2002; Chamot, Keatley, & Kennedy, 2015). Yinger (1980) viewed teachers as problem solvers and decision makers and viewed planning as what a teacher does before she or he starts teaching. He called it the preactive phase of teaching, referring to the time when the teacher is away from students, often in an empty classroom, before or after school, or during recess or other breaks (Clark & Peterson, 1986; Yinger, 1980). Most teachers use this time to grade, make copies, set up materials, speak with colleagues, plan collaboratively or alone, or pursue other activities.

Planning, according to Yinger (1980), is one of the most important activities the teacher does during this preactive phase.

Teachers' instructional planning reveals "how they transform and interpret knowledge, formulate intentions, and act from that knowledge and those intentions" (Clark, 1988, p. 8). Shavelson (1973) suggested that the most important teaching skill was decision making and wrote, "Any teaching act is the result of a decision, either conscious or unconscious" (p. 144). Researchers agreed that the considered decisions made by teachers while planning affected student outcomes and instruction (Shavelson, 1973; Yinger, 1980; Zahorik, 1975). How a teacher thinks about planning will shape classroom interactions, learning outcomes, and decision-making while concrete planning is influenced by teacher experience (Ball, Knobloch, & Hoop, 2007; Superfine, 2008). Novice teachers might have more difficulty anticipating and adjusting extemporaneously to student responses during teaching than experienced teachers (John, 2006). Teachers discover and decide what will touch every student in every class they teach (Bisplinghoff, 2002). Teachers spend most of their planning time focusing on the content and methodology of a lesson, on instructional strategies, and activities, and less time preparing materials (Krantz, 2004; Yinger, 1980; Zahorik, 1975).

Although teachers have available a variety of lesson plan templates, the traditional linear model is widely used and is based on Tyler's (1949) sequential prescriptive model (Ball, Knobloch, & Hoop, 2007). This model has four steps: identifying the objectives, choosing learning activities, organizing the activities, and lesson assessment (Clark & Peterson, 1986; John, 2006; Tyler, 1949; Zahorik, 1975) and emphasizes the end

(objectives) over the means (instructional activities). In his survey examining teacher planning models and decisions, Zahorik (1975) asked teachers to describe the types of plans they made and determined that one fourth of the 194 participants began their planning with objectives and none began their planning by choosing learning activities. John (2006) found that the main reason for the use of the prescriptive model was for novice teachers who may not understand how to develop more complicated lesson structures and adjust to a variety of classroom variables. More recent studies show that teachers' planning, despite what they learned in school or in a teaching program, is influenced by content, beliefs, available materials, school context, and experience (Ball, Knobloch, & Hoop, 2007; Kagan & Tippins, 1992; Palak & Walls, 2009; Reid, 2009). Reid (2009) argued that the way teachers plan is influenced by much more: "Regardless of the approach used by teachers to plan lessons, their intentional and accidental additions, deletions, and personal style inevitably dictate the final form of the curriculum" (p. 419).

Backward design (Wiggins & McTighe, 1998) is an example of a lesson plan model that contains Tyler's (1949) linear components, yet rearranges the method. In backward design, or backward planning, teachers begin to plan with the student's desired outcomes in mind and then plan the assignments, text, assessment, and discussion that will support the student's success. This type of planning begins with the end in mind. Backward design shifts the focus from activities to instructional goals. When teachers know what they want their students to learn and achieve by the end of the lesson or unit of study and have chosen how they will assess their students' learning, they can go back

and plan the activities that they hope will produce those outcomes. This type of planning ensures that activities and assessments are aligned with instructional objectives (Wiggins & McTighe, 1998).

The majority of teachers are trained to plan instruction by choosing specific objectives, identifying what students know and their abilities, selecting and ordering learning activities, and assessing the outcomes of their instruction (Shavelson & Stern, 1981). Research shows that teachers consistently preferred to consider the complexity and vigor of content and then select activities to support that content (Koeller & Thompson, 1980; Peterson & Clark, 1978; Shavelson & Stern, 1981; Zahorik, 1975). Bage, Grosvenor, and Williams (1999) claimed that educators' thoughts during planning could be categorized as fitting either the predictive or responsive planning mode. In the predictive planning mode, the teacher anticipated what would occur during a lesson. In the responsive planning mode, the educator modified their predictive plan and built relations between content and students' learning needs through unanticipated learning experiences, educational moments, and unpredictable learning opportunities. Research results indicated that teacher lesson planning occurs to help student learning rather than to satisfy a mandated directive (Bage et al. 1999). Student learning is as unpredictable as are the day-to-day activities in a classroom that require teachers to be flexible, adaptable, and responsive. While written lesson plans are useful and usually mandated, they represent simple generalizations of the sophisticated mental planning and situational acuity demonstrated by experienced teachers (Bage et al., 1999).

The aspects of pedagogical reason (Shulman, 1987) begin with the assumption that most teaching proceeds from "some form of 'text': a textbook, a syllabus, or a piece of the material the teacher or student wishes to have understood" (p. 14). This pedagogical reasoning relates to the teacher who takes what she or he already understands and adapts it for successful instruction. The teacher takes a subject, educational purpose, or idea and goes through the cycle of comprehension, transformation, instruction, evaluation, reflection, and new comprehension (Shulman, 1987). Shulman wrote that to teach effectively, an educator must first comprehend critically what will be taught and how it might be taught. The teacher must transform that comprehension into adapted and differentiated forms with student levels and learning styles in mind because planning proceeds from its genesis through preparation and presentation. Instruction follows as the teacher incorporates management, group work, discipline, discovery or inquiry, humor, questioning, and observable modes of teaching. Evaluation includes checking for understanding and misunderstanding while teaching interactively and formally assessing for grades and further feedback. Finally, teachers have a time to reflect critically on their teaching and its results on student learning. This reflection is how teachers learn from their experience to arrive at an evolved comprehension of students, self, teaching, content, and purpose through documentation, analysis, and discussion (Shulman, 1987).

Recent research reveals that teachers' decisions when planning for instruction are influenced by student interests and needs (Ball et al., 2007). Some factors that influence planning include teachers' interpretations and misunderstandings, instructional time for

each subject, organization of schedules, meeting administrative requirements, and planning for substitute teachers (Clark & Peterson, 1986). Experience plays a role in planning purposefully for content and individual students, although it is not necessarily an indicator of teacher expertise (Palmer, et al., 2005). John (2006) stated that teachers are driven in their planning and teaching by extensive intentions, instinct, implicit knowledge, and lesson imagery and that they consider content, learning activities, and students concurrently. Although teachers usually do not express these processes in writing or orally, they are adapted and restructured towards the activity flow of the lesson (John, 2006).

Technology Integration

Because schools build infrastructures for adding technology, many important decisions must be made regarding hardware. Each device has pros and cons that must be strongly considered including how well the device will perform in the classroom and in specific school districts (Demski, 2012). For example, the research study's district has different technology hardware in different schools. Some schools have iPads or laptops for each student; other schools have them for teachers or students to check out and share with other classes or students. Some schools have Chromebooks. The district has also implemented Bring Your Own Device (BYOD) since 2012 (Kuffner, 2012) which allows students to use their own smart and Wi-Fi ready devices such as laptops, iPads, and Notebooks during teacher driven and approved instructional time. Most schools have a variety of portable and hand-held devices and desktop computers to use with Wi-Fi or the Ethernet.

How to integrate technology successfully. Most research on the subject of lesson planning occurred before technology was introduced in the classroom (Richardson, 2009). Consequently, at best, a paucity of research is available, and most of it is speculative. Teachers are the prime movers in transforming teaching and, therefore, learning, and they will determine if and how technology can be integrated (Chen, 2008; Wang & Reeves, 2004). Teachers who struggle with technology integration report that, because of obstacles such as time, lack of access, or support, teachers often are initially discouraged from using technology (Cuban, 2001; Ertmer et al., 1999; Grimes & Warschauer, 2008; Park & Ertmer, 2007). However, more fundamental, even emotional, barriers such as beliefs about teaching, integrating technology, classroom practices, and fear of change are more difficult to influence (Palak & Walls, 2009; Shaunessy, 2007). Thus, to enhance teachers' knowledge of technology use and integration is crucial to ease their reluctance and increase their likelihood of success. Zhao, Pugh, Sheldon, and Byers (2002) determined eleven prominent factors that drastically affect the degree of success of classroom technology innovation. Each of those factors can fit into one of three interactive domains: the innovator or teacher, the project or innovation, and the context.

The innovator or teacher must have three significant attributes: technology proficiency, pedagogical compatibility, and social awareness (Zhao et al., 2002). Technology proficiency is understanding technology and the environment that facilitates the use of hardware and software and the ability to use a specific technological resource. Inan and Lowther (2010) argued that one of the most important factors affecting technology integration is educators' computer proficiency. Pedagogical compatibility is

the consistency between a teacher's instructional practices and the technology that is best suited for his or her style and content. When technology, content, and teaching style converge, technology is most likely to be successfully implemented (Yerrick & Johnson, 2009). Social awareness is an educator's understanding of and ability to negotiate the social aspects of the school culture, the success of which makes implementation of a technological project more likely (Zhao et al., 2002). As for the context, or school, three aspects are of great importance to the success of the innovation: human infrastructure, which can be a flexible and responsive technical staff that is a knowledgeable and communicative group of people who can help the teacher understand and use technology; technological infrastructure such as hardware, software, and a school's access to the Internet; and social support, or the degree to which colleagues support or discourage the teacher (Zhao et al., 2002).

Bitner and Bitner (2002) identified eight key elements influencing classroom technology integration: teachers' fear of change, training in the basics, personal use, available teaching models, learning-based technology integration, school climate, motivation, and support. Although funding, developing dynamic plans, platforms, and hardware/software also are quite important to successful integration, the teacher's skills and attitudes, which often are overlooked, might be most important (Shaunessy, 2007). Inan and Lowther's (2010) research suggested that teachers' computer proficiency, beliefs, and readiness all positively influence technology integration, and schools' technology availability, technical support, and overall support positively influence teachers' beliefs and readiness to integrate technology. Teachers must learn to use

technology and permit it to change their current teaching paradigms before technology can help effect positive changes in classrooms.

Although most students are surrounded by technology, one cannot assume that they know how to use it appropriately for learning. Students require teacher guidance if they are to use digital tools effectively for learning and collaboration (Shaffner, 2007). Teachers can effectuate such guidance by ensuring students' basic technology operating skills, by setting reasonable and reachable goals regarding levels of integration (by the end of the semester or school year), and by providing students with opportunities to practice technology at every turn. All of this helps students reach deeper understandings of concepts that might have been impossible, or at least much more difficult, without using technology (Hertz, 2011).

The effectiveness of technology integration will depend on many factors including how much and what technology tools are available to students. It will be easier to integrate technology into a 1:1 program where every student has a portable device than in a classroom that only has one computer and a Smart Board. However, the overall effectiveness of technology integration will lie on the shoulders of the teacher who must be prepared for that huge undertaking (Shaffner, 2007).

Technological pedagogical and content knowledge (TPACK).

According to Becker and Ravitz (2001), the strongest influences on teachers' integration of technology are technical understanding and pedagogical principles. Teachers with computer and other technological skills more readily integrate them into their teaching. Educators more traditional in their pedagogical philosophies are less likely

to integrate technology than those holding a more constructivist viewpoint. Shulman (1986, 1987) proposed a framework for teacher knowledge representing the relationship between content knowledge and pedagogical knowledge. Shulman (1987) saw instructional knowledge as a teacher's "own special form of professional understanding" (p. 8). Teachers' pedagogical content knowledge (PCK) leads them to make decisions about teaching strategies in relation to the content the strategies represent. Koehler and Mishra (2009) maintain that effective teaching requires awareness of common misconceptions, flexibility when exploring alternative ways to look at the problem, and making connections between varying content ideas, schema, and strategies. This transformation— interpreting content, finding multiple representations, and adapting content to student needs—is central to pedagogical content (Koehler & Mishra, 2009; Shulman, 1986, 1987). Technology is the most powerful agent to effect such transformation.

Districts have resolved to incorporate technology in the classroom, both for teachers and students. Schools' software, hardware, and broadband Internet infrastructures have become more sophisticated and pervasive. The near ubiquity of cutting edge technology, and school district emphasis, together require the adherence of teachers, as represented by the model Technological Pedagogical Content Knowledge (TPCK or TPACK, hereinafter referred to as TPACK) (Harris & Hofer, 2011; Hofer & Swan, 2006; Mishra & Koehler, 2006). Shulman's PCK comprises the abstract groundwork for Mishra and Koehler's (2006) formulation of TPACK as knowledge deeply rooted in the synergy of content, pedagogy, and technology. Koehler et al. (2007),

argue that a developed TPACK is necessary to integrate technology with teaching and learning. “At the heart of TPCK is the dynamic, transactional relationship between content, pedagogy, and technology. Good teaching with technology requires understanding the mutually reinforcing relationships between all three elements taken together to develop appropriate, context-specific, strategies and representations” (Koehler et al., 2007, p. 741). Koehler et al. (2007) consider TPACK to be interactions between content, pedagogy, and technology, not as each standing alone in a vacuum. That is to say, educators must equally exalt pedagogical content knowledge, technological content knowledge, and technological pedagogical knowledge if they are effectively to integrate technology meaningfully and not just as another tool.

Effective integration requires knowledge of the relationships between subject, best practices, and appropriate technologies, so teachers must be equipped to choose and align those technologies to learning goals and specific student needs (Ertmer & Ottenbreit-Leftwich, 2010; Mishra & Koehler, 2006). Pedagogical content knowledge, or PCK, is the interaction of pedagogy and content knowledge and an ability to apply teaching strategies to a specific content area (Harris, Mishra, & Koehler, 2009). Technological pedagogical knowledge (TPK) “is an understanding of how teaching and learning change when particular technologies are used” (Harris, Mishra, & Koehler, 2009, p. 398). Teachers must comprehend the potential advantages and drawbacks of particular technologies in diverse learning activities before they can utilize them effectively. Teachers must build this knowledge and the necessary skills to help them allocate technology for pedagogical reasons to advance student learning and

comprehension. Technological content knowledge (TCK) is understanding how technology and content affect and limit each other (Harris, Mishra, & Koehler, 2009). Teachers must learn to view their curricula through the lens of technology, select and utilize appropriate technologies to enrich those curricula, and thus communicate them in multifarious and transformative ways. Teachers who do not understand fully their content, and that content shapes technological application, will be unable to select the most appropriate and effective technological means to convey that content (Pamuk et al., 2015). For those teachers, technology can become a pitfall, as it may amount to no more than a textbook without an effective teacher's guide.

Teachers who employ and make instructional decisions using the TPACK framework may often consider their knowledge of technology, and their knowledge of pedagogy and content, but, if they do not also bring into account their beliefs and practices regarding these elements and instruction, they will never achieve the synergy suggested above (Cuban, 2001; Harris & Hofer, 2011; Palak & Walls, 2009; Park & Ertmer, 2007). Teachers who employ TPACK realize no single technological resource applies to every teacher, class, content area, or situation, and that planning must include a comprehensive situational awareness and, accordingly, an acute understanding of the relationships between technology, pedagogy, and content. (Harris & Hofer, 2011; Mishra and Koehler, 2006). "A teacher who effectively integrates technology would be able to draw on extensive content knowledge and pedagogical knowledge, in combination with technological knowledge. The intersection of the three knowledge areas, or technological-pedagogical-content knowledge, would define effective technology

integration" (Pierson, 2001, p. 427). TPACK links effective teaching with technology and comprehends the situational notion that, when integrating technology, content, and pedagogy, one size does not fit all (Harris, Mishra, & Koehler, 2009).

How teachers plan to integrate technology. Gaps in the literature exist regarding how teachers plan for technology integration (Tubin & Edri, 2004). Angers and Machtmes (2005) wrote that "teacher planning is a key underlying context factor in determining the extent to which technology gets used" (p. 787), which means that planning is important when preparing meaningful use of instructional technology (Jones & Moreland, 2004). Teachers who plan effective lessons with a view to technology as more than a means or an afterthought, but as a seamless and integral component, must be identified, held to example, and encouraged to train others (Berg, Benz, Lasley, & Raisch, 1998; Yelland, 2005). Comprehensive and integrated technological planning and deployment ensure, or at least promote, educational opportunities that may not exist at home, where technology might exist merely as a vehicle for entertainment, or perhaps not at all (Kemker, Barron, & Harmes, 2007). However, not all exemplary teachers use and integrate technology in meaningful ways because of their beliefs about the value of technology (Pierson, 2001). Pierson (2001) found that if a teacher does not view technology use as an essential part of the learning process, "it will remain a peripheral ancillary to his or her teaching" (p. 427).

Integrating technology is a positive and effective strategy if it is employed wisely, in well-considered ways and authentic situations, as technology can promote critical thinking and problem-solving skills in ways that a single teacher, calling upon only his or

her knowledge and experience, cannot (Tamim et al., 2011). Teachers who employ the TPACK framework to plan for and integrate technology must necessarily think comprehensively—they must not only integrate technology, but also their thinking. Pedagogy, content, instruction, and available technology must not be thought of as mere compartments, but as indispensable parts of a whole, none of which can exist without the others. TPACK can operate as a road map, setting teachers committed to technology down the road to integration, but it is a way to fuse traditional educational components with technology. The TPACK framework does not dictate, but facilitates. Teachers using the TPACK framework perhaps can or will more easily meld their styles, contents, and technology in ways that more traditional teachers (who use technology as simple tools) will not. In short, TPACK development is not limited to a specific way of teaching, learning, or integrating technology and like good teaching, is an ongoing process that can be aided by intentional professional development, self-study, and practice (Hofer & Grandgenett, 2012).

Digital natives often learn to play video and other computer games without instruction, usually through a rather informed or at least experienced trial and error approach and can remain so engaged for long periods (Gee, 2007). Prensky (2012) noted that, as technology becomes more automatic, so it must become more imprinted in our minds. Further, video game researchers offer evidence that children's brains change in response to the technological environments in which they live, play, and learn (Prensky, 2012). As early as 2000, the field understood that the use of computers and other technologies has grown from primarily an instructional delivery tool to a transformational

resource essential to the learning environment (Fouts, 2000). Education-based computer applications and websites help players, and therefore students, visualize elusive and sometimes confounding concepts (Fouts, 2000). There are myriad free or low-cost web-based educational programs and applications that are easy to find and use. Teachers can preview and select content, then choose what works best for their grade levels and subjects, given available technology, all by referring to the TPACK framework, state technology guidelines, and consulting colleagues (Petty, 2015).

Means and Olson (1995) conducted research on nine schools that used technology actively in classrooms and concluded that using computers and other technology improved children's attitudes toward themselves and learning in general, and increased their motivation and self-esteem. When computer programs offer students control over their learning environments, beneficial effects on their self-esteem (Passey, Rogers, Machell, & McHugh, 2004; Miller & Robertson, 2010) and engagement (Freeman, 2012; Schaaf, 2012) are seen. Teachers planning to integrate technology must keep their students foremost in mind and, after introducing a digital resource, provide opportunities for students to use technology both collaboratively and independently. Students in classrooms where teachers facilitate technology integration effectively can develop into digital peer helpers and communicators and even technical support agents (Martinez & Harper, 2008).

Other research on technology integration. Beeson's (2013) research examined three teachers as they integrated technology in technology-rich elementary classrooms. She examined how teachers' beliefs and knowledge about technology, pedagogy, and

content influenced their decisions while planning for technology integration. She found that teachers made decisions about content and the desired outcome, the learners, and technology tools. She also discovered that their beliefs about technology included that students are engaged when using technology, technology can expose students to content, and technology should be used to expose learners to technical skills through technology. Her findings suggest that strong technological knowledge influenced the teachers' decision making during planning. The research shows that teacher education should include consideration of pedagogical limitations and advantages of using technology to teach context.

Cox (2014) conducted a qualitative holistic single case study to examine constructivism in a 1:1 initiative using Chromebooks and Google applications in an upper Midwest school district. She wanted to understand if constructivism expanded based on teacher, administrator, and parent perceptions on the mobile learning initiative. She learned that having the Google Applications enhanced collaboration and learning opportunities. Access to information was constant, beneficial, and equitable because every student had a Chromebook. Students had many opportunities to learn and to communicate with other students, teachers, and experts because the online environment went beyond the school walls. Although student engagement was not dependent on the Chromebooks, student involvement improved. Parents felt that, although Chromebooks enhanced their children's learning, motivation to learn was influenced by students' intrinsic need to learn.

Kulow (2014) conducted an "explanatory, sequential, mixed methods approach, which combined quantitative and qualitative research instruments and used control and treatment groups" (p. 5) to determine if student engagement and student achievement were affected when using Chromebook technology in kindergarten and first grade during reading and math. Students in the control group were taught using a traditional model of teaching a lesson with some students practicing the lesson independently and others in small groups with the teacher. The teacher worked with students in small groups to help them develop the habits of reading, writing, math, and working independently. Students in the treatment group had teachers who had been trained in Chromebook technology and integrated educational applications and websites during the small group and independent work time. Since there were only nine Chromebooks, students took turns using them during literacy and math blocks. The research showed a positive impact on kindergarten and first grade students when using Chromebook technology but that traditional educational approaches, like small groups work, gave more opportunities for positive engagement and achievement because small groups lead to richer understanding of the topics and activities. Kulow (2014) also stated that these results could be due to several obstacles of using the Chromebooks such as teachers needing to get trained to use the device efficiently, setting up a Chromebook station where students could work independently with little teacher support, and teachers feeling confident that the applications and websites were aiding student success. Also, students used the Chromebooks to work independently instead of incorporating them into their small group instruction.

Summary

Teacher planning and technology integration and education-based applications and websites are included in this review of the literature. The research supports technology as a vital resource to aid in student learning and engagement (Bitner & Bitner, 2002; Chen, 2008; Corn et al., 2010). Informed teacher planning has a positive effect on student engagement, achievement, and motivation (e.g., Akey, 2006; Fredricks et al., 2004; Heller, Caideron, & Medrich, 2003; Jones, 2009; Marzano & Pickering, 2011; Ponitz, et al., 2009; Ullman, 2011; Yinger, 1980). Further, technology can be an important part of a student's education, depending on careful planning and the teacher's ability and willingness to use that technology (e.g., Bitner and Bitner, 2002; Chen, 2008; Cuban, 2001; Ertmer et al., 1999; Grimes & Warschauer, 2008; Pierson, 2001; Wang & Reeves, 2004; Zhao et al., 2002). However, technology alone will not aid in student learning (Kemker et al., 2007). Other considerations include the teachers' use of technology in and out of the classroom, planning for use aligned to the curriculum, and professional development to support planning and incorporating technology effectively (Berg et al., 1998; Jones, & Moreland, 2004; Yelland, 2005). Changes in the technical world and how people communicate as global digital citizens play a role in supporting the integration of technology. A key factor is ensuring educators understand and have the capacity to use Technological Pedagogical Content Knowledge (TPACK) (Hofer & Swan, 2006: Mishra & Koehler, 2006), which may be critical in maintaining student engagement and fostering success.

Chapter III

Methods

The purpose of this study is to explore and describe how three teachers in technology-rich elementary school classrooms at one elementary school plan for and utilize technology in their teaching and how the participants developed into classroom technology users. This chapter provides a detailed description of the research design, methodology, and procedures employed in the study. The methodology will include descriptions of the participants, the settings, and the research design.

The study addressed the following research question:

How do teachers in technology-rich classrooms plan to integrate technology into their teaching?

Research Design

This research was a qualitative, multiple case study (Baxter & Jack, 2008). Qualitative research lends itself well to this study because the sample size is small (Onwuegbuzie & Leech, 2007), there is little information on teacher planning when integrating technology, and the nature of the research question is to try to understand this from the participants' perspective. Case studies focus on the "how" and "why" and address the contextual conditions relevant to the phenomenon and context (Yin, 2009). Qualitative analysis may lead to understanding why teachers make certain decisions when planning for technology integration in their classrooms. Because this research study centered on the decisions made in planning technology integration, the context in which the related lessons occurred is most relevant. Each of the three teachers represented one

case study because the decisions each made were specific to their classroom, setting, beliefs, and instructional approach. Various observations, interviews, and lesson plan reviews revealed how these skilled teachers planned to integrate instructional technology in their technology-rich classrooms and how their planning decisions developed throughout their purposeful use of technology. A multiple-case study provided thorough descriptions and within-, and across- case analyses (Baxter & Jack, 2008).

Research Setting and Participants

In 2013, Mountain Independent School District (pseudonyms have been used to protect the confidentiality of the elementary school, the school district, and participants) submitted a three-year technology plan demonstrating its commitment to technology. The plan included strategies to help the district meet its four goals: students seamlessly integrating technology to solve real world problems; technology instruction for educators; support for technology use; and achieving a computer to student ratio of one to one (Pham et al, 2014). This commitment has prompted the district to fund portable technology resources such as iPads, laptops, and Chromebooks.

District. Mountain Independent School district is the seventh largest school district in the state with seventy-five schools and 73, 377 students. There are 95 languages spoken in the district making it one of the most culturally diverse in the state. It serves 26.9% Black, 26.8% Hispanic, 23.5% Asian, 19% White, and 3.8% other. 15.5% of students are English language learners, 6.3% receive special education services, and 37.8% are economically disadvantaged. Because I work in the district, I am and have been acutely aware of its progressive attitude toward technology and its plan.

Accordingly, I began to formulate a research topic and related questions, and then approached the district's Digital Learning Coordinator, Dr. Phyllis McDonald.

The selection process. For this study, I sought educators who use technology daily and in different subject areas, applying technology available to them. I wanted to identify participants who used the technology available to them–hardware, software, and the Internet—in pursuit of what the district's standards call creativity, collaboration, and critical thinking (Texas Education Agency, 2016). Dr. McDonald previously served the district as an instructional technology specialist, supporting and facilitating teachers' efforts to master State technology application standards. As Digital Learning Coordinator, Dr. McDonald coordinated all district professional development related to instructional technology and provided leadership in developing instructional technology resources and training materials. She was also responsible for the leadership in the use of new or existing technology resources. I spoke with her regarding the participant requirements for my study and stressed that eligible teachers were those who consistently followed the district and state technology standards and were immersing their students in the available technology.

Dr. McDonald highly recommended two particular teachers, citing their high level of technology integration. These teachers were part of a Chromebook initiative and had been observed using technology on a daily basis to foster creativity (e.g., students created and used PowerPoint presentations to accompany science projects), to communicate (students used the Edmodo application to communicate with peers), and for research (students used the Internet to find information for their science project presentations).

Unfortunately, only one of the recommended teachers was willing to participate. However, there were two other teachers on the same grade team who were available and part of the Chromebook initiative and whom Dr. McDonald was not aware of when she made her initial recommendation. Because they were part of the Chromebook initiative, and the teacher Dr. McDonald recommended said that they planned and worked closely together, these two teachers also became part of the study

The study was conducted in three classrooms at Silver Elementary School, Mountain Independent School District. Silver is a Title 1 PreK-5 elementary school that serves 87% African Americans, 12% Hispanic, and 1% others, and 71% are economically disadvantaged and 5% receive special education services.

Participants. The participants are three 5th grade school teachers who daily use portable and other available technology (including Chromebooks), constitute critical cases. They are prime examples of the emergent phenomenon—teachers who use portable technology as an essential part of instruction. Of the many Mountain ISD teachers, the Digital Learning Coordinator identified two grade level teammates, using homogeneous sampling, because those teachers skillfully integrated portable and other technologies in their classrooms. One of them was unavailable, but two other members of the same team were part of the Chromebook initiative, were available, and thus became part of the study. They all had been involved in district technology initiatives and were committed to using technology creatively, collaboratively, and to promote critical thinking. The participants were contacted by the principal, and later by me, through the Digital Learning Coordinator.

The descriptions that follow are brief introductions to each participant. Each participant's classroom, beliefs, technology integration, and planning are described in more detail in Chapter 4.

Carlos Jones. Carlos Jones is in his seventh year of teaching. It is his second year at Silver Elementary School. He taught Character Education for two years, 6th grade for two years and was in his third year teaching 5th grade. Mr. Jones is a certified PK-8 Generalist, has a master's in Administration, and was pursuing a doctorate in Educational Instructional Technology. Before joining Silver Elementary and experiencing the Chromebook initiative, Mr. Jones had hoped to pursue a flipped classroom, in which students watch videos and receive instruction online outside class, and practice concept engagement in class, as facilitated by the teacher, with remediation or enrichment as needed (Strayer, 2011). Mr. Jones took the job at Silver partly because one of his new colleagues also wanted to experiment with a flipped classroom in math and science, and he was intrigued by the technology initiative and the class set of Chromebooks.

Mr. Jones and Ms. Matthews tried the flipped classroom as soon as his first year started. The flipped classroom experiment failed, mostly because students could not take home Chromebooks, had limited or no wireless internet connection (Wi-Fi) at home, and had to go to a library, stay late at school, or borrow resources to participate. Mr. Jones and Ms. Matthews stopped the experiment after two weeks but they continued to try to find a way to have a modified flipped classroom. However, they both decided to end the initiative for good after four weeks and are determined to revisit the idea in a couple of

years when they will have been using the Chromebooks about five years. Nevertheless, Mr. Jones and his math/science partner were foremost in technology use at Silver.

Cindy Matthews. Cindy Matthews, an 18-year teacher, was in her 11th year as a 5th grade teacher at Silver Elementary, having previously taught 6th, 7th, and 8th. She is a PK-8 Generalist and ESL teacher with master's degrees in teaching and education. Prior to obtaining a class set of Chromebooks, Ms. Matthews used her four desktop computers and Smart Board to introduce students to technology. Although she enjoyed technology and said that there is not one day when her class is not involved in using technology, she also felt it was important to continue with hands-on, kinesthetic activities that can be enhanced by strategic technology use. Ms. Matthews and Mr. Jones unsuccessfully tried a flipped classroom, but she said she enjoyed the attempt of planning for it.

Luke Martin. Luke Martin, a 17-year teacher, was in his 11th year as a fifth grade teacher at Silver. He is a PK-8 Generalist who has taught fifth through eighth grades. Mr. Martin has a law degree and a Ph.D. in Reading. Mr. Martin was the only one of the three teachers to admit that he was very resistant to integrating technology using Chromebooks because he thought it might disturb the routines he painstakingly set in his classroom. He is proud to be one of the last "old school" teachers who keep the desks in rows, work on handwriting, and look up words in actual dictionaries. He believes that a 20-minute lecture is critical, and that it is an essential way to challenge his students to think. He admitted, however, that he was becoming a convert because he often can use Chromebooks to enlighten students on concepts they find difficult. In a recent lesson on the book *The Watsons Go To Birmingham* (1963) by Christopher Paul Curtis, students

were having a hard time understanding the concept of civil rights, the south, and the time period. Mr. Martin, after several attempts to explain by using the book and his lecture, conceded and asked the students to open up their Chromebooks. He says he realized his words may not always paint a picture as an actual picture or video can.

Data Collection

Three types of data were collected for this study: interviews, document review, and observations. Table 1 displays the data collection sequence. For each participant there was an initial interview before any observation. Then, the participant submitted for analysis a lesson plan by email, which preceded the scheduled observation and subsequent interview. This routine, including data collection, characterized the entire eight weeks.

Table 1
Data Collection

Step	Participant
1	Initial interview 1
2	Collect lesson plan 1
3	Observation 1
4	Follow-up Interview 2
5	Collect lesson plan 2
6	Observation 2
7	Final Formal Interview

Interviews. A modified interview protocol outlined by Carspecken (1996) was used for each interview. A semi-structured interview process provided parallel information across participants and allowed flexibility within the interviews facilitating follow-up on each participant's comments. The interviews were recorded, guided and were conversational (Baškarada, 2014), thus affording easy opportunities for probing follow-ups in a relative casual setting that promoted candor. Although anecdotal, these are among the most useful data sources in a case study (Yin, 2009). Three phases of semi-structured interviews were conducted for each participant (Baškarada, 2014), and the recordings, which were recorded on an iPhone, were transcribed verbatim by the researcher to ensure familiarity and accuracy.

Initial interview. At the beginning of the study, the three teachers were interviewed individually during planning time on campus, to establish backgrounds, technology usage, and approaches to planning for technology integration. The interview lasted about an hour, and included a discussion of timelines, observation protocols, and the provision of lesson plans. Each initial interview was recorded and transcribed for analysis. Appendix A shows the initial interview protocol.

Follow-up interviews. Formal, scheduled interviews occurred throughout the study, set at the teacher's convenience, and coinciding with observed lessons. Following the protocol of Carspecken (1996), field notes were shared and discussed with the participants, affording opportunities to elaborate or correct errors, mischaracterizations, or misconceptions, and all related suggestions were considered. Follow-up interviews came after preliminary coding and analysis, and unscheduled conversations (either audio

or field note recorded) were by happenstance when the researcher was on campus and the teacher was available.

Final interview. At the end of the study the participants had a final interview as a form of member check, or feedback from the participant, and clarification to allow participants to correct errors, challenge the researcher's interpretations, and to volunteer additional information; I took their input under advisement (Cohen & Crabtree, 2006). During the hour long final interview, the participants were able to read an outline of the main points in their input to date and answered follow-up questions, as needed. This final interview was recorded, transcribed, and analyzed. Table 2 shows the dates of each formal interview.

Table 2
Dates of formal interviews with each teacher

Date	**Teacher**
April 8, 2016	Carlos Jones 1
April 12, 2016	Cindy Matthews 1
April 14, 2016	Luke Martin 1
April 22, 2016	Carlos Jones 2
May 4, 2016	Luke Martin 2
May 12, 2016	Cindy Matthews 2
May 18, 2016	Carlos Jones Final
May 26, 2016	Cindy Matthews Final
May 27, 2016	Luke Martin Final

Classroom observations. Formal classroom observations were conducted twice with each teacher in a span of eight weeks. Each observation took place after a formal or informal interview where I collected and reviewed the lesson plan of the lesson that was going to be observed. During the interview I asked each teacher for a preference regarding which technology-intensive lesson I should observe. The purpose of the

observations was to determine the extent to which the teachers effectuated their plans to integrate technology. I also observed how the teachers followed the TPACK framework (Harris & Hofer, 2011; Mishra & Koehler, 2006; Pierson, 2001) and the state technology standards. Each observation was for a standard lesson period, around two and a half hours. I used an observation protocol that had two columns allowing me to describe the unfolding lesson in one and record thoughts and questions in the other (see Appendix B). Each observation was coded and included a preliminary analysis before the follow-up interview. During the eight-week period, teachers whom I was not observing or interviewing often invited me to their classes on an informal basis, and I documented those observations with field notes.

This study encompassed eight weeks during the spring semester of 2016. Each teacher had four formal, scheduled observations and several short, informal observations throughout the eight weeks. Informal observations occurred through casual visits when time permitted, as teachers were available, or as they invited me to observe when they saw me on the campus. The informal observations were recorded in field notes after each one. Table 3 shows the dates of the formal observations. There were two 2.5-hour classes of scheduled observations and around 3-5 hours of informal observations for each teacher during this eight weeks, totaling around 8-10 hours in each classroom.

Table 3
Dates of formal observations with each teacher

Date	**Teacher**
April 12, 2016	Carlos Jones 1
April 14, 2016	Cindy Matthews 1
April 27, 2016	Luke Martin 1

May 4, 2016	Carlos Jones 2
May 12, 2016	Luke Martin 2
May 18, 2016	Cindy Matthews 2

Lesson plan document review. The participating teachers provided written plans for the lesson to be observed at the end of each formal interview, and they were invited to highlight any components they might believe were especially appropriate for review. The plans were examined for evidence of the extent and nature of purposeful technology planning/integration, particularly regarding portable technology. The lesson plan review rubric (Appendix C) was based on both the TPACK framework (Harris & Hofer, 2011; Mishra & Koehler, 2006; Pierson, 2001) and the state standards for elementary school technology integration. All review data were recorded electronically.

Data Analysis

In this research study, the data were analyzed both during and after collection during the spring and summer of 2016. All audio recordings were transcribed by the researcher for analysis. As a multiple case study, data were analyzed within and across cases (Baxter & Jack, 2008).

Data such as interview recordings, lesson plans, and field notes were collected and named in a descriptive and consistent way that facilitated identification and access for analysis. Any non-digital information was scanned so that all data could reside together on a jump drive under key at my advisor's office and in password-protected cloud storage. Data analysis began by multiple readings of each interview transcript, field notes, and notes I took as I reviewed the lesson plans. I read the transcripts multiple times

and listened to the recordings to ensure accuracy of transcriptions. As I was reading, I developed codes for the data that helped to build a detailed description of each case. Digital highlighting and sticky notes were used to note themes. I began with codes based on my literature review that included teacher beliefs during planning, TPACK, and planning for technology integration and I added additional codes as they emerged. A modified version of Carspecken's (1996) coding procedures was used to continue coding, which utilized a word processing program to record and highlight emerging themes, which were assigned unique numbers or letters for ease of identification. I continued and repeated these steps using different digital highlighters and sticky notes and unique identifications to incorporate the broad themes into similar themes (Carspecken, 1996). I also used two cloud-based computer programs, Wordle and Dedoose, to help with coding and themes. Wordle was used to verify code and theme frequency and Dedoose was used for more in-depth coding and themes. There were codes for similarities and differences found across the cases. I also coded the generalizations I made within-cases and across-cases.

Coders not involved in the data collection, outside experts and doctorate peers, enhanced the reliability of the researcher's insights (Day, 2015). I enlisted the assistance of three doctoral students who were at different stages of their dissertations, all of whom have studied and utilized qualitative methods. These were my peer debriefers. Two of them are students at different stages of their dissertations and the third has completed his dissertation. These peer debriefers read the preliminary analysis of the first observation to ensure that methodology and execution were sound and later read the analysis of both the

observations and interviews. Further, member checks through a follow-up interview with each participant where they could offer feedback ensured the authenticity of the work. Peer debriefing, member checks, and outside experts guaranteed that the themes were not limited by my own point of view (Carspecken, 1996; Day, 2015).

Researcher Role in the Study

My own work as a teacher in a leadership role in Mountain ISD, and the fact that the present principal at the study context school was my assistant principal for three years, ideally placed me as a privileged insider to investigate technology integration at this particular school and provided insights into the district's polity. My role in the district afforded me access to the district coordinator, and my personal knowledge of the school principal's orientation to portable technology, validated the district coordinator's nomination of the three participant teachers. My insider role compelled me to ensure the integrity of my research, and I took great care to separate myself as an objective researcher. I have never worked with any of the participants, although it is likely we have attended some of the same trainings and district meetings. In short, I have striven to use my familiarity with institutions and people to promote an academic purpose while maintaining the necessary distance to avoid any prejudgment or otherwise to contaminate the research. I stressed to the participants that my mission was illumination regarding planning and integration of technology, without evaluation of any kind.

Validity and Reliability

In qualitative research, the purpose of validation strategies is to examine and rule out possible threats (Maxwell, 2005). Such strategies are critical to establishing the

credibility of the research endeavor. Lincoln and Guba (1985) establish four criteria to evaluate trustworthiness, or validity and reliability in a qualitative study: credibility, transferability, dependability, and confirmability.

Credibility. Credibility requires engagement and observation (Lincoln & Guba, 1985) and a common understanding of technology integration. The essential elements of this endeavor included conversing with participants to establish a foundation of trust and confidence, and observing—in person, written accounts, and through audio recordings—detailed operational settings in classrooms, offices, and anywhere that meaningful planning and delivery occurred. Triangulation, by detailed observations over time, open-ended interviews, collecting data from more than one source and member checks, ensured that descriptions were rich, robust, comprehensive and well-developed (Cohen & Crabtree, 2006; Day, 2015; Denzin, 1989). Thick descriptions and multiple data collection methods (e.g., interviews, lesson plans, and observations over time) provided the required comprehensive development.

There were peer debriefings to explore aspects of the inquiry that may persist in the inquirer's mind (Lincoln & Guba, 1985). I elicited the help of three doctoral students who are at different stages of completion of their dissertations and who have studied and employed qualitative methods to be peer debriefers. We met two times and were in diverse constant communication through skype, phone, and email from the start of the data collection. They critically reviewed write-ups to ensure the accuracy and completeness of analyses and scrutinized for bias (Carspecken, 1996; Day, 2015; Lincoln & Guba, 1985; Spillett, 2003). I took copious notes of the debriefing meetings,

documented any modifications, and provided a final report about peer debriefing at the end of the study. Finally, credibility was established by performing formal and informal member checks during interviews, where respondents had an opportunity to assess adequacy of data and to volunteer additional information.**Transferability.** Lincoln and Guba (1985) describe thick descriptions as a means of achieving a type of external validity or transferability. When there is sufficient detail in the descriptions, the degree to which the conclusions are transferable to other times, settings, situations, and people can be evaluated. The investigator has the responsibility to present sufficient contextual information for readers to take what is similar to their own situations and relate, or transfer it, to their own contexts (Shenton, 2004). The sample must represent the population for which generalization is sought. Accordingly, purposive sampling—in this case, examining candidates who were skilled at portable technology integration—is critical to maximize the value of collected data (Guba & Lincoln, 1982).

Dependability. Dependability exists when findings are consistent and repeatable. External audits, or dependability audits, require an uninvolved researcher to examine both the process and the product to assess whether the findings are supported and are sound (Guba & Lincoln, 1982). The outsider can examine processes and findings, offer any necessary critiques, promote a more penetrating and articulated approach to the data, and thus help to hone both processes and findings (Cohen & Crabtree, 2006). In this study, peer examination was accomplished with the assistance of an uninvolved doctoral outsider experienced in qualitative research (Anney, 2014) but who has not been involved

with the current study. This experienced outsider has finished his qualitative dissertation and communications were through Skype and email.

Confirmability. Guba and Lincoln (1982) state that confirmability is the extent to which the findings of a research study are shaped by the respondents and not researcher bias, motivation, or interest. As with dependability, external or confirmability audits ensure that each finding is traceable to original data. Triangulation will establish confirmability. I employed two additional strategies to establish confirmability. First, I created an audit trail where I showed how the data were collected, recorded, and analyzed. This transparent description of the research steps included raw data, process notes, and instrument development information (Carcary, 2009; Lincoln & Guba, 1985) Second, I wrote a reflexive field journal throughout the data collection and analysis processes scrutinizing my own assumptions and possible contextual biases by having a continuous and thorough written discussion with myself about the research methods and how I dealt with my role (Anney, 2014; Guba & Lincoln, 1982; Ortlipp, 2008; Shenton, 2004).

Chapter IV

Findings

The purpose of this study is to observe how three teachers in technology rich classrooms plan when integrating technology. This chapter addresses findings, including each teacher's account, and explores the factors that influenced the integration of technology as they planned their lessons. Carlos Jones, Cindy Matthews, and Luke Martin, all 5th grade teachers at Silver Elementary in Mountain Independent School District (pseudonyms have been used to protect the confidentiality of the elementary school, the school district, and participants) were observed for around eight weeks during the spring semester of 2016. Interviews, observations, and lesson plan review were used to study how each teacher planned to integrate technology using Chromebooks, Smart Boards, document cameras, and multimedia. Each case study teacher is introduced with descriptive accounts of their authentic classroom experience during the eight weeks. Their accounts are taken from fieldnotes and interview transcripts, and mostly are verbatim.

The Case of Carlos Jones

Personal and Technological Background. Carlos Jones, who teaches 5th grade math and science, is inviting—both friends and strangers alike are greeted with a big smile, a hearty "Hey!" and an extended hand. Mr. Jones has been teaching for seven years, the last two in fifth grade at his current school. The 1:1 technology initiative at his school joined his teaching career with his passion for computers. "There is nothing better than teaching with technology," he exclaimed the first time we met.

Mr. Jones has always been interested in computers and technology. Although he can't pinpoint a time when he first became attracted, he always gravitated to the latest technological craze, from Atari to iPod. He says he is the first person in line when a new device or system hits the market. "I can't hear that there is a new gadget out there because I will go get it even if my wife is not happy about it," he laughs. Although he generally prefers Apple products, he reads many trade texts, and is well versed in hardware and software that reflect his interests. His love of technology prompted him to build his first computer. "There I was on Saturday morning and I thought that it would be a great day to make a computer. So I did."

Mr. Jones plans to enter a doctoral program in educational technology to advance his passions for technology and education. He keeps up with the latest trends in educational technology by subscribing to online magazines and participating in any technology professional development offered in the district.

Mr. Jones' classroom. Mr. Jones' room is inviting, with bright cloths covering the tables, and colorful bulletin boards that are both attractive and informative. There is a bulletin board with an "Every Day Counts" Calendar (a daily 10-minute hands-on math concept conversation curriculum to build vocabulary and strengthen math knowledge). Next to the calendar is a smaller square table with a fish tank that emits the soothing sound of bubbling water. "I know it can get loud in the classroom when all the students are learning and the sound in this take seems to relax us all."

The students' desks are arranged in groups of four and are arranged for all to see the mounted Smart Board at the front of the classroom. Mr. Jones' desk is next to a

kidney table stacked with papers, boxes and books. Mr. Jones' desk includes a desktop computer through which he uses his Smart Board and document camera. His desk and large rolling chair face a wall next to a filing cabinet stacked with papers. Beside the filing cabinet is a Chromebook charging station where the Chromebooks are placed at the end of the school day to charge overnight. "If a student ever forgets to charge their device, oh, boy! You don't want to be here when that happens. They, well, we all rely on the Chromebooks daily." On the other side of the kidney table there is a round table that displays 25 half-finished robots from a Robotics unit the class will finish after state testing preparations and administration. "I want my students to get as much technology as possible in my classroom because I don't know if they get to work on robots or science at home."

To the left of the door, there is a wall of cubbies and storage spaces where students leave their backpacks and other personal belongings like lunchboxes and jackets. The students are supposed to take whatever they need for the class before storing their backpacks and are only supposed to go to that area before lunch or before going to their next class. However, students do occasionally visit their backpacks for pencils, earphones and such other items as they may require.

Classroom environment and procedures. Each student has an open Chromebook and a pair of earphones. Each Chromebook is personalized; students have adorned them with stickers and names, imprinting their personalities. Students are using what teachers call "inside voices," however, when the chatter exceeds acceptable volume, Mr. Jones calls out, "Josie, please click on your name. You get one point for being on

task and using your inside voice." All at once, the students whisper to each other, "Aw man!", "Sh!", and "I need a point!" Mr. Jones uses a popular web-based behavior management application called ClassDojo to promote proper classroom behavior. This application allows the teacher to create profiles for each student and add negative or positive points, called dojos, depending on the student's behavior. There is an audible chime when a student gets points, and many are motivated to "get chimed," thus promoting proper behavior. Parents have access to this information through the application, and Mr. Jones is impressed with the effectiveness of Class Dojo as a device to ensure on-task behavior. "I have had parents call to tell me that their child needs them to use this app at home too, but I try to explain this only works in our class." The students seem to respond well to Class Dojo, but the chimes might be more distracting than beneficial, as they seem to prompt some off-task chatter and grumbles.

When Mr. Jones introduces a concept, he addresses the entire class. He teaches for about 20 to 30 minutes using the Smart Board with plenty of opportunities for students to participate by asking questions and practicing the concept. "I think that students need to be able to freely ask questions and participate in their learning and technology makes it very easy for all of us to work together, especially when we are learning something new."

The students have their Chromebooks open and Mr. Jones often directs students to go to a website, application, STEMscopes (online hands-on math and science based curriculum) or an assignment that he has added to Google Classroom. Google Classroom is a paperless web and cloud based education system that Mr. Jones uses to distribute,

grade, and give feedback on math and science work. Students have their own login and can work on assignments online and then submit them for a grade.

After introducing a concept, Mr. Jones goes over the assignments briefly by displaying Google Classroom on the Smart Board and he and the students take turns clarifying the expectations for the rest of the class period. Students can collaborate on some assignments, but Mr. Jones is very clear on what must be completed independently. "Y'all know that what you have on your own Google page needs to be completed just by yourself. Group work is group work and your work is your work." He answers questions while walking the room and stopping to address a student who has a question or something to show on the Chromebook. Mr. Jones trades jokes with his students as he walks the room and they address assignments on their Chromebooks, then announces he will go to his desk, that students are to follow Google Classroom instructions, and raise their hands with any questions.

As the students work on their assignments, Mr. Jones sits at the kidney table and looks through some work on his own Chromebook, passes back papers, and inputs grades. He also adds websites to the assignments to address any confusion or questions that may arise. "This is what I love about having a 1:1 classroom. I can add or take away any assignment or resource and they receive it instantly." The students, some in and out of their seats, work on their assignments on their Chromebooks and approach or call out to Mr. Jones when they have a question.

Mr. Jones' professional background. Mr. Jones' manner is outgoing, patient, and humorous with all who surround him. His class, both organized and seemingly

chaotic, is filled with laughter, chatter, and movement, and it is clear that his style is calm, non-disciplinarian, and he almost seems more friend than teacher. However, Mr. Jones is an experienced character education instructor who has helped students accept and practice core values—respect, justice, and citizenship, and to take responsibility for their actions. He infuses that experience with his easy-going style, which promotes independent learning in his class. Mr. Jones has high expectations for his students, and often bolsters them by volunteering his own time as an after-school or weekend tutor. He believes his students can benefit from his example of dedication, patience, and perseverance.

> I want my students to see me, an African-American male, as an educated, successful, and outgoing go-getter. I want them to know that they can do whatever they want with what they've got. I come from a background similar to them, and if I made it with a Master's they can definitely make it!
> Mr. Jones is a certified PK-8 generalist with a Master's in administration leadership who may pursue a doctoral program in educational instructional technology. He teaches math and science to two of the four 5th grade classes and is seen as the school's "computer guy." He is often called upon by his colleagues and principals to fix minor technical problems, to assist with technology resources such as Smart Boards and document cameras, and to recommend new technology resources. "I have always loved to fix things, especially anything digital, and I love helping my friends. They always 'pay me back' with donuts or other food so it keeps me happy."

His background, including Tech 21 (a district-wide virtual technology community), attending district technology conferences, and personal technology education, have enabled him to integrate technology in his classroom. Tech 21 required

Mr. Jones to present informal classes and share ideas with colleagues in a sophisticated approach to technology in education through email blasts, video conferencing, and social media. “What I love about this group is that we share innovative things that I can then share with my team and class. We also talk about what doesn’t work and how we may make our district better with technology.” Mr. Jones demonstrated tech savvy in planning by using search engines, textbook online planning resources, and STEMscopes, and in his classroom by using Google Classroom and several online applications. Observations and interviews further established that he knew his students' capabilities and accordingly integrated technology in class.

Mr. Jones’ beliefs about technology in the classroom. Mr. Jones believes that technology plays a key role in his classroom. All his lessons, assignments, and project are technology-based, except for those related to state-mandated assessments and preparations for them. “Give me any topic and subject and I can guarantee you can find something online that is perfect to teach it!” His students use their Chromebooks from the moment they walk into the classroom to the moment they leave. Mr. Jones carries his iPad, iPhone, and Chromebook everywhere during the school day so that he can add an assignment, a grade, look at a website, or communicate with his students. There is evidence of technology all around his classroom (robots, Chromebooks, projects created by technology or printouts of technology-based work). “I can’t imagine going back to a non 1:1 classroom. I have become so accustomed to adding everything digitally in such a short time. It is not only easy, but so efficient.”

Mr. Jones says that one of the reasons he accepted the position at his present school was the possibility of a flipped classroom where students watch videos and receive instruction online outside class, and practice concept engagement in class, as facilitated by the teacher, with remediation or enrichment as needed (Strayer, 2011). As a lover of technology, Mr. Jones dreamed of a cutting-edge classroom, and the fact that every fifth grader at his school had a Chromebook seemed to make this possible. However, the flipped classroom was impossible because most students did not have wifi access outside school and they were not permitted to take home the Chromebooks. “It was great to try the flipped classroom and I am not giving up on the possibility of making it happen in a few years. The students have a more active role, I think, in a flipped classroom.”

Mr. Jones believes technological immersion prepares students for the future, and that Chromebooks are the preferred vehicle because they are user-friendly, and the fact that they are web-based means that they have virtually unlimited memory. “You can go from a Chromebook to any other computer and since everything is on the cloud you can find all your work, intact. My students are still amazed by that.” His students love Chromebooks, and would rather use them than any other tool for any assignment. As noted, Mr. Jones uses Chromebooks for all math and science except for the district-issued state test preparation and practice materials. He uses online resources such as Kahoot (a multimedia online game-based learning tool that teachers can create or modify for any subject) with Chromebooks and reviews state assessment questions online. “Kahoot has really changed the quiz game. It is so friendly and so addictive. My students want us to

use Kahoot for everything; and we can." His students were all able to use Chromebooks to go to Google Classroom and STEMscopes assignments quickly and easily, and follow the links included in the assignments. Mr. Jones said that students have had several opportunities to work with computers throughout their elementary school career and noted that students were able to use their Chromebooks with only minor problems from the first day of class.

Mr. Jones said that Chromebooks were closely related to the desktop computers in his classroom because Microsoft Office and Google Docs look similar and are easily interchangeable. For example, if one of his students is working on a Powerpoint presentation, she can easily open the same presentation using Slides, Google Docs' version of Powerpoint, and edit it. Further, Mr. Jones prefers Chromebook keyboards, which are closer to a desktop or laptop than, say, an iPad, thus making student transitions to and from desktops and laptops much easier.

Mr. Jones says students who leave his class proficient with Chromebooks need not go far to master Windows, as each Microsoft Office tool has a counterpart in Google Docs (Word to Docs, Excel to Sheets, and Powerpoint to Slides), students can use them interchangeably. In Mr. Jones' experience, students typically require around three weeks to get used to that fact that Chromebooks are completely online. Students need not open programs and manually name and save documents, and can close the Chromebooks instantly to transition to a different activity or class without fear of losing work. Further, students don't have to wait for freshly-opened Chromebooks to restart as is often the case with desktops and laptops. "My students are still learning that whatever they type or

create on their Chromebook will be there even if they don't save it since it saves automatically on the cloud. It is genious!" Mr. Jones laughs that it seems often there are students running to his desk in fear that they have deleted or failed to save work. He assures them the work has been saved to the cloud automatically.

Despite his disappointment at not having a flipped class, Mr. Jones was excited that his students (many of whom had little technology at home) would be immersed in the technology Chromebooks could make possible at school. Jones seized upon Chromebooks as a way to ensure his students were technologically proficient. Mr. Jones maintains that technology can and should be used at any time of any day with any subject. Mr. Jones was convinced that technology engaged the modern student in a way that tangible books and pencil/paper assignments simply could not. He also saw technology as a way for students to know instantly what they could work on, even if the teacher was not available.

> It's paperless and a lot of the grading is already done. They can do the assignment and it's already graded and the kids automatically know which problems they missed so they can work on it again. It's engaging for them, they love it. It doesn't matter what program I put up there; they're just interested.

Mr. Jones says students see their Chromebooks as a reward. Not only are they excited to use them during class time and for their assignments, they want to use them when they have some free time. "When they finish their assignments, if they have extra time, or if it's raining outside during recess, they can get on their Chromebooks. It's almost like it's a reward, honestly."

Mr. Jones also saw that daily Chromebook use, especially with STEMscopes (online comprehensive K-12 curriculum aligned to support math and science state standards) and Google Classroom assignments (digital learning platform that creates, distributes, and grades assignments paperlessly), propelled students to more independent thinking and finding ways to learn that were particular to them. Many websites, including math and science textbook online supplemental materials, require students to respond correctly in order to advance. “If they miss a problem the website will reteach, show them graphics or videos, and they are basically learning independently,” he said. He also notes that because he can see the problems they miss in real time, he can monitor student progress and pull any student who needs individual help when they are working independently.

Planning in a technology-rich classroom. In scheduled interviews, follow-ups, and informal interactions, Mr. Jones discussed planning for technology. Although he and his content partner--the other teacher who teaches math and science--collaborate, Mr. Jones writes the science plans and his content partner writes the math plans. Both math and science teachers are tech-oriented and often share new applications, websites, and hardware with each other as they plan with technology in mind, and find that technology simplifies the process. Mr. Jones looks for three things when he plans: 1) animation (mainly videos) because he says he has noticed it keeps his students’ attention; 2) assignments that include the state objectives, and 3) an assessment piece. If the online resource he identifies includes those three elements, Mr. Jones will use it and add it to his lesson plans, particularly if he can find all the components in one place. “Students will

not pay much attention to a resource that does not have a video or animation component, so when I find something that has video and state objectives and an assessment, I feel I have struck gold!" When asked, Mr. Jones noted that he does Google searches to find resources he can use with his class and consults the STEMscopes and textbook online resources for help with assignments, assessments, and planning.

Mr. Jones says there is so much information online that it makes planning easier and faster than using books or other printed resources. He has been able to find many assignments and ideas in the STEMscopes program and says students enjoy all the online resources but he also notes that students have their own values when it comes to education. For example, if a student does a paper/pencil activity and is diligent and timely, he will also be diligent and timely when he has to perform tasks, take assessments, and self-pace digitally. When he attended a technology conference, Mr. Jones left several assignments, noting that, of his two groups, only five students failed to complete at least half the tasks, which is a typical outcome when he is actually in class.

Mr. Jones noted that the greatest difference and advantage of planning for a technology rich class is that he needed not be as explicit. "I used to have to physically write down what I was planning to teach and find or create the resources I was going to use (i.e., activities, worksheets, assessments). Yeah, I am glad to be in a digitally-rich class and school!". One advantage is that, knowing all his students have Chromebooks and being able to put all assignments on Google Classroom, he has the freedom to include links or copy brief descriptions and paste them to his plans. Mr. Jones uses Google or STEMscopes to easily find lessons and plans that suit his objectives, will only

use the lessons he finds online that have the lesson plan already included, and simply copies and pastes them into his lesson plan template. He does not modify the plans he copies and pastes but sometimes changes them when he teaches the lesson. He wishes he had been able to plan so easily early in his career and wonders how teachers managed without the internet. “My planning time has decreased by at least half and my plans have gone from several pages to two (one for math and one for science).” He follows a template that includes spaces for engagement, exploration, explanation, elaboration, and evaluation following the 5E model.

Another advantage to planning for a class that uses Chromebooks is that websites and links promote and simplify independent practice. Mr. Jones prefers teaching a lesson to the whole group then having students independently finish the assignments he has posted on Google Classroom. He seeks lessons that include animation (as his students are especially engaged by video) and an assessment (especially when it is graded online). Online grading gives the student quick feedback and redirection, gives the teacher a grade, and also provides instant data that he can use for remediation. Further, Mr. Jones seems to prefer virtual science labs found on STEMscopes, making unnecessary the setup, cleanup, and possible loss of instruction time but still preserving an almost hands-on experience.

Mr. Jones stressed the ease of using Chromebooks, and mentioned that he planned daily with his math/science partner. Because she was a day ahead in math and he a day ahead in science, they could swap ideas about what was working and what was not. He noted that because of the daily exchange, there were often changes to the plans and to the

daily activities, and having Chromebooks made these changes easier. Mr. Jones and his content partner were glad they could add and remove assignments on Google Classroom on a daily basis if necessary. “I just can’t stress enough how easy having a 1:1 classroom is when planning and adjusting the plans, assignments, resources, or activities.”

When Mr. Jones did not have a technology rich classroom he had to write in detail what students were to do during a lesson, but when he finds plans online, “It’s pretty much done for you so it’s a lot easier. That hard work is already taken care of. I don’t have to get like super-duper detailed.” When he was absent he said that it was simple to plan for his classes, even from home, because of the ease of the Chromebooks, STEMscopes, and Google Classroom. Mr. Jones now can add assignments and plans easily and quickly and hopes never to return to planning for a classroom that is not technology rich.

Lesson plans and planning as a team. One of the data sources was examination of a written lesson plan before an observation of the lesson. When I examined Mr. Jones’ lesson plan for the upcoming observation, I found it less detailed than I expected. When I interviewed Mr. Jones he said he copied and pasted plans he found online to his own lesson plan template. However, the plans included only links to those lesson plans and not the actual plans. As a veteran teacher I know that lesson plans are organic and I often call my own lesson plans skeletal because they are more like an outline that is ready to be filled. Mr. Jones often uses digital lessons that he does not preview, claiming they come from websites he has used before and found to be effective and reputable. He admitted that he does not follow every link to ensure it functions and contains the lesson for which

he hoped. He also said that, although he uses all lessons and links in his plans, he sometimes changed them during the week, depending on pace, schedule changes, or newly-discovered resources. This flexibility is most attractive to Mr. Jones.

"My content partner does not use quite as much technology as I do, so I supplement her math plans with online activities, assessments, and videos." Mr. Jones knows the math book has online resources that include assessments and videos. "I know they can pull up the assignment online," he says about including links to the math text activities in his Google Classroom assignments, "I can just plug that in." Mr. Jones meets with his content partner almost daily to discuss what is and is not working in the day's lessons and activities, but he stressed that these meetings seldom take the entire planning period.

The Case of Cindy Matthews

Personal and technological background. Cindy Matthews, 5th grade math and science teacher for two of the four 5th grade classes, is fashionable and friendly. She was in her 18th year in teaching and her 11th in this particular grade level and school. Ms. Matthews greets visitors with a bright smile and an infectious laugh.

Ms. Matthews admits that she is not a techie, but does stress that technology has been one of her passions through most of her personal and professional life. Ms. Matthews likens technology to fashion—the latest technology is as fashionable as a new pair of shoes. "I am definitely not Mr. Jones, but I do love having the latest digital accessory, and it helps to be tech-savvy when dealing with young students who know more about technology than most adults." She enjoys taking pictures, making videos,

using multiple filters and other enhancements, and accordingly says she must have the latest phone every year. She does not care for Apple products, and was delighted when her school chose Chromebooks over iPads for its 1:1 initiative.

Ms. Matthews' classroom. There is color all about her classroom, and a number of motivational posters focusing on math and science. "I think positivity and attitude is as important as intelligence. If my attitude is bad and negative, I will not be ready to learn, so I try to bring positive messages and keep my classroom looking sunny." She posts handmade vocabulary/picture cards that highlight the current science and math units, and has a board featuring "Every Day Counts" Calendar math. The desks are arranged in groups of four, all facing the mounted Smart Board, which also is linked with a document camera. There are two short bookshelves along the wall to the right of the door, filled with children's math and science books that she has been collecting since before she became a teacher. Her desk is neatly tucked away in a corner and faces the door. There is a desktop computer, used exclusively by her, connected to the Smart Board and document camera, and a kidney table beside her desk for small group instruction. Behind the table is a bookshelf holding many neatly arranged math manipulatives, other resources, and organized group binders. "My students' parents say that their kids have become more organized because they want to be like me. I try to stay organized because our days are so full." Next to the bookshelf is a Chromebook charging station.

There are four student computers in a corner labeled Computer Station, one of several learning stations, such as the Science/Math Independent Reading Station, that conspicuously dot the room; the others are found in plastic bins. A pocket chart displays

the station schedule with student names and pictures. “I have learned that the best way for me to teach my students and get to know what they need is to work with small groups and having well-planned learning stations helps.” Textbooks, various school materials, and games are neatly displayed and clearly labeled in the available open closet space. The room is impeccably organized, down to color-coded labels on the cubbies (where students store backpacks and lunch kits), with each cubby sporting the names of two students, one color for a morning student and one for an afternoon student.

The room is not large, filled with resources and students moving about purposefully, but it is most comfortable and inviting, with lamps, pillows, and nooks for small groups and projects. “I want my students to feel relaxed and comfortable and hope each one finds a good space in our classroom to do their best.” There is plenty of space on the floor as well, and Ms. Matthews says she does not mind where students work, provided they are on task and engaged. Technology is pervasive, with Chromebooks and authentic student work (facilitated through technology) posted on the walls, including photographs of projects, printed stories, and student-created word problems, often including graphics well beyond mere word processing, such as mathematical models and other images that illuminated the problems and thus made them more accessible and understandable to students.

Classroom environment and procedures. Each of Ms. Matthews’ class periods begins with a Smart Board display—a math warm-up she creates specifically for the current unit of study, but also including some spiral review problems. “I love using the Smart Board because students and I can share the pencil and we can work together. I can

see instantly if they are understanding or if I have to reteach." She works the room to address questions, giving only hints and steering strategies, while students, armed with Chromebooks and sometimes huddled together, try to solve the posted problems. She tends to the lunch count and attendance as the students wind down their efforts, then reviews the warm-up, having students (sometimes volunteers, sometimes randomly drawn from a bundle of name-imprinted craft sticks) approach the Board or document camera with Chromebook in hand to present and explain their solution. Ms. Matthews then introduces concepts to the entire class for twenty minutes or so, answering their questions and asking them to answer hers, sometimes by hand-raisers, sometimes randomly. The discussion often is lively, almost chaotic, as students vie to be heard and very few do not want to participate. After whole group, Ms. Matthews directs her students to the various learning stations to practice relevant skills for perhaps twenty minutes. One station employs Chromebooks, while the rest feature hands-on manipulatives, books, and pencil/paper activities. During stations, she remediates a small group for about fifteen minutes, then walks around the room assisting the station groups for the remaining five minutes. "When I first started teaching I devoted the entire small group time to the small group, then I realized that walking around to answer questions and leaving my small group to do short independent work was better."

The classroom seems a bit chaotic to an outside observer, but students are on task, working independently, and their conversation seems all about the work. When learning stations are complete, students scatter about with colored paper, scissors, markers, and open Chromebooks they use to research relevant information, working to complete their

study foldables (student-made, paper graphic organizers). “I have noticed that my students love to make things and this tactile work seems to help them understand some concepts better.” Ms. Matthews is barely visible, blending in with her students, some of whom are on the floor in groups, others standing alone, and still others surrounding Ms. Matthews. All are on task, and some are quietly helping one another.

Ms. Matthews directs students in the foldable steps. Her patient demeanor and big smile put her students at ease and welcome questions and comments. She differentiates instruction with the aid of Chromebooks (including multimedia), by student peers, scaffolding, and by modeling. “I know what it is like to not understand a concept, and I try to make learning comprehensible and fun.” She is fervent when she states that she strives continuously to support her students in these ways, and conveys a sense of urgency to prepare her students and, more importantly, to instill in them the confidence to feel prepared to face any task. The students seem to hang on to her every soft-spoken word and her giggles and smiles. Although she is very friendly, she also commands authority and respect, both verbally and nonverbally. “I always say there is a time to laugh and a time to be serious. My students have learned when I mean business.”

Ms. Matthews says she has high and very clear expectations for her students. She meets with each student after every major assessment to discuss goals, what the student can do to achieve them, and how she can help. “Our meetings don’t have to be long. I want to teach my students to plan and make goals. Sometimes just saying the goal out loud helps.” There are class-made rules and consequences posted at two different places in the classroom, and Ms. Matthews refers to them as necessary. She transmits a weekly

newsletter email that includes assignment, test, and conduct information that students help create and complete. The newsletter includes the students' personal weekly goals. Ms. Matthews is certain that students achieve good conduct and grades when expectations are clear, submit all assignments timely, study materials for tests, complete work in stations; know that adverse consequences include time out, limited recess, calls home; and know that incentives include extra time on enjoyable tasks, gifts, or extra recess. "I am all about incentives!"

Ms. Matthews' professional background. Cindy Matthews is a 4-8 generalist with an English as a Second Language (ESL) certification, holding master's degrees in teaching and education. Ms. Matthews is primarily responsible for developing the math plans for the entire fifth grade, although she and Mr. Jones collaborate in both science and math. Before Mr. Jones arrived two years earlier, Ms. Matthews says she was regarded as the campus "techie," and was happy to cede that honorific title to Mr. Jones, who is even more enthusiastic about daily technology use than she. She enjoys using technology and knows quite a bit, having attended several conferences, but confesses that Mr. Jones has more passion for propagating campus technology. "I prefer to do my technology in my classroom and in my own time. Mr. Jones has more patience and loves to talk to everyone all around the campus," she laughs.

Ms. Matthews' beliefs about technology in the classroom. Ms. Matthews' view of technology in her classroom is balanced—she believes it plays an important role as a tool, as a means to an end, but is not a substitute for quality instruction or real understanding. She believes that technology is intrinsic to the modern classroom and is a

"fountain of knowledge" that must be accompanied by quality teaching lest it exist in a non-contextual vacuum. She says that technology is and has been a part of all her students' daily lives since birth, that they are digital natives and that incorporating technology is a natural extension of their lives; for them, it is one of those real world contexts that teachers are constantly urged to find and exploit to promote learning and, as such, is a valuable tool. Technology can be seen as a facilitator of academic achievement and is so pervasive and indispensable in today's world. Ms. Matthews is committed to technology as a vehicle for education, as one of the many resources that might advance her in-class goals.

> Technology plays a role in everything we do in class. We take advantage of the fact we have Chromebooks since I prefer for all students to use technology at the same time. We can all be on the same website or application and help each other as we learn.

Ms. Matthews previews any website or application the students have not used before with the whole group prior to starting a lesson or independent work where they will use the resource. She does it as a quick assessment to ensure fewer questions and problems when the actual lesson begins. "I view this time as an educational opportunity for me. I don't want to have chaos when we are having the lesson, so I want to ensure success as much as possible."

Ms. Matthews believes technology and solid instruction can motivate student learning, and she is open to a variety of online resources. She sometimes is concerned that students might be exposed to inappropriate content, especially when they are doing online research, and she tries to preview all sites that students might visit. She admits that

she relies on the district filters when she cannot scrutinize every possible site: “If they go through the district computers, which includes Chromebooks, I assume they should be safe.” Other ways she promotes cyber safety is by pairing students when doing online research, teaching students to go through the district website to reach approved search engines (although she knows Google is the search engine of choice), and providing a list of reputable site links on Google Classroom. She expects that her online vigilance and open conversations with students will continue to promote online safety.

Ms. Matthews believes technology plays a critical supporting role in her teaching. “It’s like any manipulative, anecdote, or book that we use to encourage learning, but so fast and more powerful.” She tries to include a technology piece in every lesson, noting that she does not do it blindly, but rather carefully and with her students in mind.

Ms. Matthews lauded Chromebooks but lamented that many students did not have independent access to the internet and technology outside school, resulting in an inherent unfairness. Although she had never considered a flipped classroom, Mr. Jones broached the idea when they became content partners, but the uneven access to technology fairly quickly stopped the notion. However, Ms. Matthews confessed that she was intrigued and thought that, given uniform internet access and appropriate hardware at home, the concept could be revolutionary. Ms. Matthews had no answers but believed strongly that widespread internet access is crucial, that an effort should be made to ensure universal Wi-Fi, and that a program should be emplaced to allow students to take Chromebooks home or otherwise guarantee a reasonable hardware substitute, so that flipped classrooms could become pervasive. In short, Ms. Matthews is convinced that cyber-technology

anywhere and anytime may be crucial, but she admits that, for now, she must content herself by doing her own part—promoting technology in class, providing newsletter information to parents about providing free computers to qualifying families, county library information, and low cost internet access. “I think we often take for granted that we are immersed in technology all day, every day. That is why I am careful when I plan and integrate technology. I want to make it accessible and friendly.”

Planning in a technology-rich classroom. Ms. Matthews demonstrated that she had a connection to each of her students and that she used data to inform her planning. She used Microsoft Office Excel to keep her students and their information organized. She included the students’ test scores, conduct, assignment information, and other information she felt was necessary (like special needs and personal information). She updated the spreadsheet as new information materialized. “In order to serve my students well, I have to keep all their testing and educational information well organized. I cannot help them if I don’t know where they are with my subjects.”

Ms. Matthews was very purposeful and intentional when deciding what resources, technology, and methods she would use to reach her math students. She looked for technology resources (websites, applications, hardware) that were specific for the outcomes she desired in math. In a lesson about place value, as the students were coming into the classroom, Ms. Matthews displayed simple place value word problems on the Smart Board that students solved in their math journals. After the warmup, Ms. Matthews went over the problems with the students and they took turns going up to the Smart Board and solving them. She asked the rest of the students if they agreed with the answer and

helped the students who were confused. “I love making my students think critically and one way is to have them help each other. When they can’t, then I intervene.”

Ms. Matthews says that planning for whole group takes most of her planning time because she uses the 20-minute whole group lesson to introduce new concepts. “Having my students together when I introduce a new concept helps me assess what they know and adjust my teaching from that information.” Her soft voice and great smile seem to make the students very comfortable and they all participate by asking questions and stating answers during whole-group time. She said that the document camera and Smart Board have become indispensable and she can use most of what she has planned in the past for the different units of study. Ms. Matthews uses the document camera to project premade activities that will help students learn concepts and she does this interactively. She jokes, “I cannot plan what the students will say, only what I will say and teach.” I observed the lessons and they were as she described: Whole-group lesson, interactive examples, partner practice, independent assignment, and small-group time.

During one lesson, after Ms. Matthews introduced a place-value chart and students helped to fill it out, her helpers passed out premade laminated tables and dry erase markers to each student. Ms. Matthews asked them all to partner up and practice labeling their place value tables. As they did this for about five minutes, Ms. Matthews walked around the room to help and encourage students. Then, she asked the students to open their Chromebooks and to go to Google Classroom and open up the day’s assignment. They all did that quickly and as they were opening up the assignment for the day, Ms. Matthews pulled up IXL.com (an online math and reading website for K-12

graders and stands for “I excel”). The students looked up to show they are ready for the next instruction. She introduced the website, noting she had come across it as she was planning the lesson. She showed the students that there were many math games and activities they could play to practice concepts they have already learned. She asked them to follow the first link on their assignment, a place value game on IXL.com, and they did a couple of the problems together. “You will be using this game at the Chromebook learning station during small group instruction.” You could hear several of the student say, “Yes!”

Ms. Matthews conceded that it was not always feasible to use technology in every part of the day. However, she knows that technology plays a big role in their grade level, as evidenced by their Chromebooks, therefore:

> I almost always have technology options in just about every lesson that my teammates can use if they want. I always look for a technology angle in every lesson I plan. I can’t think of too many lessons that just can’t involve technology. I look carefully at what resources are out there and if they fit with the final objective, I will include it.

She also noted that there are activities that defy technology. For example, “If the class goes outside to do human arrays or human fractions, that’s kinesthetic, not technological. At the same time, after that’s over, we might go inside and use our Chromebooks for an activity about arrays or equivalent fractions.” Students are told at the beginning of the lesson if they will use their Chromebooks. Ms. Matthews not only wants her students to be ready for the lesson by having their materials out but also by knowing, or mentally preparing themselves, they may or may not use the Chromebook for a certain lesson.

Students seem very comfortable during lessons and she says it is partly because they know what to expect.

Ms. Matthews added that the use of technology must be purposeful and intentional with the end result in mind, and not simply trotted out as a toy or a time-filler as teachers years ago may have used videos. When she plans, she has an assessment, or at least the concept of one in mind. She started using Kahoot (an online quiz game) two years ago and says that it has become her go-to assessment. She knows she can manipulate the questions and add images or content as needed. She says the students love to "play" Kahoot because it is a competition and students tell her they see it as a game not an assessment. "Their faces light up when they see that they are 'winning' and they seem to try harder because they know they will be up against each other."

Ms. Matthews also says that finding the right technology resource for the concept she is hoping students grasp is important. "There are many great websites and applications," she acknowledged, "but not all can teach fractions the way I know my students need to learn it." She enjoys looking for new technology resources and collaborates with Mr. Jones frequently to try them out, but she will only use the resource if she has an intended purpose for it. For example, when she and Mr. Jones first heard of Kahoot during a district technology training course, he used a premade quiz the very next day with his students. Ms. Matthews, on the other hand, waited until the following week to create one that would review the concepts being taught that week.

For Ms. Matthews, using a new website or application because it looks inviting and cool is not how she prefers to introduce technology to her class. She wants to "play

with it for a bit" before she incorporates it in her class. She likes for her students to share a new website or application to the rest of the class about once a month. Her only rule is that the students must report how they can use the new resource with a math or science concept already studied. When students share their finds they have planned how to introduce the resource and Ms. Matthews usually incorporates it in a learning station or as part of the warm-up. She suggests this process has deterred questionable websites. "I introduce this concept to the parents at the beginning of the year and encourage them to do it as a family. Parents have contacted me to tell me they love this because it has helped them find new ways to help their kids with schoolwork."

Ms. Matthews wanted to ensure that students could use technology effectively, and also could work without it. For example, she often changes the learning stations from digital to manual, will ask students to put away calculators, or, rarely, will change her warm-up to a paper/pencil activity. Ms. Matthews wants her students to be well rounded and to be able to use technology along with the everyday items in class. Sometimes the only technology piece may just be using a search engine to research and help them make a poster or flip book for a project. Balance is important to Ms. Matthews and she has an inspirational poster on top of the Smart Board that reads, "The purpose of life is to live. The meaning of life is whatever you choose. The secret to life is balance in all things." She mentions the quotation at times to her students and repeats that she wants to help them be balanced and learn as many things as she can teach them. In her interviews, Ms. Matthews confessed that she feels responsible to give her students a variety of tools to help them navigate the technology age and the insufficient technology at home.

Ms. Matthews was also very aware that technology was just a part of her teaching, and did not take away from the learning. She mentioned that technology, like supplemental materials and manipulatives, was supposed to enhance the experience, not take the place of her instruction. She commented, "it is my job to facilitate actual understanding through what I hope is good teaching." She vowed not to use technology just because it was available or because all the other teachers were using it, especially with the Chromebooks, but because it served and advanced a legitimate educational purpose.

> We use technology because it is faster and gives us instant access to information and interactive resources, but I also have to make real world connections with what we study and the technology we use to help study it. It doesn't do any good if they don't make connections, because we are helping to prepare them for the world, which is a lot bigger and more complicated than cyberspace and video games.

Lesson plans and planning as a team. Ms. Matthews' plans were not very detailed. She mentioned that she included what was expected, but liked to have flexibility to change them as needed. She kept her plans up on her computer during the lessons and posted them next to her door on a clipboard. Ms. Matthews used a district template for her lesson plans and included the state objectives, student personal objectives, a summary of the main points of the lesson, whole-group and independent work. During the interviews, Ms. Matthews explained her thinking behind her plans. "I don't think I need to add too much detail because my plans can change at any time." She remembered when she was studying to be a teacher they had to practice writing very detailed lesson plans that took hours. Although she admits it still takes her hours to plan the units, the weekly

plans she turns in do not take as long. She noted that her classes have done extremely well in her eleven years at Silver, have improved yearly, and that she had revisited old plans to determine appropriate alterations, especially considering the advent of Chromebooks and related technologies. Ms. Matthews admits that, when those plans were created almost a decade before, the team had spent a whole summer writing and revising them. She said, "Most of the plans are still usable and adding technology or different objectives keep them fresh."

Ms. Matthews did not claim that she and her colleagues planned together, but repeatedly asserted that her team was close-knit and shared ideas and strategies constantly, including what seemed to work, what seemed not to work, and what new approaches might be tried. She included technology in as many lessons as possible and provides a technology option in the plans that she shares with her team. She confirmed that three teachers in her team had been teaching together for eleven years and Mr. Jones had joined them two years ago. She also said that one of the teachers was going to retire at the end of the school year and she hoped the next teacher would be able to fit in as well as Mr. Jones, especially with their style of planning. "We don't plan extensively, but we are always communicating and in our communications, plans do come up."

The Case of Luke Martin

Personal and Technology Background. Luke Martin, 5th grade English Language Arts and Reading (ELAR), called himself a school nerd, and hoped to end his career in a college setting, "probably when my boy is in college." He was very respectful

and serious and extends his hand for a firm handshake and a “Good morning!” when you enter his room.

Mr. Martin considered himself “old school” and was not ashamed that he does not use technology as freely as his teammates. He has never been interested in technology as much as the people around him. He likes having the latest gadgets but admits his pre-teen son is the person who uses them the most. Although he owns mostly Apple products, he says that the Chromebook has become his favorite toy since he started using it three years prior. “When I first saw the Chromebook I wasn’t sure I would like it, but when I opened it, I realized it was better than my iPad!” He enjoys movies and says that he is very technological with sound systems and home theater.

Mr. Martin’s classroom. Mr. Martin’s classroom is fairly bare (lacking much of the color and decoration normally associated with elementary classrooms) yet very organized. There is a kidney table with an iPad and an iPhone charging on it at the entrance of the room. There are also three desks facing the back of the room where administrators or other grade level teachers occasionally send children having trouble with behavior. The student desks are set in rows as in a college or as Mr. Martin calls it, an “old school classroom.” All the desks are facing the Smart Board at the front of the room. The teacher desk faces the door and has a printer and a desktop computer that is connected to the Smart Board and document camera. The Chromebook charging station is next to the desk and there is a file cabinet on the other side of the desk. There is a large sign on an unadorned bulletin board reading “Thank you for your service!” that was signed by all the fifth graders for Veteran’s Day. To the left of the door there are cubbies

and closet space for students' personal belongings like backpacks and lunch kits. Mr. Martin posted a typed sign that reads, "Remember to take whatever you need for your next class. You will NOT be able to come back to get anything during class time!" and it was signed by Mr. Jones. There are dictionaries, novel sets, and bins of books in the available closet space.

The classroom is quiet and every student is at a desk, arranged in rows, writing or reading a book. Mr. Martin's students sit silently with Chromebooks closed, awaiting his words. "My military and law training have made me value organization, simplicity, and routine." The teacher is sitting at the kidney table near the door. He snatches up his cup of coffee in professorial fashion, and strolls about the room, lecturing on the new concepts of the lesson, and using vocabulary that seems too sophisticated for the class, sometimes providing context clues. The students seemed unsurprised, and Mr. Martin later explains, "vocabulary is paramount, and as a class we work on vocabulary daily, often dissecting vocabulary terms with roots and cognates."

Classroom environment and procedures. Mr. Martin instructs the students to open their Chromebooks, and tells them that they are going to create comic strips to retell the novel they have been studying. Each student opens a Chromebook, revealing customized landing Google pages and, almost before Mr. Martin can tell the students where to go, they are there. They have clearly used the website to create comic strips before. Mr. Martin models the project in steps, using the Smart Board. He is comfortable in the whole-class setting, and peppers the assignment with challenging vocabulary while he continues to model. He walks the room, his quiet and slightly sarcastic humor on

display for his students, who plainly are used to it, love it, and respond with knowing smiles and laughs, while remaining on task and following every rule. He later admits, "We don't often get to be on the computers this long. My students are not used to it, but they really love when we get to use them. It throws off our routine a bit, but as you saw, it was worth it."

Mr. Martin walks around the room as he creates his own comic strip to retell a novel they had previously read. He talks to the students and asks them to help him retell the most important parts of the novel. The students do this with ease, and he goes to the desktop to input the information that is shown on the Smart Board as each part of the novel is mentioned. All students are engaged, ask and answer questions, and help each other, meanwhile laughing at Mr. Martin's humorous retelling. Some students start their own comic strips and he asks them to wait until every important part of the novel is mentioned. Mr. Martin reminds them that they have resources such as handouts, notes, and assignments on Google Classroom and in their reading notebooks that they can use as aids. When Mr. Martin is finished with his example, he plays the entire comic strip for his students. The students laugh, some take notes, and he asks them to start their own comic strip. All students take out their novel, their notes, and go to Google Classroom for their resources. A few students raise their hands for consultation with the teacher or for him to see if their comic strip is progressing appropriately. He tells them that they can ask two peers for feedback before digitally submitting their comic strips. Some students stand up with their Chromebooks and immediately go to their peers to get feedback. Others

turn around and start talking with the students behind or next to them. There is quiet collaboration while Mr. Martin continues his rounds helping and giving feedback.

Mr. Martin prefers to lecture, which he admits is not the current trend in elementary school, where students are usually seated and taught in small groups. He insists that after the first three weeks of school, his students become accustomed to his routine, which is successful and has served him well (100% passed the state reading exam in the first of three possible administrations). He proudly adds that he is the only teacher in the school who has the principal's permission to arrange his class in rows and to teach mostly by lecture. "I approached my new principal with my state exam scores and all the data I use to help my students be successful in my class in hand. I asked her to let me continue with my teaching style and she would see the results. She agreed and we got the results we hoped." His background in the navy and as a deputy prosecutor have informed his notions of discipline and classroom management, and seeing many young men go to jail, mostly underprivileged and uneducated Latinos and African Americans, spurred him to succeed as a teacher.

> I'm getting them sort of at the formative stage where you like to think that you're having some impact on them and I can lend some of my background to them in saying, "Here is what's at the end if you don't take advantage of this education," and you hope they listen.

Mr. Martin's professional background. Mr. Martin is a PK-8 generalist, finishing his seventeenth year, and his eleventh in Silver's fifth grade. With a JD and a PhD, he is responsible for developing the English Language Arts (ELAR) plans for the entire fifth grade. He has been teaching with two of the three other fifth grade teachers

for the past 11 years. Mr. Martin has not attended many technology conferences or workshops and does not feel like he is an expert in technology. He sees technology as the wave of the future, a non-negotiable to most districts and administrators, and increasingly adapts his teaching to integrate technology. “I know that technology is important and we are in it most of the day, but I will continue with my teaching style which I believe will prepare them to work with any teacher and will add technology as needed.”

Mr. Martin’s beliefs about technology in the classroom. Mr. Martin was skeptical of technology in general and Chromebooks in particular when they were introduced three years earlier. “I was very resistant because technology threw off my routine.” His routine takes about three weeks to establish, involves 15-20 minutes of uninterrupted lecture, and runs counter to commonly accepted approaches of using small groups, learning centers, and student-centered approaches. He says he likes to think he can paint a picture with his words and technology is an instant, artificial picture that isn't created with his students in mind. Mr. Martin also admits that the instant picture -- especially in video form--has helped his students understand time periods and places mentioned in books. Nevertheless, he resigned himself to the inevitability, and began trying to integrate technology in a more purposeful way, beyond just warm ups and wrap ups, as he had been doing for the first two years of Chromebook implementation.

Mr. Martin admitted that “it’s taken some time; it’s taken some growing pains for me to adapt to the integration of technology in the daily routine of education.” He remembers when his 11-year-old son started using technology as the major part of his homework preparation two years ago. He looked for words and information online

instead of in the reference books at home or in the library. Mr. Martin said that is when he realized his students needed to use their available technology.

Mr. Martin says he was very resistant when his principal said each fifth grader was going to receive Chromebooks and that Chromebooks and technology integration in general was expected. He says he is not opposed to technology being used but was apprehensive that it was going to change his entire teaching style. Mr. Martin's Navy and law experiences have shaped his disciplinarian approach, his high expectations for himself and his students, and perhaps his initial reluctance to adapt. He says he expects for students to learn to write the way he learned because "I turned out all right," but he understands these are different times. He also says the Internet and programs like Microsoft Word are making people lazy about handwriting, spelling, and grammar since with a touch of a button all that can be fixed.

Although Mr. Martin is nearing the end of his third year with Chromebooks as part of his daily routine, he is still struggling to achieve true incorporation:

> In the next decade or two I think the biggest switch that we'll see with education is we'll do away with the textbooks. I think it's a reflection on society. I have to wrap my mind around it and say, "Well, this is how it's going to be for kids of the 21st century," my child included.

Mr. Martin admitted that the inclusion of technology is positive, that many students respond better to technology and Chromebooks than paper, and he applauds the fact that the internet allows him to find almost any book online in thirty minutes. Before the inclusion of Chromebooks his students only got 45 minutes once a week in the mandatory ancillary technology class. He believes in not reinventing the wheel and not changing

something if it's not broken. For him, his exemplary state assessment record is proof that what he has been doing for 11 years is working just fine.

Mr. Martin appreciates technology, increasingly incorporates Chromebooks into his lessons, and realizes from classroom discussions that technology is both necessary and perhaps even desirable. Chromebooks and the internet can provide not just words, but visualizations of most anything relevant to Mr. Martin's class, a fact that he is coming to embrace.

> So in an instant the technology puts a face on the words during the discussion we are having and that's very valuable and powerful. It's more powerful to the teacher because once you can imprint a concept in your students' brains not only with your words but with actual photographs and videos I think that's a powerful tool.

Although Mr. Martin said the Chromebook has become his "baby," and he uses it for everything from grading to finding resources for his class, he is still trying to find a balance between what he has experienced as best practices in teaching (lecture, discipline, and routine) and the reality of having Chromebooks and using them as a learning tool and resource.

Planning in a technology-rich classroom. Observations reveal that Mr. Martin knows his students' academic levels, strengths and weaknesses, and what might be necessary to get them to their goals. He uses this information as he plans. Mr. Martin is the principal architect of his team's ELAR plans and admits that integrating technology into lesson plans is not an option—it is a mandate. Mr. Martin began using technology for warm ups and wrap ups, but realizes that now technology must be integrated more thoroughly and pervasively. He says,

> I already know when the principal looks at our lesson plans the technology's to be there so all of us immediately put in the website or the app that we're going to use exclusively for our subject matter. We use readwritethink.org because they focus on reading and literature and that's always a standard in our lesson plans.

Mr. Martin feels that adding any more technology than the warm up/wrap up website to his lesson plan would limit him but that it was widely known he would use another sort of technology throughout the day. His students know that when they walk into the classroom they must go to readwritethink.org (a website with free reading and language arts resources for students, teachers, and parents) and do a 20-minute warm up for the day. The resources include interactive games and activities for students, printouts of resources like graphic organizers and story starters, and podcasts and projects on a variety of topics. When Mr. Martin asks the students to stop the warm up activity many want to continue, but he reminds them that the lecture is about to start and they all close their Chromebooks and take out a notebook and a pencil. Mr. Martin hopes to start incorporating digital notetaking next school year.

Mr. Martin added that he would use other technology when the learning opportunities arose. "I talk with my son a lot and we look for things online to help with his schoolwork. This activity is making me lean towards using more technology in my classroom, but not all at once." He said that it would be impossible to add all the scenarios that have occurred during a lesson when impromptu technology integration takes place. For example, during a recent social studies lesson about the Civil War, he decided to use the online textbook and the students asked him to follow a couple of links that were included in the lesson. The students were very engaged with the supplemental

videos and activities and led Mr. Martin to ask the teacher who writes the social studies plans to include the online textbook for the remainder of the year. He confessed that part of the lack of inclusion of technology is his content partner (two teachers teach math and science and he and another teacher teach ELAR), who is retiring, and does not use the Chromebooks very much. He says since he does not have anyone besides the principal asking for technology inclusion he does not feel pressure to include it. He also said that he often reevaluates his lessons and adds or subtracts as needed during his planning time.

Lesson plans and planning as a team. Mr. Martin's plans were not as skeletal, but he said he copied and pasted the lesson plans he had used for years and added technology to them because of his administrators' mandate. Mr. Martin believes that, because his team has stellar state exam results and has been working together for years, administration trusts them to collaborate and plan with the students' best interest in mind. "Our team is so successful that administrators do not seem to scrutinize the extent and manner in which each of us approaches technology as long as it is mentioned in the plans." For one, Mr. Martin seems willing but reluctant to comply with the technology trend, but does not seem to believe it is relevant to his apparent success. He says that his students sometimes change the direction of the lesson by asking Mr. Martin to show them using their Chromebooks or by offering a technological alternative to an assignment and those instances are not added to his lesson plans. He adheres to his tried and true plans and approaches, but ensures that they are infused at least in part with technology.

Mr. Martin says that his team does not plan together regularly but does get together to talk often. "What I love about my team is that we all like and respect each

other. We are all very different, but our goal to help our students succeed is the same." He says they are often in the same room during their planning time and occasionally go out as a team. He says that they have plans that have proven to be successful and that is what they all use with technology integration being the only difference.

Chapter V

Discussion and Implications

The purpose of this study was to describe how teachers plan when they integrate technology in a technology-rich classroom. First, a thorough discussion of the findings across the three cases as related to the research question is presented. Second, the implications of the study are examined. Third, the limitations are communicated. Last, there are suggestions for further research. The research question is: How do teachers in technology-rich classrooms plan when integrating technology in their teaching? Qualitative studies often present the unexpected, and this chapter will explore the extent to which such was the case in this study.

Cross-case Analysis

The participants are three 5th grade school teachers who daily use portable and other available technology (including Chromebooks) as an essential part of instruction. The Digital Learning Coordinator at Mountain ISD identified these three teachers because they all are skilled at integrating portable and other technology in their classrooms, have been involved in district technology initiatives, and are committed to using technology creatively, collaboratively, and to promote critical thinking.

- Carlos Jones is in his seventh year of teaching and in his second year at Silver Elementary School. Mr. Jones is a certified PK-8 Generalist, has a master's in Administration, and is pursuing a doctorate in Educational Instructional Technology.

- Cindy Matthews, an 18-year teacher, is in her 11th year as a 5th grade teacher at Silver Elementary, having previously taught 6th, 7th, and 8th. She is a PK-8 Generalist and ESL teacher with master's degrees in teaching and education.
- Luke Martin, a 17-year teacher, is in his 11th year as a fifth grade teacher at Silver. He is a PK-8 Generalist who has taught fifth through eighth grades. Mr. Martin has a law degree and a Ph.D. in Reading.

Each participant's classroom, beliefs, technology integration, and planning is described in more detail in Chapter 4.

Ms. Matthews was the most purposeful and intentional of the teachers in employing all three elements of Technological Pedagogical Content Knowledge (TPACK) when she planned her lessons and technology integration. Although Mr. Jones' room was filled with technology, and students were using it every time they were observed, he was lacking in purposeful, intentional planning for technology integration. He sought ease everywhere—planning, teaching, assigning work, assessments, and grading. He did not so much plan technology integration, but looked through the internet to find lesson plans that were easy, ready, and that included video, state objectives, and an assessment. Mr. Martin added content to his pre-made tried and true plans, without adding to his plans much technology (apart from the fifteen-minute warm ups or wrap ups at the beginnings and ends of his lessons). He shared that most of his technology integration occurred extemporaneously during a lesson and was prompted by his students.

In this section, the findings of the three cases are presented through in-depth descriptions of how each teacher planned to integrate technology by using their varying levels of TPACK and five assertions reached by the cross-case analysis.

How teachers used Technological Pedagogical and Content Knowledge (TPACK) when planning. Because technology is an important aspect of classroom teaching and learning, and because students have become accustomed to having technology and its stimulation in their daily life, teachers must learn to use technology as part of an effective lesson that will enhance learning. TPACK is not just about technology. A teacher needs to know the subject (content knowledge, or CK) they are teaching and how (pedagogical knowledge, or PK) to teach it. Technological knowledge (TK) should not replace the pedagogical or content knowledge, but rather add to it (Finger, et al., 2009). TPACK describes what teachers need to know to effectively integrate technology into their teaching practices and how they might develop this knowledge (Schmidt, et. al., 2009). This section explores how each teacher's TPACK development affected their planning.

Carlos Jones. Mr. Jones was very honest in saying that when he planned he considered the ease of using technology. If a website had a video, an accompanying lesson plan, and an assessment piece, Mr. Jones was highly interested in using it. Although he knew his students well and said he planned with them in mind, it was evident through observations and interviews that his technology and content knowledge were more developed than his pedagogical knowledge. Mr. Jones' self-proclaimed love of and passion for technology transferred into the classroom. He shared that he would

take as many technology-related professional development he could find in the district and beyond. He said he was part of a district-wide technology group of people who shared new technology weekly via Skype and online forums. He also shared he had recently made his first computer and it was actually working very well. He said he subscribed to online magazines or websites that focused on educational technology and spent at least one hour each morning reading articles on the latest finds that he could use personally and with his class. He said he often brought those new resources to his classroom to share with his students. Although he did not include most of these new resources in the weekly lesson plans he submitted to his administrator, during the school day he would find time to add them to his daily lesson so he could use them in the future. Mr. Jones also attended, subscribed to, and belonged to math or science related offerings in person or online. He was part of his school's science, technology, engineering, and math (STEM) team and met monthly with them to exchange ideas, lessons, websites, and activities that would benefit the entire student body. He said the STEM team created lesson plans sporadically that were vertically aligned and his knowledge of math and science was crucial because the team believed that the fifth grade math and science content was the goal they were all trying to reach.

In my observations and interviews with Mr. Jones, I did not see strong pedagogical knowledge or technological pedagogical knowledge, however, I did observe pedagogical content knowledge. I did not see him utilizing strategies for classroom management with the exception of the sporadic, often ineffective use of ClassDojo and saying, "SHH!" with a smile. The students did not behave badly, and this held true

throughout all four classes I observed, yet the chatter was often noisy. I did not observe the use of a variety of teaching strategies in his teaching, but there were several different strategies being used in the activities, websites, and applications students were given as assignments. Mr. Jones' planning, as he mentioned, was quick and easy and he used pre-made assessments and activities.

Mr. Jones viewed technology as a most reliable tool for math and science instruction, chiefly because he found it easy to apply. Because today's students are children of the gaming generation, technology naturally promotes engagement, the byproduct of which is learning—even if that learning is sometimes a bit incidental to the game-like environment and attendant fun students had with Chromebooks. With Chromebooks, Mr. Jones found that, even students motivated far less by their studies than the opportunity to play with computers, actually embraced them as more than just gaming platforms. For science, STEMscopes was user-friendly and effective, both to Mr. Jones and his students, as it usually included state objectives and ready-made assignments, assessments, engaging images, videos, and activities. He used these technological resources because, increasingly, they were well-constructed, required little adaptation, in some cases provided copy-and-paste lesson plans, and almost always ensured student engagement. Engagement and connection to the lesson, for Mr. Jones, equaled learning.

Although Mr. Jones did not always take the time to thoroughly investigate the website or application he would use, he said that planning for the integration of technology was "so much easier than planning when not integrating technology." He explained that it was easier because he could find a myriad of lessons, lesson plans,

activities, websites, and applications in a few minutes that he could actually use with his classes. He also said that it was also less time consuming than planning when not integrating technology because once he knew a website was safe and he considered its content good (meaning, it had the objectives he was seeking, a video component, an assessment piece, and a lesson plan) he could go and just copy and paste the link or the lesson into his lesson plans. Mr. Jones was knowledgeable regarding websites and applications that would engage his students and provide related lesson plans. He did not use spreadsheets with student information, but he could see Google Classroom or STEMscopes and know the levels of each of his students. He also noted that, "all my students will enjoy this as long as there is video." He knew the content he had to teach and said he preferred to follow the online textbook and its supplemental online resources and use STEMscopes for lesson content.

Mr. Jones followed the 5E model (engage, explore, explain, extend, and evaluate) and always planned with the end in mind. That is how he had learned to plan when he first started teaching. The most noticeable differences between planning when he was not going to use technology and when integrating technology in every lesson were time, ease, and resources. The time he spent planning for science was about 30 minutes because he could go to the STEMscopes website, type in what he was looking for, preview the lessons they have and copy and paste it into his own lesson plan. He had not had to plan without integrating technology since he began teaching fifth grade at Silver and the days he did not use technology were only during state assessment preparation time. The TPACK model is useful as a descriptor of a teacher's technology planning level. The

observations and interviews showed Mr. Jones had the *TCK* to integrate technology to foster learning built upon strong subject knowledge and a mastery of "more than the subject they teach" (Koehler & Mishra, 2009). Figure 1 shows the relationship between TK, PK, and CK and the size of each circle shows the extent that each knowledge influenced his planning. The two larger circles show his stronger development of *TK* and *CK* and the smaller circle represents the developing *PK*. Although he used his *PCK* to find websites, applications, activities, and lessons that help his students learn content using various learning strategies, his lack of intentionally using particular technologies to teach certain concepts shows that his *PK* is still in development. Planning time spent scrutinizing technological resources and how each resource will provide a specific learning experience would be helpful as Mr. Jones continues teaching and advancing his TPACK.

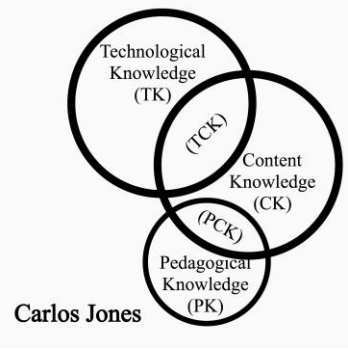

Figure 1
Carlos Jones Level of TPACK

Cindy Matthews. Ms. Matthews was strong in content, pedagogy, and technology but did not believe it was necessary to include technology at every moment in her teaching. She said she was very careful about using technology and would only use resources that would enhance the subject, adding that the administrators liked seeing

technology integrated in her lesson plans. Ms. Matthews tried to include some kind of technology option for every lesson because she planned math for her team and she knew Mr. Jones expected technology for every lesson. She planned thinking about which application, internet site, or technology resource would help her students achieve, enhance their learning, and not simply be a distraction. She would not use the Chromebooks simply because they were available but only when they were a means to her instructional ends.

Although she was strong in *CK* and *PK*, and welcomed technology, Ms. Matthews admittedly was "still developing" in the latter, perhaps harboring the mistaken belief that teachers must be able to use technology all day every day in every subject to be considered strong in TK. Obviously, she was influenced by Mr. Jones, her partner, whose immersion was motivated somewhat by ease of planning and administration. Ms. Matthews' experience was to the contrary—planning for technology integration was more difficult and time-consuming for her than it was for Mr. Jones. She was not looking for ready-made, copy-and-paste plans with accompanying resources. Rather, she made her plans in a more personal, studied way, seeking new technology resources to support her plans. Ms. Matthews felt she was improving, enjoyed discovering new tech resources (experiencing them herself before using them in class), and believed they engaged and enlightened her students, but she also feared that students were "bombarded by digital media, and we are almost competing with technology for their undivided attention when we are teaching core subjects." Ms. Matthews was committed to hands-on and outdoor activities that connected students to real life in both math and science and she recognized

the value and necessity of technology integration. She appreciated that technology could bridge gaps between often limited student experiences, academic concepts, and the real world. Ms. Matthews believed that the versatility and capacity of Chromebooks made for the ideal vehicle to move forward in that effort.

Ms. Matthews was not opposed to having 1:1 technology in her grade level. On the contrary, she was both ecstatic and nervous. She knew that it could potentially feel like a computer lab in her classroom, but she also feared that she had to learn how to use the new device correctly. Before the beginning of the first school year that the fifth graders were going to use the Chromebooks, she took hers home and tried to learn as much as possible about it and was able to incorporate the knowledge into her planning. Being able to have every student working on a website or application at once made teaching a concept using technology less stressful and more effective. Her ability to use her developing *TK* and incorporate it into her strong *CK* and *PK* is evident in the learning centers, independent work using Chromebooks, and small group instruction.

Ms. Matthews showed deep knowledge of the content and displayed skillful teaching with or without technology. She showed an understanding of how technological, pedagogical and content knowledge could synergize to provide the best learning with sound technological and pedagogical principles based upon a thorough understanding of the subject matter. Figure 2 shows the relationship between *TK*, *PK*, and *CK* and the size of each circle shows the extent that Ms. Matthews' strong PCK and developing TK influenced her planning. The *CK* and *PK* circles are larger than the *TK* to show that her

strong *PCK* guides her planning and as she continues to strengthen her *TK*, she continues to become more balanced and the *TK* circle will grow along with the TPACK area.

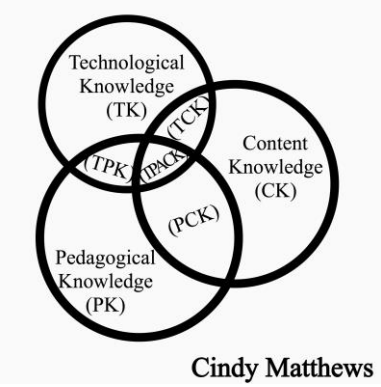

Figure 2
Cindy Matthews Level of TPACK

Luke Martin. Mr. Martin was strong in both content and pedagogy, but admitted that his technological knowledge is not as developed as he would like. He was a home sound-system aficionado, loved using his iPad, iPhone, and Chromebook, but preferred records and actual printed photographs to digitalized media. Like Ms. Matthews, he compared his *TK* to Mr. Jones' technological usage noting that administrators loved seeing plenty of technology in the classroom and in the lesson plans. When the district approached his grade level as part of a 1:1 feasibility pilot project he was hesitant to use technology daily in class, preferring a lecture approach, which he maintained benefited his students, and they appreciate. His hesitance, he noted, was waning as every year he saw more benefits from the use of Chromebooks and included more time in the lesson plans for the use of technology.

Mr. Martin used charts and spreadsheets with student information, using the same plans each year, but adding some technology and further customizing them to fit current

student needs based on strengths and weaknesses. His strong *PCK* was evident as he was able to build upon strong subject knowledge and teaching and learning strategies. His submitted lesson plans only showed the website he used for warm-up and wrap-up, readwritethink.org. However, in the interviews and observations, Mr. Martin shared other websites, applications, and assignments he used to integrate technology. He also interacted with his lesson plans daily and added supplementary materials, including technology resources, he used during the day. Incorporating technology into the lessons was not as difficult as he thought it was going to be when he was first confronted with 1:1 technology education. But it was still not something that happened naturally and usually had to go back to his lesson plans to add the technology he used during the day. Being able to include technology daily because every student had a Chromebook was ideal and less burdensome than in a regular (not having 1:1) classroom.

His *PCK* also informed his classroom management, saying that students must have routines in place before any learning can start. He was adamant about establishing and maintaining routines. His lesson plans for the first few weeks of school included specific routine instruction, which included the 15-20 minutes of warm-up and wrap-up using readwritethink.org at beginning and end of every class period. For him, establishing routines also meant that his lessons were easier to plan and were predictable for his students and administrators in terms of schedule. He planned for his small group time, which took place while the rest of the class was doing independent work, before he met with each group using his strong *PCK*. Small groups were fluid groups of students needing help in particular areas that Mr. Martin had identified after observing and

assessing the students. Those lessons were intensive, lasted about 45 minutes and proved to be successful as all his students passed the state assessment on their first of three tries. During interviews, Mr. Martin mentioned that he hoped to use the Chromebooks during small group instruction the following year because he had found some applications that would enhance his teaching.

Mr. Martin was very strict with his lecture time of twenty minutes at the beginning of every period, and employed an inquiry-based style, encouraging his students to question and challenge him. Mr. Martin had tried to plan purposefully and intentionally for the infrequent technology use in his classroom, perhaps largely because technology integration was expected in the district and especially in the fifth grade 1:1 classroom by his administrators. He was not confident with his own ability to use the available technology, including Chromebooks and a Smart Board, but did admit that his comfort level had risen in the last three years as he continued using the classroom technology personally. One thing he appreciated about Chromebooks was that students struggling with a word or concept, that he could not clarify, could seek immediate internet assistance. Those instances helped Mr. Martin to increasingly use his own Chromebook to locate online resources that could help students, and he expected to improve with time and practice. Referring to his teacher Chromebook as “my baby,” Mr. Martin said he loved using it because it was easy to use, a perfect platform for his purposes (gradebook, communicating with parents, assignments), economical, and very fast.

Although he was the most resistant of the three participating teachers to technology integration, preferring a traditional style (which he still managed to keep student-centered), Mr. Martin understood the inter-relation of content, pedagogy, and technology as essential elements of learning. Unlike Ms. Matthews, who skillfully chose when to incorporate technology, but used it freely, Mr. Martin was more circumspect and meticulous when he determined to use technology. Figure 3 shows the relationship between *TK*, *PK*, and *CK* and the size of each circle shows the extent that each knowledge influenced his planning. His strong PCK and developing *TK* guided his planning. The reason there are various amounts of overlap in TPACK, TPK, and TCK is that, in spite of his hesitation to incorporate technology daily, he was very intentional when he used technology and assured that his strong PCK informed what applications or websites to use in teaching for the maximum impact.

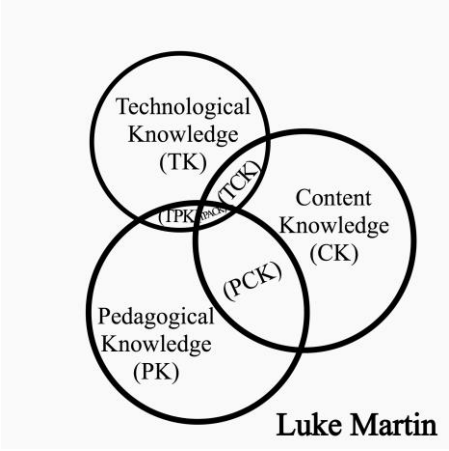

Figure 3
Luke Martin Level of TPACK

The cross-case analysis guided the formation of four assertions:

- Experienced teachers with technology at their disposal are unlikely to change their planning, but will simply include technology when they deem it an appropriate and convenient tool to achieve their ends.
- Standardized technology does not necessarily lead to standardized uses or planning.
- Observable high and even skillful use of technology does not necessarily indicate strong planning.
- Teachers are not motivated to change the way they plan when their students consistently excel at high stakes tests.

Below is the data that led to the development of each assertion.

Assertion 1: Experienced teachers with technology at their disposal are unlikely to change their planning, but will simply include technology when they deem it an appropriate and convenient tool to achieve their ends. Each of the three teachers considered the end result when planning, and offered that technology simplified the means to the end in most cases. To this end, they planned using student data and perceived needs at the forefront, recognizing that each student has at least a slightly different style of learning, and that a continuum of differentiation is necessary to reach them. They said that when they plan for their struggling students and small group instruction, they set goals and attainable objectives first using each student's data.

Mr. Martin planned with each student's data and needs in mind and incorporated technology as appropriate to get his students to the level they needed to be. However, he only inserted technology in his plans as part of warm up or wrap up. His goal in any

lesson was to get his students ready to pass the state assessment and that is what his drive was when lesson planning. The assessments he sought and created mirrored the state assessment format and questions to prepare his students. He created, modified, or reused assessments that he felt had been successful in the past to prepare his students for the state assessment. Although daily Chromebook use happened when students walked in and when they were about to leave his class, it was only for 20 minutes on the same website daily which Mr. Martin admitted could have been substituted with any other state preparation material.

Ms. Matthews used student data to drive her instruction, and sometimes did not use technology if she did not think it would advance her immediate goal, but she always used it for reteaching, enriching, or cementing concepts. She differentiated expertly, with alternative approaches to each objective, seamlessly presenting visual, auditory, and often kinesthetic activities in an effort to illuminate learning objectives in every possible way, usually but not always with technology. “We use our Chromebooks every day, but sometimes we have to go outside and act out what we are learning. We do that about once a week.” When planning a new concept or starting a unit, she said she asks herself what she wants her students to know and be able to do at the end of the unit. She then creates an assessment that will allow her students to show her that they have learned those skills and knowledge. After creating an assessment, she designs ways her students can practice the skills and use their new knowledge, usually in the form of small groups and learning stations or Kahoots (a game-like online competitive quiz that teacher or students can create on various topics). Finally, when she thinks about how she will introduce the

information to the whole group and how she will teach the skills both to whole and small groups she writes the lesson plan. Although Ms. Matthews is very diligent when adding technology, her lesson plans show that any activity can be added, including technology, and is not part of the core plan.

In my observations and interviews I noticed that only Ms. Matthews mentioned that she planned differently when she was integrating technology in her teaching and when students were learning independently using technology. She prefered to teach any new concept, website, or activity to the whole group and only then would she include it in a learning center or an assignment. However, there were some websites that her class used that went beyond what she had taught because they were websites or applications that built upon the previous answer. Some students responded well to independent learning and could catch on quickly as they navigated the levels but others had to have more guidance before they could move on. For the students who had a harder time with independent learning she used her small group time to reteach or help the students move forward.

Although all teachers said technology had made planning easier and faster, only Ms. Matthews said she planned differently when incorporating technology. Mr. Jones and Mr. Martin said that they plugged in technology where they wanted to use it, but that their teaching and planning was basically the same as if technology was not present. Mr. Jones admitted that planning before Chromebooks was tedious and slower but that he basically planned the same way, but now was able to plug in technology on the spot. “If it

isn't broken, why fix it," seemed to be the attitude that Mr. Jones and Mr. Martin took by using previous tried-and-true plans and adding some technology to them.

Assertion 2: Standardized technology does not necessarily lead to standardized uses or planning. Each subject, teacher, set of students, and classroom is different. Because every fifth grade student at Silver had a Chromebook, teachers could plan to use technology without worrying about having enough devices for every student. Mr. Jones remembered his frustration when he planned for technology integration in his previous assignments where he only had a small number of computers or handheld devices. He wanted his whole class to experience a new application or website but with the technology resource limitations the students were not able to fully enjoy or learn how to use them. Being able to change the assignments without having to make copies (since he adds them digitally to Google Classroom or gets them from STEMscopes) or check out handheld devices like iPads from the library was liberating. His planning time had been cut by at least half since he was able to plan for a class that had Chromebooks.

Although Ms. Matthews did not use the Chromebooks exclusively or for every activity, she did see the benefits of having a 1:1 technology classroom because it made incorporating technology for every student possible. When she started teaching the computers were not very accessible for students and planning to use technology was not a priority. Up to three years ago if she wanted all her students to have access to an application or website together they would have to wait until they were at the computer lab once a week. Planning for those weekly whole-group computer times was challenging. If it was an online resource that she wanted the students to use for an

assignment it may not be available in her own classroom computer or borrowed iPads because the computer lab technology was usually up to date and the classroom technology was not. With the onset of 1:1 technology through Chromebooks that hurdle was eliminated and she was able to plan for daily use, if desired.

A common theme was the ease with which the teachers planned, because the 1:1 technology meant that each student had exactly the same resource. Although Mr. Martin had "grown to accept" planning to use technology during his teaching day, he admitted that Chromebooks "made everything very easy for you." Each student had an identical Chromebook, with identical capabilities, and teachers could plan with some certainty that their technology lessons would unfold as they expected. Teachers without 1:1 technology cannot expect for their entire class to follow a technology lesson as easily as when every student has an identical device in front of them.

These three teachers expressed, in their own way, that planning while having 1:1 technology was not only easier, but opened up many opportunities for integrating technology on a daily basis, if desired. The teachers also enjoyed the ease and versatility of using Chromebooks and the internet to augment their lessons with remediation, solidification of concepts, or enrichment as indicated. However, observations and interviews showed that each teacher used the technology in their classrooms, including the Chromebooks, in very different ways. Each teacher used their own levels of TPACK to drive their integration of technology in their classroom and in their planning.

Mr. Jones, a high tech "computer guy," used his 1:1 technology daily and some of the time without planning it. Using technology came easy to him and he was not afraid to

use his resources, particularly Chromebooks, to make his planning, teaching, and even assessment easier. Ms. Matthews used her technology experience during planning to seek out just the right amount of technology she felt necessary to help her students learn. She wanted to have a more balanced approach to planning for the integration of technology and was intentional with its quantity and quality. Because he regarded structure and routine highly and did not want to sacrifice his lecture time, Mr. Martin was hesitant to incorporate more technology than what he was already using. He was, however, the only one of the team to promise his students full-day Chromebook access for the last two weeks of school if 100% of his students passed their state exam, which they did.

Assertion 3: Observable high and even skillful use of technology does not necessarily indicate strong planning. In Mr. Jones' classroom, the students were on their Chromebooks, as he hyperbolized, "24/7." There was evidence that Chromebooks and other technology, including Robotics, were being used extensively. Every time I observed or visited, the students had open Chromebooks on their desks, easily navigating and utilizing the websites, assignments, and assessments on their Google Classroom logs. Pencils had been replaced by keyboards, and paper by screens. Mr. Jones' students assisted one another and completed work with minimal direction. The school's administrators, other teachers, and even Mr. Jones, considered him to be the school "computer guy." He had once even built his own computer. Mr. Jones found planning to be very easy once he and his students had access to Chromebooks, and he used their facility exclusively for all assignments, projects, and assessments. He used worksheets or other paper material only for school-mandated state exam preparation.

The district had provided one day of technology training in summer, a few workshops throughout the school year, and maintained a district-wide virtual technology community that met monthly, all of which Mr. Jones enthusiastically availed himself, along with other nation-wide technology offerings. However, when he planned, Mr. Jones used only links to online lesson plans, providing the assignments and assessments that they contained, without entering the websites to ensure that they were working and actually contained the materials they claimed in the ways they claimed. Occasionally, students advised Mr. Jones that websites were not working or that there were other impediments to their use, and he simply directed them to another website or asked them to find an alternative to share with the class. Mr. Jones might have been quite skillful in his employment of technology, but these events indicate planning that is more convenient than purposeful. Even with all the outward signs of strong and effective technology usage there was not much evidence in lesson plan analysis, observations, or interviews that there was intentional planning for integrating technology.

Assertion 4: Teachers are not motivated to change the way they plan when their students consistently excel at high stakes tests. The three teachers mentioned state assessments and their students' success in the interviews. Mr. Martin was very vocal about not wanting or needing to change the team's plans because he felt they were very successful. Throughout his eleven years in the team, the students had increasingly achieved very high state assessment scores. His mantra was, "if it isn't broken, why fix it?" Mr. Martin also felt that he did not have to incorporate more technology than the 20-30 minutes a day because he always fell back on the success of his traditional methods.

He used his past high stakes testing results to justify to administration that keeping his desks in rows and lecturing was the best idea and he would use them if he was questioned about his lack of technology use. Mr. Martin knew his own child would rather open a smart device than a book, but this knowledge did not translate to his own planning or integration of technology. He seemed to make the connection, but somehow was not often able to use it to effectuate technological planning.

Mr. Jones, being the newest member of the very successful team, said he felt a bit of pressure when he started teaching because of his new team's success in high stakes testing. However, as time passed and he got to know both the team members and the school climate, he felt more at ease and, although he made his lesson plans using the internet, he also used the old lesson plans as a guide. Mr. Jones did not feel the need to change the way he was presently planning because he saw his students' success as a confirmation of his teaching and planning choices.

Ms. Matthews, although she seemed a bit more intentional in her planning and integration of technology, also said that she felt the way her team planned and taught had a positive effect on the students as evidenced by their high passing rates. She was more concerned about differentiating and using technology when appropriate than she was about putting all that on paper. She said even though the plans she posted may look exactly like they did a few years ago, her activities, small group instruction, and independent work changed on her own copy of her plans because she modified them often.

Summary of assertions. As the research question states, the purpose of the study was to examine planning for technology integration, but the study morphed into an exploration of individuality among educators. That is, the data demonstrate that the extents and ways in which technology is used are highly dependent not on emergent rules, or even conventions, but on the teachers themselves—who they are, their strengths and weaknesses, and even how they perceive themselves. Each subject teacher brought individual experience, education, and disposition, just as the assertions suggest. Indeed, one of the teachers was technologically quite capable, appeared to take great pride in his capability, but still viewed technology only as a tool, a resource, and a matter of convenience, not as a centerpiece of personalized planning. Another teacher took a more balanced approach respecting planning for and using technology, and was most thorough and purposeful regardless of whether she was planning to use technology on any particular day. The third teacher used some technology, was unconvinced that planning for its use was most important, and actually evidenced an attitude of resistance. His state scores were consistently the highest, and he therefore had adopted the mantra "if it isn't broken, why fix it?" when it came to planning All three teachers were very different in their approaches to planning for the integration of technology, and seemed more informed by their personalities and experiences than its availability.

However, there may be more to the above phenomenon than meets the eye. Technology as a pervasive and almost universally available tool is a relatively recent evolution. Most schools still have limited technological resources; there are very few in which each student has a device such as a Chromebook. The participant teachers' school

had not been part of the Chromebook initiative for very long at the time of the study. Their prior experiences, which cannot and should not be erased, may be so dominant at this relatively early stage of 1:1 technology that they are just not yet equipped or oriented toward a committed and purposeful integration of planning and technology. As they gain experience with this technology, these teachers may well assume a more technologically immersive approach to planning. One might observe a similar "delayed-onset" immersion in other schools, districts, and states, as 1:1 technology gradually becomes the norm.

Summary of the cross-case analysis. The three teachers had technology-rich classrooms where the six state standards were apparent. The classrooms evidenced varying degrees of creativity and innovation, research and information fluency, critical thinking, problem solving and decision making, technology operations and concepts, communication and collaboration, and digital citizenship. All three planned with a view to end results and, to different extents, with their Chromebook 1:1 reality in mind. The teachers' beliefs on engagement, content exposure through technology, and 1:1 availability influenced their planning. The teachers' technological, pedagogical, and content knowledge also informed the way they each planned, although each in very different ways. Mr. Jones' planning was based on his knowledge of technology and content more than pedagogical knowledge. Ms. Matthews planned with almost equal attention and devotion to her knowledge of content, pedagogy, and content. Mr. Martin's planning was most influenced by his content and pedagogical knowledge and informed far less by his developing technological knowledge and therefore understandable resistance.

What became readily apparent is that experienced teachers are more likely to create almost skeletal plans, which thus are more easily adapted, expanded, and enhanced daily, or even during a lesson. Formal and informal observations, and interactions in hallways, clearly demonstrated that the students in each class by and large responded well to and genuinely liked their teachers. The students were engaged in class, as evidenced by the ways they interacted with and responded to their teachers and each other, often in complicated academic situations. There was great respect among and across students and teachers. Technology played varying yet important roles in each of the classrooms, serving as a tool to advance content and pedagogical imperatives, and invariably facilitating successes.

Implications of the Research Findings

The findings of this study have implications for teacher educators, school and district leaders, and teachers. These are discussed below.

Teacher educators. As technology continues to be a daily reality and necessity in classrooms (Gray et al., 2010), teacher educators must consider how to prepare teachers whose schools will have differing technological tools and availabilities. In this day and age, obviously there are schools and districts worldwide that are piloting 1:1 technology initiatives, and teacher educators must understand the decisions teachers will face when integrating such ubiquitous technology (Corn, et. al., 2010; Richardson, et. al., 2013; Sykora, 2014). Teacher preparation programs must efficiently combine pedagogy, content, and student needs with available technology if they are to be effective, and those programs must begin with the student teachers. Teacher preparatory courses must

increasingly focus on the integration of technology, and that integration must begin with planning. Technology cannot be an afterthought or a mere vehicle for convenience—it must be foundational. Technology integration as a mandatory element of student teacher pedagogy courses will further solidify technology and the need to plan for its use. In short, training with technology planning in mind will shape new teachers for whom technology is second nature—it will be a given, not an afterthought or a novelty (Hanover, 2014; Moeller & Reitzes, 2011; Moynihan, 2014).

Assignments that require student teachers to plan for and practice technology integration would promote that which is inevitable, and in most cases, mandated by school districts—integrate technology. Early and often training, coupled with the fact that younger generations are generally more tech savvy, suggest that student teachers can innovate purposefully, and perhaps more fully appreciate the benefits of effective technology integration. Mr. Jones, a veteran teacher, might have benefitted from such an approach, and thereby enhanced his technological orientation and foundation. This, in turn, would have enabled more deliberate technological planning and integration. Mr. Jones, and all the veteran subject teachers, would benefit from more opportunities to integrate technology in a purposeful way. Each of them is finding a way, but providing real-life technology integration opportunities to all, especially to student teachers, will inevitably develop technological pedagogical content knowledge (TPACK) (Mishra & Koehler, 2006).

Although most student teachers in 2016 belong to the millennial generation, born between 1982 and 2004 (Schrum & Levin, 2009), and, as such, have never lived without

the internet or technology, they may not be attuned to the relationship between technology, content, and pedagogy. Mr. Jones and Mr. Martin said that their own children were the same age as their students and, so they could see the differences between teaching to which the children responded and how each of them were taught in school. Although Mr. Martin's own son would rather use the internet to look for a word than a book, Mr. Martin was proud to have the only set of dictionaries in his grade level. He knew most of his students would rather use the Chromebook but this knowledge did not translate to his own planning or integration of technology. He understood the connection, but somehow did not use it to effectuate technological integration in planning. Student teachers, probably steeped in social media, gaming, and all things cyber, are well-equipped to integrate planning and technology, and are good bets to do so effectively in the future. Their modern socialization will inform their planning and use of technology in the classroom (Sandholtz & Reilly, 2004). Accordingly, those who teach teachers should avail themselves of all that is out there. Technology is pervasive; it is inevitable; it usually is mandated. Teachers of teachers therefore must combine content, pedagogy, and technology. That is to say, there always should be time in any teacher training to discuss the pedagogical affordances and limitations of using the technology to teach the content (Harris, et al., 2009).

The present study and other research (Kay, 2014; Pamuk, 2012; Tondeur, et. al., 2012) suggest a number of steps to guide teacher educators in the technological challenge of helping teachers to purposefully plan to integrate technology using a balanced TPACK:

- Survey student teachers to share views on technology in general (including their comfort with technology), and its role in the classroom.
- Model technology integration in both lesson planning and actual teaching.
- Build on the solid technological knowledge that many preservice teachers already have, by training them to import that foundation to pedagogy and content, to create technology-rich lessons, and experiencing student responses.
- Continue to develop their own TCK and TPK with videos, webinars, professional development, and writings that focus on technology integration and the many ways it can refine teaching and learning.
- Explore and provide professional development that acknowledges students' different learning styles and needs, and the ways that technology can promote modeling and advance differentiation.

New teachers should be equipped with the ability to plan for technology integration for innovative teaching. Integrating technology, pedagogy and content knowledge, and then effectuating that integration, is paramount for new teachers.

School and district leadership. Districts and, to a lesser extent, schools, are best equipped to promote technological content and technological pedagogical knowledge (TCK and TPK, respectively). They can accomplish this knowledge through customized professional development (Bos, 2011; Monroe-Ossi, et al., 2014). This sort of professional development would necessarily focus on the impact of technology on teaching and learning in specific content areas. That is, what works in math might not work in reading, and the differences must be explored. Teachers who lack technological

knowledge would benefit from professional development focusing on how to incorporate technology in the curriculum. Teachers whose strengths are content and pedagogy can feel more confident using technology in their classrooms if they have technology professional development that focuses on their particular skills and knowledge (Shaffner, 2007). For example, Mr. Martin could use professional development that focuses on how he can incorporate technology during his lecture. There were several times where incorporating a visual, an online quiz tool like Kahoot, or video could have helped the students better understand a particular concept. If Mr. Martin received instruction on how and where to find websites, applications, and online activities that enhanced his already strong ELAR knowledge, he would be able to incorporate more technology and utilize 1:1 more effectively and habitually. District and school leaders need not be experts in technology, but they must embrace and fervently support professional development that is not faddish, seizing the latest tool, app, or device, but centers on content and pedagogy, which are positively impacted by integrating technology (Davis, 2009). However, district and school leaders certainly could benefit from their teachers' improvement and judicious use of TPACK during planning.

Mr. Jones was part of the district's cohort of new teachers who met monthly to share new technology resources and discuss whether and how integrations in their classrooms had succeeded. He found the district instructional technology experts friendly and helpful, but there were too few of them to staff the phones in a timely manner or to appear on campus as often or as quickly as needed. He also suggested that the district could and should do more to support technological integration, especially for campuses

that possess and are expected to use 1:1 technology extensively. New teachers often enter schools at different times of the year and need technology development and support to incorporate technology that might be new to them. Accordingly, district leaders must provide professional development focusing on content, pedagogy, and best practices throughout the school year. Leaders can offer technology and curriculum support for teachers, identify and inspire excellent teachers who seamlessly integrate technology in their classrooms, encouraging them to be technology leaders who model lessons, provide professional development, and mentoring both in person and by online discussions and planning (Schrock, 2011).

These three case studies demonstrated that their school district did not standardize the way teachers use technology in their classrooms. They were all given the same technology in their 1:1 classroom initiative, but they were not given a mandate of how and when to use it which allowed the teachers to use their experience and varying TPACK. Although scope and sequence are standardized in each subject, every classroom is uniquely stamped by the teacher, and if any of the three teachers were forced to adhere to any particular model for integrating technology, their individual approaches and styles might be stifled, and their effectiveness diminished. For example, Mr. Martin is inexperienced with and resistant to a model that requires grouping desks and using Chromebooks all day: adopting such a model would run counter to Mr. Martin's very structured approach, probably would decrease his comfort level, and might thereby heighten the possibility of a more chaotic environment. Mr. Martin's personality, technique, and especially successful results might suggest the argument, "If it isn’t

broken, why fix it?" Nevertheless, he has embraced technology, has integrated it (albeit more slowly than the other participants), and has reported both satisfaction and success. Ms. Matthews uses a balance of technology and hands-on activities in an experienced and proven effective effort to differentiate. Where she compelled to adopt her partner's less balanced and more intensive use of online tools, she might sacrifice what appear to be exemplary differentiation skills. Finally, and perhaps in contrast to the other two teachers, Mr. Jones relies on Google Classroom as an essential tool. Mr. Jones did not believe he could accomplish his goals without Google Classroom and, although he may not be fully immersed in technology, he has found a technological niche without which he does not think he could maintain what he believes is effective teaching.

Professional development in technology usually involves the latest trends and how to manipulate technology, but seldom connects that technology with content and pedagogy more than superficially (Daccord, 2015). The manipulation of a Chromebook, iPad, or other tool, is useless if content and pedagogy are not integrated; the technologies become toys and not tools. Some teachers, like Mr. Martin, may be unready for mandatory technology integration, perhaps because they view such a mandate as yet another thing they must do (Daccord, 2015; Patterson, 2016). Purposeful professional development with a meaningful pedagogical framework would mitigate such resistance. Teachers afforded such training might well embrace technology as more than just a sideshow, but as an indispensable tool to advance their goals. From the data come these two questions districts may consider when they plan professional development:

- How can district and school leaders enable teachers, who have varying degrees of technological know-how, to integrate available technology with their content and pedagogy, especially during planning?
- How can district and school leaders differentiate professional development to achieve technological integration in the same way that classroom teachers are expected to differentiate to reach all their students?

Professional development that focuses on teachers' learning goals and provides sample lesson plans and related materials, all providing a clear concept of technology integration, would have a positive impact on implementation that is real and meaningful. (Daccord, 2015; Patterson, 2016).

Teachers. As technology becomes even more affordable and districts make it more available (Gray et al., 2010, Johnson, 2015), teachers must recognize how these technology gains change teaching, learning, and planning. To integrate technology successfully, teachers may be required to change, at least in part, their views of technology and their approaches to planning and content delivery (Ertmer & Ottenbreit-Leftwich, 2010; Roschelle et al., 2000; Windschitl & Sahl, 2002). Successful technology integration requires knowledge of the relationship between content, best practices, and the technological resources best suited to deliver that content and bolster instruction. This is known as Technological Pedagogical and Content Knowledge (TPACK) (Mishra & Koehler, 2006).

Two of the teachers had strong technical knowledge and the third was developing, but they all utilized 1:1 technology, created and instilled technological routines, and thus

improved both teaching and learning. These teachers, knowing that their students knew when and how to use technology on a regular basis, were confident when they integrated technology even more aggressively and beyond mere routine, and were therefore largely unfazed by the occasional hardware or software glitches. The teachers were at different stages of developing their technological content knowledge (TCK) and technological pedagogical knowledge (TPK) which inform how technology integration and use impact content and pedagogy. Teachers may benefit from professional development that would develop TCK and TPK and promote purposeful consideration of the TPACK framework—technology, content, and pedagogy—professional development that focuses on pedagogy and content and not just explaining how a technology resource or application works (Niess et al., 2010).

Teachers can develop their technological content knowledge (TCK) by seeking videos, webinars, professional development, and writings that focus on technology being integrated in specific content areas. All three teachers in the study were experts in their content; however, they did not plan the integration of technology into their administration of curriculum scope and sequence quite so expertly. Mr. Jones' monthly technology group meetings helped with information and strategies, but there is an opportunity to delve deeper into TCK. Teachers can develop their technological pedagogical knowledge (TPK) by looking for videos, webinars, professional development, and writings that focus on how technology can change teaching and learning. For technology to become an integral tool for learning, planning, and teaching, teachers must develop a comprehensive

view of their subject matter and technology and what it means to teach with technology and develop TPACK (Jang & Chen, 2010).

Teachers can also look for professional development that focuses on how to use technology to differentiate based on student talents and needs. Mr. Jones and Mr. Martin can find appropriate technology to use in their small group instruction, perhaps through targeted professional development. It is most important for teachers to understand how to differentiate, then find technological means to help them do so (Hobgood & Goddard, 2011). Teachers can choose technology tools that are most appropriate to their content and pedagogical needs and goals, and can find in-person or online groups in their own content areas and share ideas for using a certain technology tool, website, application, or device. In the monthly technology meetings, Mr. Jones shared some websites, applications, and devices, but the offerings were not intentional. Mr. Jones stated that he subscribed to a few free online resources that focused on technology, but only as a hobby, not as a teaching tool. However, teachers can subscribe to any number of online or printed resources that will discuss pedagogy and content, and direct them to even more sources that will assist their planning and incorporation of technology into their lesson planning.

Teachers can raise one or more of these questions when they are considering planning to integrate technology within their lessons (adapted from Beeson, 2013):

- What technology tool will I use in my lesson?
- Why am I using this particular technology tool? Is this technology tool content specific or can it be used in any content area?

- Does the technology tool I have chosen affect how I will teach the content of the lesson?
- Am I using the technology tool thinking of how it will help the different needs of my learners?
- Does this technology tool help me differentiate?
- Are all students going to be using the same tool at the same time?
- Will all students have the same amount of time with the tool?
- Would this tool be used in a center or as part of a whole-group lesson?

Teachers who ask themselves these questions at every planning opportunity, whether or not they have the answers or address the questions in their planning, are nonetheless keeping technology integration at the forefront, and need only adopt a more purposeful approach to achieve complete technological integration.

Limitations

Methodological choices influencing data collection. For this study, I sought the help of the District's Digital Learning Coordinator, Dr. Phyllis McDonald, and told her I was looking for educators who used technology daily and in different subject areas. I wanted to identify participants who used the technology available to them in creative, collaborative, and critical ways. Because Dr. McDonald coordinated all district professional development related to instructional technology, provided leadership in developing instructional technology resources and training materials, and was responsible for leadership in the use of new or existing technology resources, I spoke with her regarding the participant requirements for my study. I stressed that eligible teachers were

those who consistently followed the district and state technology standards and were immersing their students in the available technology. Dr. McDonald highly recommended two particular teachers, but one was not willing to participate because she was retiring. There were two other teachers in the same grade level who were part of the Chromebook initiatives; Ms. Matthews (one of the two recommended teachers) said she planned and worked closely with them, and thus they became part of the study.

If I were to repeat the study, I would ask more people to help me identify possible participants for the study. I would ask the district digital specialists to connect me with possible teachers and school digital specialists to help with the selection process. I would cast a wider net around the district and perhaps go to another district where I have district contacts. I might also ask for teachers who are not in a 1:1 setting that are using technology extensively in their classrooms. I would be more clear about my research question that focuses on planning, and not only on usage. A negative consequence of having studied these particular three teachers is that there may have been better representatives to provide more complete data. However, the few people with whom I spoke regarding the participants, including the principal and science specialist, agreed that they were excellent choices. A wider possible participant pool would have enabled me to conduct interviews before arriving at the best choices for the study.

The data revealed more usage than planning, and may have been impacted in unanticipated ways by additional factors. The study occurred during the middle of the second semester, when high stakes test preparation was in full swing, disrupting normal scope and sequence planning and class schedules. Further, observation and interview

schedules were interrupted by illnesses, school assemblies or events (of which the participant teachers were unaware), and flooding.

Other limitations. Although the goal of the study was not to generalize the findings to all situations, there are some limitations that must be presented. One limitation of this study is the amount of technology the participant teachers had. They were selected because of their technological knowledge and skill set as rich technology integrators who taught in a technology-rich classroom. Although technology has become more economical and available to schools (Cheung & Slavin, 2013; Johnson, 2015; Kinshuk et al., 2013), most teachers as yet lack the 1:1 technology the participants enjoy in their classrooms (Gray et al., 2010). The focus of this study is how and the extent to which teachers plan to integrate technology in technology-rich classrooms, rather than on the available tools, a factor which must be taken into account when assessing technology. Technology integration is not possible without technology tools, however.

The context of the research study may also be a limitation. Three teachers in the same district and in the same school serving the same population of predominantly African-American children living in a low socioeconomic neighborhood, and their use of technology to build the possible lack of background knowledge might not make the same decisions while planning as other teachers in different circumstances and with different populations.

Another possible limitation was the timing of the study. This study began at the latter part of the spring semester close to state testing and continued after state testing. Although the students performed very well in all subjects, the stress of state testing might

have had some impact on the lesson planning and technology integration because teachers had to include state testing review in their lessons. Mr. Martin and Mr. Jones mentioned that planning for review of the state exam influenced their technology integration decisions and attendant plans, as they were forced to use mostly paper resources to prepare for paper tests. It is important to consider this state testing period as a possible limitation to the study.

The data collection spanned only eight weeks with three cases. Having three subject teachers promoted a great deal of familiarity and insight, but I could have benefitted from more time to really embed myself in their lives. However, this study's purpose was not to generalize the findings to other teachers, but to present three separate detailed cases of how teachers plan when integrating technology in their technology-rich classrooms and also to present the common patterns and themes found in and across those cases. If I were to repeat this study I would spend a semester observing how each teacher's TPACK grew with purposeful and intentional planning in respective content areas.

Suggestions for Future Research

The findings here suggest the need for future research, in the following areas: case studies of teachers planning to integrate technology in a variety of situations (e.g., technology availability and limitations, and applicable time frames); professional development focusing on developing technological content knowledge and technological pedagogical knowledge to increase teacher comfort when they integrate technology; and,

integration approaches that are geared to differentiation. These suggestions for future research are explained below.

Additional case studies of teachers planning for incorporating technology. This study included three teachers in the same campus and in the same grade level who had access to 1:1 technology and focused specifically on how they planned when incorporating technology in their technology-rich classrooms. Future research might include additional teachers, different student populations, and different available technology resources (e.g., classes without 1:1 technology, with iPads, laptops, and/or miscellaneous other devices) or schools where Bring Your Own Device (BYOD) has been successful. This study also focused on the last eight weeks of the spring semester which included state testing and end of the year activities. In future research, teachers could be observed for a full semester or even an entire school year. Future studies could focus on the populations that were not observed in this study, such as school administrators, district leadership, or students and their various relationship with technology integration.

This study shows that teachers' beliefs and knowledge of technology, content, and pedagogy necessarily influenced their decisions in planning to integrate technology. Additional research can examine how teachers with varying degrees of Technological Content Knowledge (TCK) and Technological Pedagogical Knowledge (TPK) use their beliefs about technology to inform their planning when integrating technology. This research could shed a light on teachers' needs to advise districts, administrators, and teacher educators regarding professional development to facilitate technology integration

in the classroom. Further, identifying and using as examples the teachers who have been most successful in technology integration, in a variety of settings and contexts, would ease the way for those who are not yet so skilled.

Integrating technology that addresses specific learning needs. All three teachers affirmed that technology aided differentiation. Observations revealed that they usually used the same programs, applications, and other technology resources for the entire class. They all mentioned that they considered their students when incorporating certain technology but technology as a differentiation tool was not evident in their classes or lesson plans. Additional research should focus on how teachers plan to incorporate technology when addressing specific student learning needs. Research suggests that teachers can use technology in the general classroom to provide direct support for specific needs of some struggling students (Bray et al., 2004; Hasselbring & Glaser, 2000; Lewis, 1998), such as using built-in audio and visual options in eBooks (Karchmer, 2001; Lewis, 1998; Rhodes & Milby, 2007; Zucker et al., 2009). Future research might well include descriptive case studies of teachers who have used successfully some specific technology tools when planning to meet the needs of exceptional learners in the general classroom setting. These findings could help inform teachers, teacher educators, student teachers, and school and district leaders for future technology professional development or for specific targeted technology support when integrating technology in the classroom.

Conclusion

This study examined how three elementary school teachers planned to integrate technology in a technology-rich classroom. These three teachers, teaching the same grade level but different content areas, and identified by district leadership as teachers who daily use portable and other available technology (including Chromebooks) as an essential part of instructions, shared similar beliefs regarding why it was important to integrate technology. They believed technology helped with engagement and to disseminate content, and being part of a 1:1 initiative made it easier to incorporate technology. As each planned their instruction, those beliefs influenced their decisions. Each had different levels of Technological Pedagogical and Content Knowledge (TPACK) and that knowledge, together with their backgrounds, personalities, and mandates dictated their planning decisions.

Effective technology implementation requires effective planning, which, in turn, requires effective technological pedagogical and content knowledge (TPACK)—as well as effective integration of technology, pedagogy, and content. All of these entities are essential components of effective integration. Teachers must know how to effectively use available technology resources to further their students' education.

This study found that standardized technology does not imply standardized uses or planning; experienced teachers with even 1:1 technology at their disposal are unlikely to change their planning, and their observable high and even skillful use of technology does not yield the conclusion that they plan in a purposeful and dedicated way for its use. The subject teachers further were unmotivated to adopt new planning approaches because

their students have consistently excelled at high stakes tests. Understanding how one's own level of TPACK and beliefs affect the choices teachers make during planning for technology integration can guide teachers and districts to identify teachers' specific needs in order to make a 1:1 initiative successful.

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APPENDIX A

INITIAL INTERVIEW PROTOCOL

Introduction: Thank you for talking to me today about the technology used in your classroom. The purpose of my study is to understand the thought process and decisions teachers make when planning to integrate technology into their lessons. I am recording today's conversation for accuracy and will be taking some notes. Do you have any questions before we start?

Research Question
How do teachers in technology-rich classrooms plan when integrating technology into their teaching?

Background questions before starting interview:
Please tell me about yourself and include your experience as a teacher.
What grades have you taught?
What are you certified to teach?
How long have you been teaching?
Is there anything else about your background in teaching you would like to share?

Topic Domain 1: What kind of technology is used in the classroom and how often

Lead-off Question
Please walk me through a typical day in your classroom and include all resources your students use. Please be as detailed as possible. If I went into your classroom, what would I see?

Covert Categories
Daily technology being used. How much technology is being used. What technology is being used.

Possible Follow-up Questions
It sounds like you use ___ technology in your classroom throughout the day. Please tell me more about that.
Out of all the technology resources you mentioned, is there one that is used more often? Why?
What do you think is the role of technology in your classroom?

Topic Domain 2: How does teacher plan when integrating technology

Lead-off Question

I am very interested in you telling me how you plan when you use technology in the classroom. Please walk me through a typical lesson planning session when integrating technology.

Covert Categories
Does the teacher plan intentionally to use technology
Does the teacher plan differently if she will not use technology
Does the teacher plan with her/his partner or team

Possible Follow-up Questions
Do you think you plan differently when you will not be using technology?
Is there an alternative if the power goes off or the internet is down?
Do you assess your students' use of technology?
How do you prepare yourself to use the technology (do you go to each app or website to make sure it is appropriate or working)?
What do you think is the role of technology in your planning?
How do you decide when it is appropriate to use technology in your lessons?

Closing: Thank you for talking to me about how you plan for the use of technology in your classroom. I look forward to observing you and speaking again.
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APPENDIX B

CLASSROOM OBSERVATION PROTOCOL

Observation date:	Time
Subject(s) taught:	Teacher:
Observations	Researcher Thoughts:

APPENDIX C

LESSON PLAN REVIEW PROTOCOL

(Based on TPACK framework and Texas Education Agency Technology Standards for teachers and students which are based on the National Educational Technology Standards for Students and the International Society for Technology in Education standards for teachers and students)

Lesson plan date(s):
Teacher:
Subject(s):
Example(s) of evidence of TPACK framework:

Area	Evidence/notes
Content	
Identified Standards to be addressed	
Described skills to be demonstrated.	
Described characteristics of the content	
Pedagogy	
Differentiated between learners and needs	
Described what some learners know and what some learners do not know	
Described setting	
Described expected outcomes from the lesson	
Described the instructional strategies	
Described how students will be assessed	
Technology	
Identified technology tools and digital resources by name or website	
Why are these specific tools being used?	
What advantage will the technology provide?	
Might there be any obstacles to their use?	
Is there an alternative to the technology?	

Example(s) of evidence of state standards (descriptions of each standard can be found http://www.iste.org/standards :

Standard	Evidence/notes
Creativity and innovation	
Communication and collaboration	
Research and information fluency	
Critical thinking, problem solving, and decision making	
Digital citizenship	
Technology operations and concepts	

APPENDIX D

FOLLOW-UP INTERVIEWS PROTOCOL

Topic Domain 1: Talk about upcoming/observed lesson

Lead-off Question
How did you decide what technology was appropriate to use with this lesson?

Covert Categories
Thought process regarding technology integration.

Possible Follow-up Questions
What role do you believe the technology had in this lesson? In your planning?
How did you differentiate in this lesson? Did technology play a role in that?

Topic Domain 2: Member check

Lead-off Question
These are some of the notes I wrote while observing you/interviewing you. Would you please read them and comment on what you read?

Covert Categories
Are my observations in line with the teacher's perceptions?

Possible Follow-up Questions
Tell me how your view on this differs from mine.
How might I better explain this?

APPENDIX E

THINK-ALOUD INTERVIEW PROTOCOL

Introduction: Thank you for agreeing to plan a lesson aloud for me. I understand that planning aloud in one sitting may not be your typical planning method. Thank you for letting me observe your thought process. I will be recording this session with my iPhone for accuracy and will be taking notes. I might also ask questions for clarification. Do you have any questions before we start?

Topic Domain 1: Planning a lesson out loud

Covert Categories
Thought process regarding technology integration. Is technology something specifically planned for? Is technology a separate category or integrated in each subject?

Possible Follow-up Questions
Can you tell me more?
What else will you do?
What objectives are you addressing?
Do you have campus goals you must meet in terms of technology?
Tell me how you use technology for differentiation.
What lead you to use technology in your lesson (parts of your lesson)?

APPENDIX F

FINAL FOLLOW-UP INTERVIEW PROTOCOL

Topic Domain 1: Member check

Lead-off Question
I gave you my written report last week and you said you had finished reading it and were ready to meet about it. Please tell me what you thought of it. Did you agree? Do you have questions, comments, or corrections?

Covert Categories
Member check for accuracy.

Possible Follow-up Questions
Tell me why you thought that.