ABSTRACT

The Impact of the Internship Experience on Interns' Self-Perceived Preparedness to Teach in a Technology Rich Society: A Mixed Methods Multiple Case Study

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Preservice teacher education programs are the foundation of the future generations of teachers, and the pinnacle of beginning teacher training is the internship experience. A gap in educational literature exists in relation to the role of the internship experience in the development of preservice teachers' understanding of teaching students to be prepared for a technology rich society through the integration of technology, pedagogy, and content. Using a mixed methods approach 33 preservice teacher interns were surveyed to examine potential change in interns' perceptions and actions regarding their preparedness to teach in a technology rich society. Six embedded cases were analyzed holistically to examine the factors that impacted the interns' understanding and use of technology over the course of a one-semester internship. The results of this study indicated little change in interns' self-perceived preparedness to teach in a technology rich society, however it was determined that the effects of the internship experience were individualized and influenced by multiple factors. Implications for practice and additional research recommendations are provided.

The Impact of the Internship Experience on Interns' Self-Perceived Preparedness to Teach in a Technology Rich Society: A Mixed Methods Multiple Case Study

by

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A Dissertation

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DEDICATION

To my incredible family, my wonderful wife Tracy, and my amazing boys, Payton and Ashton; and Kate: Thank you for your support, patience, and love. Without you I wouldn't be driven to strive, and grow. You are my passion and my motivation.

CHAPTER ONE

Overview

Introduction

Teacher preparation programs in the United States are charged with preparing teachers to educate the future citizens of a changing society. As preservice teachers graduate and enter the teaching profession, they are expected to incorporate technology within their classroom practice (International Society for Technology in Education [ISTE], 2008; TEA, 2014b). Many teacher preparation programs have developed skill-based courses in instructional technology and some have worked to integrate technology into required courses for preservice teachers (Angeli, 2005), but what happens to preservice teachers during their internship or student teaching experience? Do they interact with innovative instructional designs that incorporate digital technologies? How do they continue to develop in order to become effective teachers in a technology rich society?

Overview of the Issue

Technology has changed and continues to change every part of people's lives. Even with increased pressure on school districts to emphasize the incorporation of technology into teaching, the public education system and its teachers have been slow to adopt new technologies and pedagogical strategies that support learning and living in a technology rich society (Lux, 2010; Lux, Bangert & Whittier, 2011).

Students matriculating in schools the in the United States live in an age when digital technologies impact every aspect of their lives (Rideout, Foehr, & Roberts, 2010). Handheld mobile computing devices are introduced to children in their infancy, and many children enter the classroom knowing how to navigate handheld devices in order to be entertained by a video or game. Digital technologies have replaced outdated analog systems and are creating new ways of thinking and living (Turkle, 2012).

The reasons behind schools' and teachers' slow incorporation of digital technologies into their practice are varied. Some believe this is a generational issue defined by age of the instructors (Palfrey & Gasser, 2013; Prensky, 2010) though others contribute this to lack of access and funding (Norris, Sullivan, Poirot & Slolway, 2003). Vockley (2008) discussed how a narrow conception of skills-based technology education hinders the incorporation of digital technologies into school curriculums.

Preservice teacher programs have the responsibility of developing a competent and professional teaching workforce who are innovative in educating students in the current technological revolution. "We have entered a crucial time when fundamental shifts in the economy, changing nature of the workforce, demographic shifts, educational competitiveness, globalization of society, and computerization of the workplace make the technological preparation of teachers an urgent problem we can no longer afford to marginalize" (Lambert & Gong, 2010, p.55).

Funding and initiatives for integrating technology into education have been on the rise. The National Educational Technology Plan 2010 (U.S. Department of Education, 2010) outlined a comprehensive federal model and suggested that preservice and inservice teachers be provided with "professional learning experiences powered by

technology to increase their digital literacy and enable them to create compelling assignments for students that improve learning, assessment and instructional practices" (p. 50). Thus providing technical training and experiences to incorporate teaching with technology in preservice teacher preparation is imperative.

An integral part of teacher preparation is the student teaching experience or teaching internship (hereafter referred to as internship). The internship occurs after teacher education students have completed coursework in educational theory and methods of pedagogy. This experience has been described as the most important component of teacher preparation (Arnold, 1993; Cuenca, 2010; Cuenca, 2011; Guyton & McIntyre, 1990) offering the prospective teacher the opportunity to apply previously learned theories and methods in a controlled classroom setting with real students. Researchers identified a myriad of factors as contributing to the success of the internship experience (Darling-Hammond, Hammerness, Grossman, Rust, & Shulman, 2005).

The intern's own philosophies, predispositions, knowledge, and motivation contribute to the growth and development that is experienced during the internship (Kagan, 1992; Knowles & Cole, 1996). As interns continue their development by being immersed in the classroom environment, they are coached by both a mentor teacher, whose classroom they are entering, and an intern supervisor, who is responsible for the evaluation and approval of the intern's matriculation. As ascertained by Wyss, Siebert, and Dowling (2012), the availability of a mentor or supervisor capable of providing support and consultation to preservice teachers situated within field-based experiences can have a significant positive influence on the preservice teachers' comfort level and preparedness for teaching. Variances in the independent school districts involved in the

internship experience may also contribute to the success of the experience. Of concern to this study are variances in the ways that school districts integrate digital technologies for teaching in a technology rich society (Donovan, Hartley, & Strudler, 2007). School district technology plans may range from extensive long-term technology integration plans to no specified district-wide plan for teaching with technology. Thus, the experience and development of the interns' knowledge and skills for teaching in a technology rich society can be influenced by the internship experience.

Problem Statement

Teaching is a multifaceted activity that requires the ability to make informed decisions within the context of the school and classroom (Schulman, 1987). The intricate relationships and multitude of factors that exist in the contexts of schools and classrooms (Mishra & Koehler, 2006) add to the complexity of the teaching internship experience. The internship has been described as a beneficial experience that bridges theory and practice by providing practical on the job experiences that allow interns to build and develop their own contextualized understandings of teaching (Darling-Hammond et al., 2005; Cuenca, 2010). One of the theory-to-practice components that must be addressed during the internship experience is the development of interns' preparedness to teach with technology. In fact, the integration of digital technologies into teaching is a requirement for all public school teachers in Texas (TEA, 2014b). Although previous research has addressed numerous factors that impact interns during the internship experience, a gap exists in the research literature regarding change that occurs during the internship experience specific to teacher interns' abilities to teach in a technology rich society. Therefore, this study was designed to provide evidence about how the internship

experience contributes to the development of the intern as a future teacher in the technologically rich 21st century.

Theoretical Framework

At the beginning of the 21st century, the United States was in the early stages of a technological revolution. Mobile phones became a norm, and access to the Internet grew exponentially. Since that time, technological developments have changed the nature of how people live. It is no surprise that these same developments are changing the nature of education and how people learn (Berry, 2011; Collins & Halverson, 2009). Digital and mobile technologies inundate every aspect of life and are influencing the classroom. Bound books are being replaced with tablet computing devices, and assessments are being completed on digital devices instead of paper. Teachers are now required to incorporate digital technologies into curriculum (U.S. Department of Education, 2010; ISTE, 2008). Therefore, a theoretical framework for teaching in a technology rich society is essential.

In 2006, Mishra and Koehler developed the Technological Pedagogical Content Knowledge or TPCK (Later renamed TPACK [Thompson & Mishra, 2007]) framework for teacher knowledge (Mishra & Koehler, 2006). The TPACK framework draws foundational understanding from Shulman's (1987) notion that two distinct knowledge bases, Content Knowledge (CK) and Pedagogical Knowledge (PK), intersect and interact in creating Pedagogical Content Knowledge (PCK), which is the hallmark of the effective professional educator (Shulman, 1987). Adding to the PCK framework developed by Shulman (1987), Mishra and Koehler (2006) proposed a third distinct knowledge base, Technology Knowledge (TK). TK includes understandings of new digital technologies as

an essential component for teaching in the digital technology infused 21st century. The interactions of these three essential knowledge bases create the TPACK framework (Mishra & Koehler, 2006).

Teaching requires "complex cognitive skill occurring in an ill-structured, dynamic environment" (Mishra & Koehler, 2006, p. 1020). In order to make effective teaching decisions, a teacher must have a strong foundational knowledge base. The development of teacher knowledge is of primary concern to teacher education programs. Before the cultural infusion of digital technologies, content and pedagogy were the two knowledge constructs deemed necessary for effective teaching (Veal & MaKinster, 1999). Currently emphasis has now been placed on digital learning and development of 21st century skills that involve cognitive pliability across digital domains as well as the ability to apply knowledge to abstract settings often influenced by digital technologies (ISTE, 2008; Keengwe, 2007; Oigara, 2013; U.S. Department of Education, 2010). These new constructs are the result of the onset of personal and mobile computing and Internet technologies, and these societal changes require the addition of Technological or Technology Knowledge (TK) to the PCK framework. Without a dynamic understanding of digital and information communication technologies, teachers will be unable to prepare students for life in a dynamic, ever-changing society.

The TPACK framework relies on distinct individual knowledge bases and the interaction and relationships between these theoretical concepts. The elements of this framework include:

- Content Knowledge (CK), knowledge of a specific content area that is to be learned or taught.

- Pedagogical Knowledge (PK), knowledge of the processes, methods, and practices of teaching.
- Pedagogical Content Knowledge (PCK), knowledge of teaching approaches that align with content and are specific to the discipline.
- Technology Knowledge (TK), knowledge and skills needed to operate technologies.
- Technology Content Knowledge (TCK), knowledge of technology's relationship with a particular content area.
- Technological Pedagogical Knowledge (TPK), knowledge of how technologies are used in teaching.
- Technological Pedagogical and Content Knowledge (TPACK), "understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems students face; knowledge of students prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies to strengthen old ones" (Mishra & Koehler, 2006, p. 1029).

The TPACK framework is a complex combination of the three distinct bodies of knowledge that act in "dynamic equilibrium" (Mishra & Koehler, 2006, p. 1029), and suggests that the best teaching in the technology age happens at the intersection of these three bodies of knowledge. Figure 1.1 presents a graphic representation of the TPACK framework. The TPACK framework has been widely accepted as a useful framework for integrating technology into curriculum (Abbitt, 2011a; Mishra & Koehler, 2006; Saeli, Perrenet, Jochems & Zwaneveld, 2012).

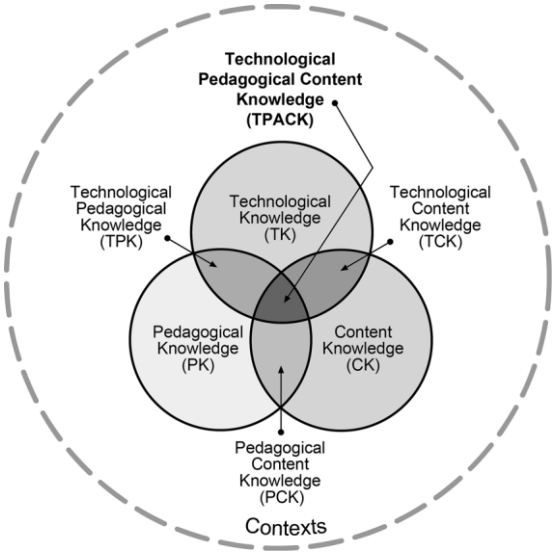

Figure 1.1. TPACK Framework. Reproduced by permission of the publisher, © 2012 by tpack.org

Purpose

The purpose of this mixed methods multiple case study was to examine the change in preservice teachers' perceived preparedness to teach in an ever changing, technology focused society during one semester of a teaching internship and to identify factors that contribute to the narrative of the intern's change as a professional educator.

The participants in this study were 33 preservice teacher interns from a private central Texas university who began their internship in a K-12 public school setting during the fall 2014 semester. The interns were placed in classroom settings based on their chosen field of study (e.g. elementary generalists were placed in elementary classrooms and secondary English interns were placed in high school English classrooms). The interns who participated in this study completed two online surveys composed of two sub-surveys (See Appendix), one quantitative (PT-TPACK) and one qualitative. The pre-internship survey was completed prior to the beginning of the internship, and the post-

internship survey was completed following the 12th week of the internship field placement.

The PT-TPACK is a quantitative instrument that assesses the interns' self-perceived ability to teach using the TPACK framework (Lux, 2010; Lux, et al., 2011). This assessment was utilized in both the pre-internship survey and post-internship survey. The qualitative instruments used in this study were developed by the researcher and were composed of open-ended short answer items designed to evaluate the expectations and understandings of teaching in a technology rich society prior to the interns' internship experience, and the post-internship survey items were designed to explore the interns' experiences and changed understandings of teaching in a technology rich society after one semester of the internship experience. All questions were developed in connection to the research questions for this study and the a priori framework of TPACK, and the questions aimed to forge a deep understanding of any changes that occurred during the internship specific to the interns' self-perceived preparedness to teach with technology.

Significance

Many studies have assessed preservice teachers' TPACK both quantitatively and qualitatively, but there were no studies found through an extensive search that focused solely on the internship experience and TPACK. Because the internship experience is considered highly important in the process of training the preservice teacher (Darling-Hammond, et al., 2005; Cuenca, 2010), it is imperative that the internship provide opportunities for the interns to grow and develop skills that contribute to teaching in a technology rich society. The changes in the interns' self perceived preparedness to teach in a technology rich society during the internship was the central focus of this study.

This research adds to the literature by contributing to the conversation regarding the change in self-perceived 21st century knowledge for preservice teachers during their internship experience. The apparent gap in the literature regarding change in preservice teacher knowledge during field placement internships as it pertains to the TPACK framework was narrowed by this study.

Methodology

This study was a multiple case study that employed both quantitative and qualitative research methods (Gay, Mills & Airasian, 2009). This approach values all data equally. Data was collected using both quantitative methods and qualitative methods in order to develop a clear holistic picture of the experiences of the participants within the bounded context of the research setting (Johnson & Onwuegbuzie, 2004; Creswell, 2007; Yin, 2009). The case focused on the contemporary phenomenon of the change in teaching interns in relation to technology rich teaching. The case was bounded (Yin, 2009) in that it was limited to first semester teaching interns from a central Texas university. It was a multiple case study where the first case included the entire sample of 33 teaching interns. Within the sample, six additional embedded cases were chosen as exemplar cases for further analysis. Moreover, the 27 interns who were not selected as exemplar cases were considered an additional embedded case.

The research questions guiding this study were:

1. Does a one-semester (12-week) internship experience impact preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?
    a) Does intern placement contribute to the impact of preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?

b) Does intern certification level contribute to the impact of preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?

2. In what way(s) does a one-semester (12-week) internship experience impact preservice teachers interns' understanding of technology and the infusion of technology with pedagogy and content?

3. In what way(s) does a one-semester (12-week) internship experience impact preservice teachers interns' described utilization of technology and the infusion of technology with pedagogy and content

Participants were interns who completed all methods and theory courses in preparation of becoming a fully certified professional educator. Additionally, university faculty members recommended each participant for placement in the internship experience, and all interns had attempted at least one of the two official required state assessments for teacher certification including the Pedagogy and Professional Responsibilities (PPR) examination and the individual interns' content exams. These examinations evaluate the candidates' competencies based on the Texas State Teacher Standards, and successful completion of these examinations is a required step in the process of Texas teacher certification (TEA, 2014b).

The interns in this study were placed in classrooms corresponding to their chosen degree plans and certification levels and the classrooms in which the interns were placed were in three separate school districts that partnered with the participating university. The demographic make up of the school districts were different and the districts had three different technology plans. All interns were required to complete a two-semester internship before graduating from the university, but the scope of this study was only the first semester of the preservice teachers' internship. The reason for limiting the scope of the study to one semester of the internship was based on the fact that as a part of their program, some interns who were seeking secondary certifications changed school

placements during the second semester of the internship. For consistency between levels of the program, it was most beneficial for this study to collect data for only the initial semester of the interns' experiences. Moreover, many university teacher preparation programs only require one semester of internship (Cochran-Smith & Zeichner, 2010).

The quantitative instrument utilized to collect interval data was the 27-item PTTPACK (Lux, 2010; Lux, et al., 2011). The PT TPACK was developed to assess the self-perceived TPACK of preservice teachers based on their teacher training. This survey was given before interns entered their assigned classrooms and after they had completed 12 weeks of their first semester of internship. This quantitative instrument measured the interns' self-perceived preparedness in each domain of the TPACK framework. The data was analyzed using statistical methods, specifically a multivariate Hotelling's T^2 test (Hotelling, 1951; Hotelling, 1957) for dependent samples. This omnibus statistical procedure measured the variances in mean differences between and within constructs of the PT-TPACK. Additionally, descriptive statistics were analyzed in relation to the intern group, individual interns, the interns' district placements, campus placements, and certification levels.

A qualitative questionnaire was utilized in this study to supplement the quantitative survey. The pre-internship qualitative instrument contained a series of open-ended written response items designed to explore the interns' conceptual understandings and expectations of teaching in a technology rich society and incorporating technology within the classroom. The post-internship qualitative instrument was designed to compliment the pre-internship survey by generating data that explained both the expectations of the interns and the realities experienced during the internship experience.

Thus, the pre-internship items focused on understandings and expectations, and the post-internship items focused on the interns' understandings and events of the internship experiences. All data collected was compiled to explain and interpret the phenomenon of intern change during the internship experience and to develop an analytical understanding of the changes in the intern participants as well as the factors involved in any changes or lack of changes that occurred during the internship as it pertained to teaching in a technology rich society.

Assumptions

Assumptions are factors in the study that are presumed to be true and would invalidate the research if they were determined to be false (Gay, et al., 2009; Simon, 2011). Assumptions in this study included the previous preparation and abilities of the interns, the assumption of truthful responses to the surveys, the assumption of multiple realities, and the assumption that mixed-methods research design was appropriate for study of this phenomenon.

The first assumption was founded in the design of this case study and the posed research questions it posed. This study explored only the internship experience and not the whole of the teacher preparation program at the participating university. It was assumed that the interns who participated in this study displayed the necessary skills and abilities to move forward to the internship phase of their preparation of becoming a professional educator. Additionally, it was assumed that the successful entry into the internship was a result of excellent teacher preparation, as the teacher education program has been considered highly effective and ranked among the best teacher preparation programs in the United States (Atlantic, 2014).

It was assumed that the participating interns had a basic knowledge of digital technologies and a basic knowledge of educational theory and methods. In order for an intern to have progressed to the internship, he/she was required to meet minimum university requirements. Interns were required to have completed all their coursework in the teacher preparation program of the participating university and to have attempted at least one of the two required state level tests for their certification level including the Pedagogy and Professional Responsibilities Exam and an exam specific to their content area. The coursework included two required courses that explicitly covered technology skills for teachers. Interns must have also completed the teacher education courses and passed each course in their field of study with a minimum grade point average of 2.75. These program requirements indicated that the interns involved in this study had, at the least, a minimum knowledge foundation of teaching theory, methods, and technology.

It was also assumed that the interns completed the survey completely and honestly. In order to ensure this, the interns provided their agreement to participate in the study through the completion of a consent form. The informed consent outlined the requirements of anonymity and confidentiality of all data throughout the study. All participants and participating institutions named in the study were assigned pseudonyms in order to protect the privacy of each participant and entity, and no personally identifiable data was presented.

The assumption of multiple realities is one that is prevalent in mixed-methods and qualitative research. This theory assumes that participants perceive life and experiences in different ways. Each individual participant constructed reality and therefore all responses were the unique representation of the participants' lived experiences within the

bounded context of the study (Simon, 2011; Merriam, 1998). A final assumption of this research design was that the mixed-methods approach drew both quantitative and qualitative data that reciprocally complimented the other in the development of a deep evaluative understanding of the interns' experiences (Simon, 2011).

Limitations

One limitation of this study was the inability to generalize findings to the general population of preservice teaching interns. This study was a multiple case study and could only tell the story of the specific participants and their experiences during a specified time period. The participants were selected because of their unique situation within the teacher education program at the participating university.

Another limitation of this study was that of time. Data collection and analysis reflected a specific time and, thus, only told the story of those participants engaged in the treatment during the fall 2014 semester. Additionally, this study only investigated change during the internship and, thus, only in relation to this experience: an experience that represented only a portion of the teacher education program at the participating university. The teacher internship at the participating university included two semesters of internship experience; therefore, this study only observed a portion of the fully developed program for teacher development.

Logistical and programmatic issues within the university's teacher education program further affected the time allowed for this study to occur. Of great concern to this study was the district placement of the participants. Because the three participating school districts each had unique ideas about implementing technology, school district placement was an important factor to assess within this study. Although all participating

interns were required to complete two semesters of internship within their certification level, interns participating in this study who were seeking a secondary certification spent one semester placed in one district and the second semester in a different school district, yet elementary interns did not change districts during their field experience. For instance, a secondary mathematics intern may have been be placed in an Alpha ISD high school classroom for the time frame of this study (fall, 2014), and, at the commencement of the spring 2015 semester, the placement may have changed to a Beta ISD high school classroom. Change in placement affected the design of the study because a major research question for this study examined the effect of intern placement on the change of the interns' self-perceived preparedness to teach in the technology rich society of the 21st century.

There were a myriad of factors, some predicted and some not predicted, that had an effect on the interns during the internship experience, and these factors affected the results of this study. The factors of particular interest that were addressed within the study included district and campus placement, technology in relation to availability and connectivity, intern perceptions, and intern reported experiences. Factors that had an effect on the interns' development during the internship that were not controlled by this study were social factors including relationships between the mentor teacher and the intern, school administration and the intern, and intern supervisors and the intern. Other factors that were uncontrolled yet may have impacted the interns and their experiences included demographic and socio-economic influences of the student population, the interns' abilities to develop rapport and working relationships with students. Finally, additional factors such as uncontrollable family or personal events outside the classroom

that occurred during the internship may have affected the results of this study. It was impossible, in the context of human subjects research, to control for all variables that could affect this experience. However, by collecting both quantitative and qualitative data that told the narrative of the participants, the evaluation of intern impact and identification of factors that led to intern change could occur.

Delimitations

The purpose of this study was to examine the change in interns' knowledge and abilities to teach in a technology rich society. It was grounded in the proposed understanding that effective teaching in a technology rich society integrates digital technologies as presented in the TPACK framework (Abbitt, 2011a; Lux, 2011; Mishra & Koehler, 2006). This focus on teaching in a technology rich society was predicated on the understanding that technology is not only infused in culture, but the constant development of new digital technologies (Turkle, 2012) requires teachers to develop understandings about technology and how it impacts the world and thus the classroom.

The findings from this study pertain to the teacher preparation program at the participating university and contribute to the development of teacher education programs at similar universities comparable by location, student population, or program. The results of this study will assist the university and school partners in developing a deeper understanding of changes or lack of changes that occur in interns' self-reported perceptions of their preparedness to teach in a technology rich environment as explained by the TPACK framework.

Definitions of Key Terms

Technology: Although any tool that is used in the classroom can be considered technological, the working definition of technology for this study was digital and information communication technologies.

Intern: Pre-service teacher at the participating university engaging in a teaching internship experience similar to student teaching. This student had completed his/her coursework in theory and methods and has attempted one of the two required minimum competencies tests for the state of Texas. This student must complete the internship and be recommended by the participating university in order to gain a certification to teach in a K-12 classroom in the state of Texas.

Internship: The internship is traditionally known as student teaching. It is the culmination of the teacher education program when the preservice teacher experiences fulltime teaching in an EC-12 classroom with supervision of a mentor teacher who is responsible for the classroom.

Technology rich society: The current and future society and culture that incorporates digital technologies in almost all areas of life (Turkle, 2012) and influences how people learn and live.

CHAPTER TWO

Literature Review

Introduction

This chapter presents a review of relevant research related to the development of teaching with technology, frameworks for exploring teaching with technology, and factors integral to the internship teaching experience. Specifically, multiple frameworks for teaching with technology are introduced and discussed, and a comprehensive review of the Technological Pedagogical and Content Knowledge (TPACK) framework is reported. Literature regarding the internship experience is discussed relative to the current state of research connecting the internship experience and teaching with technology. Thus, the literature review reveals the researcher's considerations and subsequent decision to utilize the PT-TPACK framework foundation for this study.

Teaching with Technology

The invention of the computer in the 1940's began a transformation of society that has continued to present day. Although it was a slow process at first, taking decades to evolve into a useable tool, the computer eventually became an essential educational device (Molnar, 1997; Spazak, 2013; Troutner, 1991). Present day society relies on digital technologies in every facet of life (Turkle, 2012), and since 1983 when *A Nation at Risk* was published outlining the economic need for improvement in education and reporting a deficiency in educational technology integration, there has been an emphasis

on incorporating digital technologies into classroom practice (Collins & Halverson, 2009; Cuban, 1986; Cuban, 2009; Cuban, 2010; Cuban, Kirkpatrick, Peck, 2001).

For this study, the definition of technology focused on digital educational technologies. This included any digital device, software, or application appropriate for use in a classroom setting. These devices can include, but were not limited to; tablet computing devices, the Internet, video, audio, interactive white boards, and clickers.

In the high speed, mobile, Internet-based culture that exists today, it is necessary for education and educators to not only keep up with educational technologies but to also become innovators in the art and science of teaching with technology (Berry, 2011). In an effort to better understand and describe integral aspects of teaching with technology, numerous frameworks have been developed. Effective frameworks for teaching with technology should assist instructors by providing contextual boundaries for the use of technologies in education, but the framework must also be predicated on pedagogically sound methods of teaching as well as a deep understanding of the unique characteristics of the content being taught (Mishra & Koehler, 2006). Below are descriptions of teaching with technology frameworks. Some of these frameworks are explicitly described as conceptual in nature, yet other frameworks are implicit and explained through the use of emerging technologies.

Teaching with Technology Frameworks

The first framework for teaching with technology emerged early in the twentieth century with the invention of teaching machines (Troutner, 1991). These analog devices presented a multiple-choice question to a student and required the student to choose a response. The machine would then present either a subsequent question that followed a

logical path toward an end result if the choice was correct or a remedial question if the student choice was incorrect. This same framework of automated drill and practice teaching machines evolved to use branching logic based on response logic (Troutner, 1991; Uttal, 1962). The framework here was based on a drill and practice tutorial ideal and the purpose of the technology was meant to increase meaningful practice and drill for those encountering the machine.

B.F. Skinner (1960) discussed teaching machines and the role of the teacher when utilizing these machines, predicting that teachers would create courses using branching logic and multimedia to teach and eventually reach end of semester goals using the teaching machine. This Skinnerian educational technology framework was based on his experiments with analog machines that allowed students to self-check for correctness in the context of a fill in the blank type scenario. Skinner reported that using the machines raised student interest and motivation, and he predicted that entire college courses could be taught using the machines because of the logic potential they offered. Skinner's machines were different from the other machines of the time in that they required a student composed response rather than a multiple-choice response (Troutner, 1991).

Around the same time that Skinner was discussing his paradigms of teaching machines, the first computer dedicated to large-scale educational purposes was developed by the University of Illinois: Programmed Logic for Automatic Teaching Operation (PLATO) (Troutner, 1991). PLATO was used as a tool that incorporated drill and practice software as a means for teaching, but it was innovative in that it included inquiry logic and provided tutorial instruction for users in multiple course and topic offerings (Troutner, 1991).

The development of the microchip in the 1970's and the growing availability of smaller computer systems like the Apple IIe and the Commodore 64 led to an increase of computer programs intended for teaching. Six categories of educational software soon emerged. These categories were: (a) drill and practice, a flash card like system; (b) tutorials that provided information and comprehension questions; (c) simulations where students were able to view real situations as they developed understandings; (d) interactive video programs using graphics to display information in video and text form; (e) utility programs and tools for teachers to create items for student use like crosswords; and (f) tool software including word processors and spread sheets (Spazak, 2013; Troutner, 1991).

These six categories did not create an explicit framework for teaching with technology, but they revealed the growing availability of technological tools for classroom integration and support of student learning. As digital technologies became more prevalent in the 1970's and 1980's, explicit frameworks began to emerge.

Multiple frameworks for educational technology have developed over time, and theories regarding the most effective practices for teachers continue to evolve. These frameworks fall into three categories: (a) frameworks developed to assess the amount of technology used in a classroom, (b) frameworks developed to alter or improve the curriculum or purpose of technology in the classroom, and (c) frameworks created as practical tools for use in the classroom.

Logo Mindstorms

Seymour Papert (1980) was an early contributor to the development of technology in education. While at MIT, Papert and his colleagues developed a programming

language he titled Logo, derived from Greek meaning word or thought. The Logo programming language was the foundation of a framework for technology in education described in Papert's book *Mindstorms* (1980). This framework was intended to alter the curriculum and develop students' logical thinking skills based on experiential learning with computer programming. Papert's framework was developed from a constructivist ideology drawn from French educational psychologist Jean Piaget. Within the constructs of computer programming with Logo, and with specific tasks for students to complete using an icon known as a turtle, the student would develop real world understandings of mathematics and physics. Papert proposed that this new way of learning and a new curriculum that incorporated computer science would be beneficial to the educational experiences of children and society as a whole; a philosophy that has been reiterated by other experts in the field of technology (Berry, 2011; Collins & Halverson, 2009; Rushkoff, 2010).

Engagement Theory

Engagement theory is a framework for educational technology that was founded in distance and electronic educational environments (Kearsley & Schneiderman, 1998). The framework focuses on real world problem solving as a means for teaching. Online environments require high levels of student motivation; subsequently, engagement theory is a practical framework for teaching in this specific environment. This framework consists of practical and situational based teaching methods, prescribing, "all student activities involve active cognitive processes such as creating, problem solving, reasoning, decision making, and evaluation" (Kearsley & Schiderman, 1998, p. 20). The authors proposed that this active learning would intrinsically motivate students to learn.

Three principles are present in this framework. The first principle is the *relate* component that prescribes learning occurring in collaborative teams. Second is the *create* component that involves teams working and creating within the confines of a mutually meaningful activity. The third principle is the *donate* component. This principle prescribes the purpose of the project: to contribute to a wider audience throughout the learning process (Kearsley & Schiderman, 1998).

The authors distinguished engagement theory from other frameworks by focusing on the collaborative nature of the work (Kearsley & Schiderman, 1998). The framework was proposed as a model for learning in technology-based environments and is not intended for traditional classrooms.

LoTi

The Level of Technology implementation (LoTi) is a framework that was developed to assess the amount of technology used by teachers (Moersch, 1995). The developer of this framework recognized that teachers' technology self-efficacy influences their use of digital tools in the classroom environment and that efforts to train teachers were seemingly insufficient. Thus, the framework was developed to assess the levels of use and the variety of instructional technologies utilized in the classroom. It was anticipated that utilization of the framework would promote the development of more effective technology-focused teacher training programs and administrative technology plans.

The LoTi Framework consists of seven levels of technology use where the lowest levels indicate teacher-centered instruction and as the levels increase, instruction becomes more student centered. The lowest level of the LoTi framework is nonuse; here

the teacher perceives a lack of access or time and fails to pursue teaching with digital technologies. The next level is awareness where the instructor has knowledge of systems but does not value them within his/her instructional paradigm. The third level is exploration where the teacher uses existing technology to supplement his/her existing instructional program. The next level is labeled infusion, and at this level technology-based tools augment instructional events. Following the infusion level is the integration level where technology tools are integrated into classroom practice and are perceived as tools to identify and solve conceptual problems. The fifth level is classified as expansion; at this level technology use expands beyond the classroom walls and elicits communication with outside entities that apply and contribute to the process of learning specific concepts. Finally, the last level of the LoTi framework is refinement. At the refinement level, "Technology is perceived as a process, product, and tool to help students solve authentic problems related to an identified real-world problem or issue" (Moersch, 1995, p. 42).

The levels proposed in the LoTi framework provide excellent descriptors for teachers' current practices, yet despite the development of and emphasis on educational technology, today's teachers continue to struggle to incorporate technology into the classroom even with increases in personal use of technologies (Kumar & Vigil, 2011; Rakes, Fields, & Cox, 2006).

ISTE NETS-T

The International Society for Technology in Education (ISTE) is the world's largest association dedicated to educational technology. In the year 2000, the ISTE published their first set of standards for educational technology for teachers titled

National Educational Technology Standards for Teachers (NETS-T) (International Society for Technology in Education, 2008). The NETS-T were revised in 2008, and since then the ISTE has revised the title of their standards to reflect the name of the organization (ISTE, 2008). The standards are now called ISTE Standards for Teachers (ISTE Standards-T). These standards are not explicitly considered a framework, but like a framework, they present a basic structure of what teachers should be able to do in relation to teaching in a technology-rich environment. In addition to teacher standards, ISTE has published standards for students, administrators, coaches, and computer science educators.

There are five overarching standards in the ISTE Standards-T. Each standard is followed by a narrative explanation and clarification, and performance indicators accompany each standard. The ISTE Standards-T as displayed in Table 2.1 reflect the development of good teaching in a technologically rich environment.

The ISTE Standards-T have contributed directly to teacher education programs and the development of preservice teachers' technology skills. These standards were accepted and promoted by the federal initiative *Preparing Tomorrows Teachers to Use Technology Programs* (PT3) (U.S. Department of Education, 2010). The National Council for the Accreditation of Teacher Education (NCATE) has approved and adopted the ISTE standards and incorporates them in the accreditation process for teacher education programs (Levin, 2006; Willis, 2012).

Table 2.1.

ISTE Standards-T (ISTE, 2008)

Standard	Explanation
Facilitate and inspire student learning and creativity	Teachers use their knowledge of subject matter teaching and learning and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.
Design and develop digital age learning experiences and assessments	Teachers design, develop, and evaluate authentic learning experiences and assessments incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the Student Standards.
Model digital age work and learning	Teachers exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society.
Promote and model digital citizenship and responsibility	Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices.
Engage in professional growth and leadership	Teachers continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources.

Universal Design for Learning

Universal Design for Learning (UDL) is a framework with three overarching principles for developing curriculum for all students with equal opportunity for learning through technology (Rose & Meyer, 2002). UDL is based on Vygotsky's (1978) zone of proximal development, focuses on the diverse nature of student needs in the classroom (Benton-Borghi, 2013), and includes an emphasis on educating students with special needs (Rose & Meyer, 2002). The three guiding principles for UDL are (a) provide multiple means of representation, (b) provide multiple means of action and expression, and (c) provide multiple means of engagement (Rose & Meyer, 2002). "The UDL model requires all teachers to approach instructional decision-making, teaching, and assessment through the lens of accessibility, providing solutions to remove barriers through the

effective integration of technology" (Benton-Borghi, 2013, p. 254). The UDL model places special emphasis on differentiation of curriculum and learning styles that teachers encounter in the classroom setting. It provides a structure for planning, but it does not encompass all the teacher should know in order to effectively teach in a technology rich environment.

Each of the above-referenced frameworks and trends contributed to the development of teachers prepared to teach in a technology-rich environment, and although each encourages creativity and the incorporation of technology, none were founded on the constructs of holistic effective teaching. A teacher must have both foundational knowledge of their content area and pedagogy to teach effectively (Shulman, 1986). Including the infusion of technology that has been required by law for public schools (Yell, Shriner, & Katsiyannis, 2006; U.S. Department of Education, 2010) adds a dimension to the knowledge an effective teacher must possess. The TPACK framework developed by Mishra and Koheler (2006) provides a sufficient theoretical foundation for what is needed for effective teaching in a technology rich environment. It is also non-specific and non-prescriptive enough to account for the vast variety of disciplines and levels of education and expertise that are found in the spectrum of education. The following section examines the TPACK framework, its constructs, development, uses, and current state of scholarly research.

TPACK Framework

Mishra and Koehler (2006) developed the Technological Pedagogical and Content Knowledge (TPACK) theoretical framework as the culmination of multiple years of experimentation in preservice teacher development. The framework was originally

published with the name TPCK, but it was changed to TPACK to make it more recognizable and easier to say as an acronym (Thompson & Mishra, 2007). These acronyms are interchangeable and both are represented in the literature. For the purposes of this work, all references to the framework will be under the TPACK acronym. What follows is a survey of the literature regarding the TPACK framework. First, the development of the framework will be examined. Second, an explanation of each construct and the combination of constructs will be explained. Next, a review of developments in the measurement of the TPACK framework will occur. The practical applications of the TPACK framework in classroom practice will be outlined, and the ways in which the TPACK framework is implemented in teacher education will be discussed. Finally, a report will be provided specific to how the ability to incorporate each domain of TPACK into the classroom exemplifies teaching in a technology rich environment.

TPACK development. The TPACK framework is an extension of the Pedagogical Content Knowledge (PCK) concept that was originally published by Shulman (1987). Shulman discussed PCK as a necessary construct for effective teaching. Pedagogy and content had been separate distinct categories until Shulman (1987) explained the combination of these knowledge bases:

> Teachers must not only be capable of defining for students the accepted truths in a domain. They must also be able to explain why a particular proposition is deemed warranted, why it is worth knowing and how it relates to other propositions, both within the discipline and without, both in theory and practice. (p. 9)

PCK requires teacher understanding of the intricacies of learning content. The organization, preconceptions, and conceptions that are implicit in a content area must be

understood and married with instructional strategies that are "most likely to be fruitful in the reorganizing the understanding of learners" (Shulman, 1987, p. 9-10).

Mishra and Koehler (2006) added technology knowledge (TK) to create the TPACK framework. The addition, this third construct and the development of TPACK was in response to the cultural and educational technology revolution. Due to the revolution, it became necessary and mandated for teachers to implement and integrate technology into classroom practice (U.S. Department of Education, 2010). The TPACK framework has a foundation in exemplary holistic teaching practices that are content specific and attuned to the needs of the learner: The completion of the framework added the essential construct of technology knowledge that brought teaching practice into the 21st century (Lambert & Gong, 2010; Lux, 2010; Mishra & Koehler, 2006)

TPACK Constructs

As exemplified in Figure 1.1, the TPACK framework is composed of three separate theoretical constructs that intersect to create combined knowledge constructs totaling seven individually distinct domains or constructs (Mishra & Koehler, 2006; Schmidt et al., 2009).

Technology Knowledge (TK). Technology knowledge refers to the understanding of technologies (Mishra & Koehler, 2006). Technology can be either digital, (i.e. computers, digital cameras, and video) or analog (i.e. books, white boards, and markers). Operational understanding of the uses of a variety of technologies is evidence of TK proficiency. The manipulation of digital resources including information communication technologies (ICT) like social media and computer software and the ability to use

peripheral devices also contributes to TK. Simply put, TK is the knowledge and skills necessary to use both digital and analog technology for personal and professional uses.

Pedagogical Knowledge (PK). Mishra and Koehler (2006) present PK as the understanding of processes and methods of teaching and learning. This knowledge manifests itself in the ability to facilitate a classroom environment for learning including lesson plan development, classroom management, evaluation of learning, and teaching strategies. "A teacher with deep pedagogical knowledge understands how students construct knowledge, acquire skills, and develop habits of mind and positive dispositions toward learning" (Mishra & Koehler, 2006, p. 1027). PK takes into account the development of the learner both socially and physiologically, and PK requires a deep understanding of the cognitive processes involved in learning (Lux, 2010; Schmidt & Gurbo, 2008; Shulman, 1986).

Content Knowledge (CK). Knowledge of the subject matter being learned or taught composes the CK construct (Mishra & Koehler, 2006). There are distinct content knowledge bases that are separated both by audience and discipline. Science is a different discipline than history and therefore requires a different knowledge base. A teacher with deep CK understands the theories, concepts, frameworks of connected ideas, rules, and procedures for defining and validating information within a discipline (Shulman, 1987). Teachers without adequate CK can misrepresent discipline-specific differences to students (Ball & McDiarmid, 1990; Mishra & Koehler, 2006).

Pedagogical Content Knowledge (PCK). The intersection of the knowledge regarding a specific discipline and the knowledge of pedagogy create PCK.

> PCK is concerned with the representation and formulation of concepts, pedagogical techniques, knowledge of what makes concepts difficult or easy to learn, knowledge of students' prior knowledge, and theories of epistemology. It also involves knowledge of teaching strategies that incorporate appropriate conceptual representations in order to address learner difficulties and misconceptions and foster meaningful understanding. It also includes knowledge of what students bring to the learning situation, knowledge that might be either facilitative or dysfunctional for the particular learning task at hand. (Mishra & Koehler, 2006, p.1027)

The blending of the PK and CK constructs into PCK brings effective concept-specific teaching strategies into the practice of the educator (Schmidt et al., 2008).

Technological Content Knowledge (TCK). The development of TCK recognizes the reciprocal relationship between TK and CK. TCK is evident in a teacher's understanding of the potential and ability of new technologies to represent and present conceptual constructs of a specific discipline. In addition, TCK involves the knowledge of specific technologies that apply to a discipline and the learning of that subject matter (Lux et al., 2011). For instance, microscopes are a technology used in many areas of science education but a history instructor would not need to use a device to analyze microscopic organisms.

The TCK construct as a theorized component of TPACK has a logical foundation and can apply to specific situations. For instance, TCK would be employed when a science teacher is employing probes to teach a concept. Probes are a specific technology that applies to a specific content area. The TCK construct did not emerge in the exploratory factor analysis of the quantitative research instrument used in this study (Lux et al., 2011). Lux et al. (2011) suggested that learning objectives and pedagogy drive the use of technology, and therefore the construct of TCK is a secondary construct in the

decision making of the teacher when deciding to incorporate technology into instruction. "When a teacher is examining how technology influences the content, the theory and research suggest the strongest position to integrate it is with considerations of pedagogy to avoid creating a new missing paradigm" (Lux et al., 2011, p. 427).

Technological Pedagogical Knowledge (TPK). The understanding of educational technologies, their functions, applications to instruction and learning, and capabilities to alter instructional strategies composes TPK (Mishra & Koehler, 2006). TPK includes the ability to find and manipulate technological tools and apply them to the pedagogical goals and the faculties required to develop assessments using technological tools. The knowledge that technologies can alter the way one teaches is also a concept imbedded in TPK (Schmidt et al., 2009).

Technological Pedagogical and Content Knowledge (TPACK). The "dynamic equilibrium" (Mishra & Koehler, 2006, p. 1029) of TK, CK, PK, PCK, TCK, and TPK formulate the TPACK construct. Teaching in a technology rich environment is exemplified by the teacher's ability to incorporate each knowledge construct of TPACK into classroom practice. Mishra and Koehler (2006) explained that TPACK is not a knowledge held by subject matter experts or pedagogues, or even technologists, rather it is central to a teacher's work as he/she interweaves each source of knowledge into meaningful classroom practice. Expert teachers intuitively understand the integration of the three distinct constructs and the interplay that occurs in the planning and execution of teaching a specific content with technology.

Measuring TPACK

Measuring knowledge and levels of TPACK in the dynamic, multifaceted, ill-structured environment of education is complex (Abbit, 2011b; Lux et al., 2011; Mishra & Koehler, 2006; Schmidt et al., 2009; Shulman, 1987) and the development of instruments for measuring teacher and preservice teacher TPACK levels have produced multiple instruments. These instruments are both quantitative and qualitative, and they measure a variety of aspects of the TPACK framework. The instruments developed for standardized TPACK qualitative data collection include rubrics; while quantitative TPACK instruments employ self-reported, Likert style, instruments as explained next.

Quantitative TPACK Instruments. During the development of the TPACK framework and the process of defining the constructs of the framework, Mishra and Koehler (2006) designed a survey that measured participants' thoughts about designing online curriculum while participating in an online course. The survey used a seven point Likert scale for 33 items and two short answer items. The online environment contextually bound the survey and the participants involved, and it was not intended for broad application (Abbit, 2011b). The study added to the literature and reported conclusions that, within the context, the participants' results revealed positive trends toward a higher TPACK thought process. However, the specific nature of the survey limited results to the participants involved (Abbit, 2011b; Mishra and Koehler, 2006).

The next assessment of TPACK attempted by the developers of the framework was a mixed methods discourse analysis. Koehler, Mishra, and Yahya (2007) collected detailed notes of discussions, emails, notes, and other artifacts as well as self-progress surveys from students enrolled in a fifteen-week seminar for developing online courses.

All data was coded and analyzed to determine patterns of occurrence. The authors concluded that, "effective technology integration for pedagogy around specific subject matter requires developing a sensitivity to the dynamic transactional relationship between all three components taken together" (Koehler et al., 2007, p. 743). This assessment was essential to the development of the TPACK framework, but the time involved in this type of research limited its feasibility for wide scale application. Therefore, although this type of research was informative and essential in the development of TPACK theory, the use of this type of research is limited because of scale, time, and difficulty (Abbit, 2011b; Anderson, Rourke, Garrison, & Archer, 2001).

Schmidt et al. (2009) developed a quantitative instrument that measures the self reported TPACK of elementary preservice teachers. The need for a reliable, fast, teacher-rated instrument designed to assess the development of each component of TPACK and change in teachers' knowledge was the driving force for the development of this instrument. This instrument is unique in that it assesses the knowledge components of the TPACK, not the perception of the framework. One hundred twenty-four students participated in the data collection process of the development of this instrument, and a factor analysis was implemented to construct a rigorous instrument. The results indicated that the instrument developed with seven subscales is a reliable instrument for "examining preservice teachers' development of TPACK" (Schmidt et al., 2009, p. 137). The major limitation of this instrument is the limited audience for whom it is designed. This instrument is only valid for PK-6 teachers or generalists because the constructs were developed with language that is focused on this level of teaching (Abbit, 2011b; Schmidt et al., 2009).

Yurdakul, Odabasi, Kilicer, Coklar, Birinci, and Kurt (2012) developed an instrument titled TPACK-deep. Faculty from multiple universities in Turkey designed the TPACK-deep instrument during a collaborative symposium, and the instrument is based on specifically designed competencies and performance indicators. This instrument is different from other TPACK instruments in that it does not measure or distinguish between the constructs of the TPACK framework; instead, the framework measures preservice teachers' self-reported abilities in six competency areas: (a) Designing Instruction, (b) Implementing Instruction, (c) Innovativeness, (d) Ethical Awareness, (e) Problem Solving, and (f) Field Specialization (Yurdakul et al., 2012). The instrument was considered valid and reliable after being assessed using 995 preservice teacher participants in Turkey. Yurdakul et al. (2012) presented the TPACK-deep instrument as a differently scaled instrument that allowed for questioning and development of technology integration based on four factors: design, exertion, proficiency, and ethics. With the integration of the above factors, Yurdakul et al. (2012) proposed that assessment of the subdomains of TPACK do not adequately assess the development of preservice teachers' TPACK. The claim made by Yrudakul et al. (2012) was that the knowledge bases including PK, TK, and CK do not directly contribute to the development of TPACK. This claim, however, has been refuted in the literature by the creators of the original TPACK framework (Mishra & Koehler, 2006; Schmidt et al., 2009).

Another group of researchers from Turkey developed a quantitative research instrument to measure TPACK and explore the relationships between the components of the original framework. Pamuk, Ergun, Cakir, Yilmaz, and Ayas (2013) found that the relationships between the components were strongest in the second level of the TPACK

framework. The second level of the TPACK framework refers to the combinations of two of the individual knowledge constructs. PCK, TPK, and PCK were found to be the strongest contributors to overall TPACK variance, and the first level components of TK, PK, and CK did not impact the overall statistical variance of TPACK (Pamuk et al., 2013). The research determined that the dominating knowledge base that affects the TPACK framework should be PCK because it is the theoretical foundation on which the framework is built, and PCK is considered essential knowledge for effective teaching (Mishra & Koehler, 2006; Pamuk, 2011; Pamuk et al., 2013). Pamuk et al. (2013) proposed a power relationship between components of the TPACK framework that indicated a greater emphasis on the direct impact of second level constructs and less emphasis on primary level constructs in relation to the overall TPACK framework.

Angeli & Valanides (2005) contributed to the discussion and assessment of TPACK in their development of an alternative component of the framework titled ICT-TPCK. Similar to Yurdakul et al. (2012) and Pamuk et al. (2013), Angeli and Valanides (2009) recognized through empirical studies that TPACK is a unique knowledge construct, but growth in related constructs does not automatically translate to growth in the overall TPACK of the preservice teacher. (Angeli & Valanides, 2009; Angeli, 2005). The understanding of the relationships between the components that comprise the TPACK framework was determined to be essential for growth of preservice teachers' TPACK. Additionally, to deepen the effectiveness of developing preservice teachers' TPACK, Angeli and Valanides (2009) proposed an alternative practical framework that hinged on the development of epistemic beliefs, practical experience, and contextual factors within the learning environment. The ICT-TPCK framework model was

composed of five knowledge bases: (a) subject matter knowledge, (b) pedagogical knowledge, (c) knowledge of learners, (d) knowledge of the classroom contexts, and (e) Information Communication Technology (ICT) knowledge. Angeli and Valanides (2009) determined that these five domains work together in relation to each other. Angeli and Valanides (2009) further developed technology mapping as a practical tool for the development of ICT-TPCK. To assess preservice teachers' ICT-TPCK, participants completed two assigned technology-mapping tasks that were assessed by themselves, peers, and an expert grader using specific criteria that correlated to the ICT-TPCK framework on a five-point scale. Scores were statistically analyzed and the researchers concluded that through the teaching of ICT-TPCK, preservice teachers improved in overall design efficiency. This form of assessment and theory development is valuable and practically relevant, but for larger scale research, it is impractical. The conclusions of Angeli and Valanides (2009) are essential to building understanding that the TPACK framework is broad and that within the framework, multiple contexts can be defined differently. The illumination of context and teacher epistemology represents consideration of how individual TPACK development can vary.

PT-TPACK

The instrument chosen for this study was developed by Lux (2010), revised by Lux et al. (2011), and is titled the Pre-service Teacher-Technological Pedagogical Content Knowledge Survey Instrument (PT-TPACK). This instrument effectively assesses the self-perceived level of TPACK of preservice teachers in relation to the program in which they are trained (Lux, 2010; Lux et al., 2011). Similar to the instrument developed by Schmidt et al. (2009), this instrument assesses the individual constructs of

the TPACK framework as presented by Mishra and Koehler (2006), however the PT-TPACK is broader in scope, because it is not limited to a specific level or content area specialization. The PT-TPACK measures participants' self-perceptions based on statements related to the constructs in the TPACK framework. This style of instrument is similar to many teacher self-efficacy instruments in that it measures the participants' understanding of themselves in relation to a task or action (Bandura, 1977).

In developing of the PT-TPACK, Lux et al. (2011) found that TCK as a theoretical construct did not statistically contribute to the overall development of preservice teachers' TPACK. Possible explanations for this are that classroom instructional decisions for preservice teachers are determined mostly by pedagogical knowledge, or that lack of experience influences preservice teachers' perceptions of discipline specific technology applications.

> The lack of presence of TCK might possibly be due to the structured nature of a teacher preparation program that emphasizes subject matter knowledge, pedagogical knowledge and the intersection of the two. By reinforcing the importance of this concurrent consideration of pedagogy and content (PCK), it might be challenging or impossible for a preservice teacher to accurately assess their technological content knowledge (TCK) without being influenced by their pedagogical knowledge (PK)….In other words, a preservice teacher might simply not have sufficient opportunities to think about and consider technology and content without contemplating how it is influenced by pedagogy. (Lux et al., 2011, p. 427)

The PT-TPACK is meant to be a tool to assess the effectiveness of a preservice teacher program in relation the development of the preservice teachers' TPACK. Thus, PT-TPACK can be used to identify both strengths and shortcomings of preservice teacher programs (Lux, 2010; Lux et al., 2011). The application of this instrument to this research was particularly applicable in that the development of preservice teachers' TPACK during their internship experience was the central concern of this study.

The Internship Experience

Field experience is considered highly important in the process of teacher training, (Arnold, 1993; Cochran-Smith, 1991; Greenberg, Pomerance, & Walsh, 2011) and it is the seminal portion of most teacher preparation programs in the United States. Teacher interns leave the confines of the university and are placed in the classrooms alongside a mentor teacher to complete their training and fulfill requirements to obtain their teacher certification (Greenberg et al., 2011). Many factors contribute to the success or failure of the internship experience including placement and setting, cooperating/mentor teachers, university supervisors, and interns' perceptions and philosophies. Additionally, technology and the interns' abilities to use technology can contribute to the success or failure of the internship experience (Ertmer, 2005; Kumar & Vigil, 2011). Teaching in a technology-rich environment that supports students' current and future successes is of paramount importance, and the development of teachers who can integrate technology into the classroom is needed (Levine, 2006; Greenberg et al., 2011). The internship is the final piece of the teacher preparation program, and it has often been considered the most integral piece (Levine, 2006). Thus, exploring the factors that impact the internship experience contributes to the understanding of change and the impact of the internship on the preparation of preservice teachers.

Setting

School placement and the setting in which the intern is placed contributes greatly to the interns' development as an educator (Grossman, Ronfeldt, & Cohen, 2012). Much of the research regarding school placement and setting has focused on the development of culturally responsive teachers who teach underserved students in urban settings (Grande,

Burns, Schmidt, & Marable, 2009; Greenberg et al., 2011; Helfeldt, Capraro, Capraro, Foster, & Carter, 2009; Lloyd, 2007; Ronfeldt & Reininger, 2012). Research of this type is both necessary and relevant because much of the domestic population is found in multicultural urban settings. Conclusions have been mixed in regards to the placement of interns in schools with a large population of underserved students (Grossman et al., 2012). One perspective is that although teaching in an urban, multicultural, environment may be difficult because a large portion of preservice teachers are white middle class females (Greenberg et al., 2011), preservice teachers learn through the process, become more seasoned, and gain from their experience (Grande et al., 2009; Knoblauch & Hoy, 2008). Other perspectives regarding teaching in urban, multicultural settings with underserved student populations are that the retention of teacher candidates is lowered when frustration with the setting and teaching experience rises, and added hours in urban schools are not necessarily beneficial for the intern (Grande et al., 2009).

The setting in which the intern encounters their clinical field experience is an overarching factor contributing to the development of the preservice teacher (Cochran-Smith, 1991; Huang & Waxman, 2009; Zeichner, 1986). Interns' perceptions of the teaching environment can affect their teaching efficacy either positively or negatively (Huang & Waxman, 2009). Psychosocial contexts and the perceived quality of the environment can influence the interns' satisfaction with teaching and influence their future decision making regarding their teaching career (Grossman et al., 2012; Huang & Waxman, 2009; Ronfeldt & Reininger, 2012). Huang and Waxman (2009) revealed that relational aspects of the work environment, including peer interest in discussing teaching

strategies, had the most influence on increasing professional interest and future career plans of preservice interns.

Mentor Teacher

The cooperating mentor teacher (here after referred to as mentor teacher) is a certified teacher with three or more years of experience who volunteers to work cooperatively with university faculty members and agrees to allow an intern to be placed in his/her classroom. The relationship between the mentor teacher and the intern is an integral factor in the development of the teacher candidate (Butler & Cuenca, 2012; Grossman et al., 2011), and it is a factor that could use some development (Orland-Barak, 2005). The mentor teacher spends the most time with the intern and can have the most influence on the intern's future practices and perceptions (Colton, & Sparks-Langer, 1992). For instance Valencia, Martin, Place, and Grossman (2009) concluded that the authority of the mentor teacher and the amount of autonomy provided to the intern could limit the development of alternative practices. Also, Smagorinsky, Jakubiak, and Moore, (2008) observed a young teacher candidate's teaching style change from constructivist and student-centered to the teacher-centered approach modeled by the mentor teacher. Although mentor teachers can limit the interns' development, they may allow the interns access to the whole world of teaching and can thereby confer a sense of legitimacy on interns throughout the internship experience (Cuenca, 2011).

The relationship between mentor teachers and the development of CK and PCK is underrepresented in professional literature (Grossman et al., 2011). This may be because the variable of the mentor teacher is abstract and does not fit in a conceptual mold. In recognition of the need to explore the role of the mentor teacher, research involving the

Professional Development School (PDS) model indicated a concerted effort by certain universities to train and develop mentor teachers in order to positively impact the intern and improve the clinical experience (Castle, Fox, & Fuhrman, 2009; Grossman et al., 2011; Rodgers & Keil, 2007). Through extensive investigation, the researcher found that no studies have been completed regarding the influence of mentor teachers on interns' TPACK.

Intern Supervisors

Intern Supervisors are university appointed personnel who supervise, assess, and coach the intern during the internship. These supervisors are an integral part of the development of the intern, but supervisors are at times considered less relevant to the learning process than the mentor teacher because the frequency of their interactions with the intern are limited (Fives, Hamman, & Olivarez, 2007; Grossman et al., 2011; Oh, Ankers, Llamas, & Tomyoy, 2005). Research suggests that more training and guidance of intern supervisors could enhance the supervisors' impacts on the development of the interns (Conderman, Morin, & Stephens, 2005; Grossman et al., 2011).

Intern Perceptions and Philosophies

An underlying understanding of constructivist philosophy is that learners bring a variety of experiences, biases, prior experiences, philosophies, and dispositions to the learning environment (Darling-Hammond, 1999). In the same way, the intern, the learner in this scenario, brings his/her own philosophies, dispositions, biases, and experiences to the internship, and these components can influence the learning process and performance of the intern. Pajares (1992) labeled these components as attitudes, dispositions, and

knowledge. Intern beliefs are incredibly complex, and they can be both a positive and a negative factor in the preparation and understanding of the intern (Pajares, 1992; Parker & Brindley, 2008). The seminal research regarding preservice teachers' beliefs comes from Pajares (1992). Pajares proposed sixteen fundamental assumptions of preservice teachers' educational beliefs:

- Beliefs are formed early and tend to self-perpetuate, persevering even against contradictions caused by reason, time, schooling, or experience.
- Individuals develop a belief system that houses all the beliefs acquired through the process of cultural transmission.
- The belief system has an adaptive function in helping individuals define and understand the world and themselves.
- Knowledge and beliefs are inextricably intertwined, but the potent affective, evaluative, and episodic nature of beliefs makes them a filter through which new phenomena are interpreted.
- Through processes may well be precursors to and creators of belief, but the filtering effect of belief structures ultimately screens, redefined, distorts, or reshapes subsequent thinking and information processing.
- Epistemological beliefs play a key role in knowledge interpretation and cognitive monitoring.
- Beliefs are prioritized according to their connections or relationship to other beliefs or other cognitive and affective structures. Apparent inconsistencies may be explained by exploring the functional connections and centrality of the beliefs.
- Belief substructures, such as educational beliefs, must be understood in terms of their connections not only to each other but also to other, perhaps more central beliefs in the system. Psychologists usually refer to these substructures and attitudes and values.
- By their very nature and origin, some beliefs are more incontrovertible than others.
- The earlier a belief is incorporated into the belief structure, the more difficult it is to alter. Newly acquired beliefs are most vulnerable to change.
- Belief change during adulthood is a relatively rare phenomenon, the most common cause being a conversion from one authority to another or a gestalt shift. Individuals tend to hold onto beliefs on incorrect or incomplete knowledge even after scientifically correct explanations are presented to them.
- Beliefs are instrumental in defining tasks and selecting the cognitive tools with which to interpret, plan and make decisions regarding such tasks, they play a crucial role in defining behavior and organizing knowledge and information.
- Beliefs strongly influence perception, but they can be an unreliable guide to the nature of reality.
- Individuals' beliefs strongly affect their behavior.

- Beliefs must be inferred, and this inference must take into account the congruence among individuals' belief statements, the intentionality to behave in a predisposed manner ant eh behavior related to the belief in question.
- Beliefs about teaching are well established by the time a student gets to college. (pp 324-326)

Preservice teachers' beliefs about teaching with technology are of particular concern to this study. Kumar and Vigil (2011) recognized that preservice teachers do not incorporate emerging technologies into their professional lives; instead they assimilate new technologies into informal situations. Teachers teach how they were taught, and the report from Kumar and Vigil (2011) implies that regardless of the technology situation, the teaching as you were taught cycle continues, purporting that a teacher-centered approach still dominates the pedagogical landscape (Ertmer, 2005). Ertmer (2005) proposed that although changing teacher beliefs regarding integrating technology, pedagogy, and content is difficult, small steps could be taken to increase teachers' utilizations of technology. Thus, this research revealed that preservice teachers' beliefs have a great impact on the internship experience and the TPACK of the preservice teacher.

Technology in the Internship

As mentioned above, technology has had a place in education since the 1940's, yet the influence of technology and its integration with pedagogy during the internship learning experience has not been well chronicled. Most studies include preservice teachers at various levels in their teacher preparation program, but no research has explored interns as an exclusive population. Along those lines, some studies explained results and mentioned student teachers or interns as a portion of the population. Graham

(2011) reported that interns who had been involved in a technology professional development program felt more confident than their inservice teacher counterparts in their abilities to solve technology related issues, develop technology integrated lessons, and teach children to use technology. Some studies have focused on the change in preservice teachers' understanding and development of TPACK while in methods courses (Graham, 2011; Pope, Hare, & Howard, 2005). Bullock (2004) published an exploratory case study that reported five categories of factors that enable or disable interns' abilities to integrate technology during the internship. The categories included instruction from the program, professors, and mentor teacher; personal and professional expectations; requirements of the mentor teacher, school, district, or state; technical support or availability; and attitudes, fears, and experiences prior to the field experience.

Rationale for this Research Study

The development of the preservice teacher in the midst of the current technologically rich society is of great importance (Berry, 2011). This literature review illuminated a variety of frameworks for integrating technology into the classroom, but recognized that the TPACK framework currently represents the best model for developing teachers who flexibly navigate the highly complex yet ill-defined field of the technology rich classroom environment. In addition, the internship experience presents as an integral part of preservice teacher education programs, but there has been little to no research regarding the development of knowledge including TPACK during the internship experience.

Summary

This chapter reviewed relevant research in relation to teaching with technology, frameworks for integrating technology in K-12 education, the internship, and factors in relation to the success of the internship experience. Technology is integral to the formal and informal education of children (Berry, 2011; Prensky, 2001). Therefore, it is essential for teachers to integrate technology into teaching. There are many frameworks that incorporate technology integration, yet the TPACK framework (Mishra & Koehler, 2006) exemplifies the necessary knowledge that is needed for preservice teachers to integrate technology and teaching practice. The PT-TPACK instrument (Lux, 2010; Lux et al., 2011) was developed to evaluate the self-perceptions of preservice teachers' preparedness in relation to their teaching program and the TPACK framework, and this instrument was chosen for this study because of its validity and application to EC-12 teacher education students and programs.

Literature and research on the internship or student teaching experience was also analyzed in this chapter. Several factors including setting, cooperating teacher, mentor teacher, and beliefs and philosophies influence the success of the internship. The development of the intern is incumbent on these factors and the interns' personal lived experiences during the internship. Adding to these factors is the influx of technology and the need for technology integrated instruction.

Finally, this chapter illuminated the need for additional research in relation to preservice teacher internships and the development of TPACK as well as an exploration of the actual use of technology during the internship experience.

CHAPTER THREE

Methodology

Introduction

The goal of this research was to examine the change in preservice teacher interns' perceived abilities to teach in the ever changing, technology focused 21st century, during one semester of a teaching internship. Teaching in a technology rich society incorporates the ability to flexibly utilize appropriate technological resources, both digital and non-digital, with effective pedagogy that is aligned with curriculum content (Lambert & Gong, 2010). The results of this study illuminated the effect a one-semester internship had on preservice teaching interns, and it revealed factors that contributed to the perceived preparedness of interns to teach in the technological age.

Research Design

This study is an explanatory multiple case study that employed a mixed methods case study research design. A case study examines a contextualized, specific, real-life phenomenon with multiple uncontrolled variables (Yin, 2009; Stake & Schwandt, 2006) and one or more cases in a bounded system (Creswell, 2007). The specific real-life phenomenon was the experience of interns from a private central Texas university during one semester of internship teaching. It was bound by the setting and context of location, three partner districts in central Texas, and time, the first semester of a teaching internship that began in August 2014 and ended November 2014.

The goal of this case study design was to explore the impact of a real-life intervention that is too complex for experimental strategies. The intervention was one semester of an internship experienced by senior level preservice teacher interns who were completing their degrees in education and seeking certification to teach in public schools in Texas. This study measured and reported the interns' perceptions of their preparedness to teach in public school environments with an emphasis on incorporating technology with pedagogy and content. Additionally, this research was designed to, "enlighten a situation in which an intervention has no clear, single set of outcomes" (Yin, 2009, p. 20).

The research design incorporated quantitative data garnered from an existing instrument that measures preservice teachers' self-assessed TPACK and qualitative data gathered through additional open-ended questions. This design was the best fit for the study because mixed methods research design reduces the weaknesses of either the quantitative only or qualitative only designs and bridges any gaps in the data that are not explainable by a single design (Johnson & Onwuegbuzie, 2004). Any weaknesses in the quantitative instrument was explained and offset by the explanatory qualitative data.

A general assumption embedded in the methodological philosophy of this study was the recognition that there are things in nature that can be described by employing a quantitative approach, and there are emerging phenomena and cognitive constructs that can be explored by employing a qualitative approach (Johnson & Onwuegbuzie, 2004; Luft et al., 2011). This research equally valued the quantitative and qualitative data and rigorously and systematically analyzed each in order to develop a complete description of the phenomenon experienced by the participants.

Research Objectives and Questions

The objective of this study was to gain insight and a better understanding of any change in preservice teacher interns during the internship experience in relation to teaching in a technology rich society. The intern experience is a bridge between the theory and methods learned in the college classroom environment and the full-time practice of a professional educator (Cuenca, 2010). It is a form of guided training in an authentic setting (Cuenca, 2010). This study sought to better understand the self-perceived change that occurred within the preservice teacher interns as they experienced the first semester of their internship in relation to effective teaching that incorporates content, pedagogy, and technology into classroom practice.

As with most human subjects research, it was beyond the scope of this study to control or examine all variables involved in the internship experience. It was the goal, however, to better understand the factors and variables that contribute to the change or lack of change in interns' self-perceived preparedness to teach in a technology rich society.

This study was based on the following research questions:

1. Does a one-semester (12-week) internship experience impact preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?
    a. Does intern placement contribute to the impact of preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?
    b. Does intern certification level contribute to the impact of preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?
2. In what way(s) does a one-semester (12-week) internship experience impact preservice teachers interns' understanding of technology and the infusion of technology with pedagogy and content?

3. In what way(s) does a one-semester (12-week) internship experience impact preservice teachers interns' described utilization of technology and the infusion of technology with pedagogy and content?

Context of the Study

Participants

The participants for this study were first semester preservice teaching interns who had completed all coursework in their teacher education program, except a required two-semester internship, at a private university located in central Texas. Interns were starting their initial semester of a two-semester teaching internship in classrooms specific to their self-determined, previously designated certification levels and content areas (i.e. middle level science, high school mathematics). University personnel within the School of Education's Office of Professional Practice made all intern placement decisions, and all interns were placed in classrooms within one of three independent school districts in the central Texas area. Prior to placement and the commencement of the teaching internship, each intern was required to have attempted one of two state mandated examinations including the Pedagogy and Professional Practice Exam or their chosen content exam that correlates to their desired certification. For all intern participants, the teaching internship experience represented the final piece of the their teacher preparation program.

The intern participants were purposely selected because they fit the profile of this multiple case study. Each participant was beginning the first semester of internship and was placed either in Alpha ISD (pseudonym), Beta ISD (pseudonym), or Delta ISD (pseudonym), in a setting appropriate to their desired certification level and content area. Interns seeking an elementary education certification were placed in elementary (grades Early Childhood [EC]-6) classrooms. Interns working toward a middle level (grades 4-8),

all level special education (grades EC-12), and secondary level (grades 7-12) subject specific certifications were placed in classrooms that correspond to their subject area; for instance an intern seeking certification in secondary history was placed in a high school history classroom. The number of participants by certification level is displayed in Table 3.2.

Table 3.2

Number of Participants by Desired Certification Level

Desired Certification Level	Number of Interns
EC-6 Generalist	17
EC-12 Special Education	6
4-8 Middle Level	4
7-12 Secondary Level	6
Total Participants	33

All participants were assigned a campus level mentor teacher, and all mentor teachers were employees of the school districts. In addition, each participant was assigned an intern supervisor from the university who assessed and coached the intern throughout his/her time in the internship.

Setting

Three distinct public school districts in central Texas under the management of the Texas Education Agency (TEA) housed the placement of all participants involved in this study. Each district had a unique demographic profile and each school district had an independent philosophy regarding the implementation and purchase of technology for educational purposes. All demographic data was collected from the latest available reported data provided by the TEA.

District Profiles. Alpha Independent School District (AISD) is a school district with 31 schools including six high schools (grades 9-12), six middle schools (grades 6-8), and 19 elementary schools (grades EC-5) AISD had a total student population of 15,254 as reported in 2013 (TEA, 2014a).

Beta Independent School District (BISD) is a public school district with 10 campuses including six elementary schools (grades EC-4), two intermediate schools (grades 5-6), one middle school (grades 7-8), and one high school (grades 9-12). BISD had a total student population of 7,456 as reported in 2013 (TEA, 2014a).

Delta ISD (DISD) is a public school district with five campuses including one primary campus (grades EC-1), one elementary school (grades 2-3), one intermediate school (grades 4-5), one junior high school (grades 6-8), and one high school grades (9-12). DISD had a total enrollment of 2,244 students as reported in 2013 (TEA, 2014a). Table 3.3 presents district student population by ethnicity.

Table 3.3

Student Population by Ethnicity

District	Hispanic	African American	White	Asian/Pacific Islander/Other
Alpha ISD	57%	30.2%	10.5%	2.3%
Beta ISD	21.1%	11.3%	59.6%	8%
Delta ISD	21.3%	3.6%	71%	4.1%

Of great concern to this study was each district's plan for implementation of digital technologies into the curriculum; it constituted the foundation research question 1.a. BISD planned and published an initiative that puts digital technology devices (iPads) into the hands of every student. At the time of this study, AISD was in the first year of a

three-year technology plan. This plan dedicated monies toward teacher professional development and explicated the goal of having one computer for every three students in the district. Although technology was used in the classrooms of DISD, at the time of this study, no formal plan for integrating technology and curriculum had been published by the school district. District technology plans presented as a contributing factor to this study because the plans potentially impacted the experience of the intern: district placement and availability of technology could have, therefore, significantly impacted the interns' understanding of integration of digital technologies to pedagogy and content.

University teacher education program profile. The teacher education program at the researched university is described by this website quote;

> The teacher education programs are challenging, and are designed to develop teachers who are knowledgeable, adaptable, reflective, competent, and morally prepared professionals ready to meet the challenges of dynamic and changing learning environments. These programs are child centered, focusing on guiding all children to achieve their best academic and personal potential. (University, 2015)

The teacher education program and development of course work, field experience, and knowledge formation is founded on the following seven principles:

1. Classrooms and schools must be learner-centered.
2. Formative assessment provides information about the student and assists in designing and adapting instruction.
3. A deep foundation of factual knowledge must be organized conceptually to facilitate its retrieval, application, and transfer.
4. Strategies are important in learning to solve problems and in becoming an independent, effective teacher.
5. Learning is developmental and influenced by the context.
6. Collaboration is important in creating a diverse learning community.
7. Reflection deepens the understanding of effective practices. (Borko & Putnam, 1996; Bransford, Brown, & Cocking, 2000; Darling-Hammond, 1999; Murray, 1996) (University, 2013, p.8)

The seven tenets of the teacher education program have helped develop a comprehensive and effective educational experience for preservice teachers. It is interesting to note that these seven tenets do not include a technological component.

At the time of the study, the teacher preparation program at the participating university had a total student population of 409 as reported in the Spring 2014 semester. Ninety-one percent of the students enrolled in the teacher education program were female and nine percent of the students were male. The class designations were as follows: 21 % were classified as freshmen, 22 % were classified as sophomores, 22 % were classified as juniors, and 35 % were classified as seniors. The ethnicity percentages of university teacher education students by race were as follows: African American = 3%, Alaskan Native/American Indian = 0.5%, Asian = 2%, Hispanic = 7.5%, Multiracial = 4.5%, and White= 82.5%.

The school of education at the participating university offers certification programs in the multiple disciplines and levels of the K-12 spectrum from Early Childhood (EC) through High School. The certifications offered are:

- EC-6 Generalist
- EC-6 Generalist Dual Gifted and Talented
- EC-6 Generalist Dual Special Education
- EC-12 Physical Education Sports Pedagogy
- EC-12 Special Education
- 4-8 English Language Arts
- 4-8 Mathematics
- 4-8 Science
- 4-8 Social Studies
- 6-12 Business
- 7-12 English Language Arts
- 7-12 Mathematics
- 7-12 Life Science
- 7-12 Science
- 7-12 Social Studies.

For the sake of this study these certifications were grouped into four categories including elementary generalist (grades EC-6), all level special education (grades EC-12), middle level (grades 4-8), and secondary (grades 7-12)

All of the school districts described above are partnered with the central Texas university through a Professional Development School (PDS) model. "The Mission of the University and Professional Development School Partners is to enhance student learning through teacher quality at all levels" (University, 2013, p.4). This model partners the local school districts' individual schools and the university in a unique reciprocal relationship with the goal of developing high quality teachers and ensuring student success. The PDS model as implemented by the University is different from traditional models in multiple ways. First, it allows preservice teacher candidates the opportunity to experience field experience early on and throughout their teacher education program. Because of the partnership between the school districts and the university, preservice teachers engage in multiple teaching and tutoring field experiences throughout their undergraduate training. Second, this PDS model creates a unique partnership between the preservice teacher program and the schools in which candidates are placed.

A support network between the districts, schools, and the university has been developed and is in existence at each location for the development of the preservice teacher. This network includes the individuals employed by the school district including the mentor teachers, the site coordinator, and principals, and the university educators listed as clinical instructors, resident faculty members, university liaisons, and intern supervisors. Each person in the network has multiple responsibilities described in the participating university's Professional Development School Teacher Education

Handbook (University, 2013). Important to this study is a general description of the developed roles and responsibilities within the PDS network as they relate to the interns and the interns' experiences during the internship.

All PDS administrative responsibilities including budgeting and funds, intern placement, and logistical issues are a collaborative responsibility of the partner school principal, the campus site coordinator, and the university liaison. Other stakeholders included in the PDS network but not directly related to this study included resident faculty and clinical instructors. The development of the PDS network is integral to the success of the school and university partnerships, but of concern to this study were the interns and those who directly interacted with the intern, including the mentor teacher and the intern supervisor.

The mentor teacher is an employee of the school district and a fulltime certified teacher with at least three years teaching experience who hosts the intern in his/her classroom and serves as a mentor to the intern. This person had the most direct contact with the intern during this study. The responsibilities of the mentor teacher include contributing to the professional development of the intern by coaching and collaborating with the intern in all areas of teaching during placement and employing a co-teaching stance that allows the intern the opportunity to engage in guided pedagogical practice. Finally, the mentor teacher is partially responsible for assessing the skills and development of the intern.

The intern supervisor is an employee of the university, a certified teacher, and is the teacher of record for his/her assigned interns. Each intern supervisor supervises multiple interns. The intern supervisor is also responsible for coordinating all

collaborations with the partner school, the mentor teachers, and the interns for the continued professional development of the interns. Intern supervisors are responsible for formal and informal observations and assessments of the interns' teaching skills and practices, they are also responsible for identifying areas the intern needs to improve. Finally, the intern supervisor role includes additional teaching that supports the interns' continued development into professional educators.

Gaining Access and Building Trust

Qualitative and mixed methods research is different from experimental research in that the researcher has a vested interest in the research. The researcher in this study had primary interest in educational technology and was employed by the participating university as an expert in educational technology. The researcher also played a primary role in designing and teaching the two required educational technology courses. It was the hope of the researcher that the relationships he built with the interns in the past would contribute to the assumption that participants would respond honestly and comprehensively on all surveys.

The researcher's role in the research was as an independent observer who was primarily interested in the development of the intern as a professional educator in a technology rich society. The researcher had interacted with the participants in the past but had no interaction with them during the internship phase of their teacher education program. Additionally, although the researcher was the teacher of record for two required educational technology courses previously completed by all participants, he did not have all the intern participants in his course sections.

Data Sources

Data was collected through a two-part online survey that incorporated two separate instruments. Instrument one, the Pre-service Teacher Technological Pedagogical and Content Knowledge Survey (PT-TPACK survey) (Lux, 2010; Lux et al., 2011), was used to gather quantitative interval data that assessed preservice teachers' perceptions of their preparedness for teaching with Technology, Pedagogy, and Content Knowledge (See Appendix). The second instrument was a qualitative open-ended inquiry instrument that was used to gather data related to the interns' expectations and experiences for teaching within the TPACK framework.

Quantitative Instrument

The PT-TPACK instrument was developed using the TPACK framework developed by Mishra and Koehler (2006). The goal of the development of the instrument was to create a reliable and valid instrument "that could be used to assess preservice teachers' perceptions of TPACK" (Lux et al., 2011, p. 419). It was anticipated that these perceptions would then lead to insights that could improve teacher preparation in the areas of curriculum, program development, and field experiences. The PT-TPACK instrument uses a four point Likert scale to assess each of the six domains of the TPACK framework.

Lux (2010) developed the PT-TPACK using quantitative and qualitative measures for instrument development. Initial scale development was based on an extensive literature review, an understandability study, and a pilot survey of 45 items. The instrument was revised after dimensionality was examined using exploratory factor analysis. Cross-loaded and items with low correlation were removed from the instrument

leaving a 27-item survey. This survey assesses the participant's self-perceived preparedness in relation to the constructs of the TPACK framework. It is similar to instruments that are intended to evaluate the level of teacher self-efficacy in that it is evaluating the participant's understanding of themselves in relation to a specific task or ability (Bandura, 1977). This instrument does not measure the participant's actual ability or actions in a classroom, however proponents of self-efficacy instruments contend that efficacy correlates to actions, goal setting, and levels of attrition in relation to a specific task (Erdem & Demirel, 2007; Tschannen-Moran, Hoy, & Hoy, 1998).

Construct Validity

Six interpretable factors were verified using Varimax rotation with Kaiser Normalization (Lux, 2010; Lux, et al., 2011). These factors correlate with Mishra and Kohler's (2006) hypothesized TPACK framework. The factors include pedagogical knowledge (PK), technological knowledge (TK), content knowledge (CK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), and technological pedagogical and content knowledge (TPACK).

Internal Validity

Internal consistency was reported to be high with the following coefficient alphas reported in Table 3.3. Six of the seven constructs were considered acceptable because the alpha was reported as greater than 0.60.

One construct of the hypothesized framework was not considered valid for this instrument. Technological content knowledge (TCK) was argued by Lux et al. (2011) to be a construct that is not distinguishable within the context of teaching. Lux (2010)

proposed that a teacher does not consider a technological tool outside of the context of pedagogy. Therefore, it was determined that TCK was not valid within the instrumentation of the PT-TPACK.

Table 3.4

Internal Consistency of the PT-TPACK Survey

Dimension of the framework	Coefficient Alpha (α)
TPACK	0.90
TPK	0.84
PK	0.77
CK	0.774
TK	0.75
PCK	0.65
TCK	<0.60

External Validity

Because results from this multiple case study were bound by the sample, time, and context, external validity was not considered. The purpose of this study was to investigate the phenomenon of the change in the intern in relation to teaching with technology, therefore the results applied directly to the university and programs involved in this study.

Qualitative Instruments

Two instruments were used to gather qualitative data. The qualitative instruments were comprised of a series of open response items posed to the interns through surveys supplemental and complementary to the PT-TPACK survey (See Appendix). These open

response items were derived from the TPACK model and informed the research by providing additional data regarding individual interns' understandings, expectations, and reported uses of technology aligned with pedagogy and content. The survey items aligned with the research questions and provided depth of information for the purpose of enriching the statistical analysis of the PT-TPACK instrument. The items on the pre-intervention survey served to measure the interns' expectations of technology integration before the internship experience began. These items were:

- List the specific technologies you plan to incorporate into your teaching practice this semester.
- What classroom experiences do you want your students to have that involve the incorporation of technology?
- Why do you want your students to have the experiences described above?
- How do you expect your understanding of the content you will be teaching to impact the experiences you described above?
- What classroom factors do you expect to affect your ability to incorporate the above experiences?

Qualitative items on the post-intervention survey were designed to gather data related to the interns' experiences and practical uses of technology applied to teaching while involved in the internship experience. The qualitative items posed on the post-intervention survey were:

- List the specific digital technologies you incorporated into your teaching practice this semester.
- Describe the classroom experiences you offered your students that incorporate technology?
- What was your rationale in providing the experiences above?
- How did your understanding of content impact the experiences described above?

- What factors motivated and assisted you to incorporate technology into your classroom experiences?
- What barriers were in place that hindered the incorporation of technology into your classroom experiences?
- Based on your experience this semester, how do you plan on incorporating technology into your future classroom practice?

Administration

This study was bound by context and time. All subjects were volunteer participants who were entering their first semester of a two-semester classroom internship in the fall semester of 2014. The pre-intervention survey, including the combined instruments, was administered digitally beginning August 11, 2014, and all pre-intervention data was collected before August 25, 2014 when interns began their internship interactions with students.

The interns completed the post-intervention administration of the combined instruments electronically after the 12th week of their first semester of internship. The first date the instrument was available was October 31, 2014, and all responses were recorded no later than November 14, 2014. The schedule for completion of the post-intervention survey coincided with the participating university's schedule for interns. Some participating interns participated in a study abroad program that limited their availability at the end of the fall 2014 semester.

Data Analysis

Both quantitative and qualitative data was collected concurrently and analyzed for this explanatory multiple case study. Quantitative data was analyzed using statistical procedures. Demographic data including gender, age, certification, degree plan, district,

and school placement of the interns were gathered. Descriptive statistics from the PT-TPACK (Lux, 2010; Lux et al., 2011) were reported. Each data analysis procedure in this study was directly connected to the research questions. To address the first question of whether a one-semester (12-week) internship experience had an impact preservice teacher interns' perceived preparedness to effectively teach in the 21st century, it was necessary to analyze quantitative scores on the PT-TPACK from the whole group of participants. For this purpose, a Hotelling's T^2 test for a multivariate dependent sample (Hotelling, 1957) was utilized to verify and report any significant difference of total score from the pre-internship survey to the post-internship survey. To address the research sub-questions regarding the impact of the variables of intern placement and certification level on the TPACK constructs, descriptive statistics were analyzed.

As stated previously, the PT-TPACK allows for the measurement of interns' self-perceived preparedness to teach in a technology rich society. Because the data generated through instrument responses is interval data, similar to a measurement of self-efficacy, a spectrum of self-perception for each validated construct of the TPACK framework was presented. Therefore, the interns placement on the spectrum of the TPACK construct was of primary concern to this study. The PT-TPACK instrument includes seven questions in the TPACK construct and is measured on a four point Likert scale where responses to statements were valued as follows; strongly agree corresponds to a values of one, agree corresponds to a value of two, disagree corresponds to a value of three, and strongly disagree corresponds to a value of four. Therefore, the lower the score within a specific construct the closer the interns' confidence of preparedness for that particular TPACK construct. This allowed the interns' self-perceived preparedness to be analyzed across a

spectrum. Because the TPACK construct is the integration of all the necessary knowledge bases for teaching in a technology rich society (Mishra & Koehler, 2006), the scores from the PT-TPACK on the TPACK construct were considered of highest importance to this study. Figure 3.2 is a graphic representation of the TPACK construct as the spectrum of self-perceived preparedness to teach in a technology rich society. The TPACK target represents the highest confidence an intern could report in consideration of their self-perceived preparedness to teach with TPACK. Individual TPACK scores from the PT-TPACK were analyzed in relation to their placement on the spectrum of self-perceived preparedness to teach in a technology rich society. It is important to note that this is a spectrum of self-perception and this study sought to analyze change over the course of the internship. Lack of movement between the pre-internship PT-TPACK survey and the post-internship PT-TPACK survey indicates no change. Movement, either toward the TPACK target or away from the TPACK target did not correspond to positive or negative movement; movement in any direction was indicative of change in the interns' self-perceptions of preparedness to teach in a technology rich society. These perceptions did not directly correlate to the interns' abilities, actions, or actual preparedness to teach in the current classroom environments.

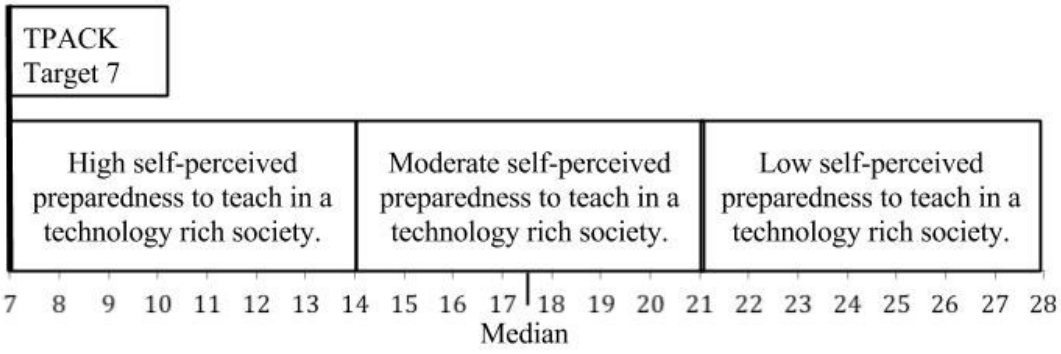

Figure 3.2. Spectrum of self-perceived preparedness to teach in a technology rich society based on the TPACK construct.

Qualitative data collected from the open-ended items on the second administration of the integrated survey was used to address research questions 2 and 3. Data gathered during the qualitative phase of the study was used to explain and provide a deep sense of understanding of the participants' dispositions, expectations, and understandings of teaching in a technology rich society.

Six embedded cases were selected as exemplar cases and were analyzed using both the qualitative and quantitative responses. These six cases were selected because initial analysis revealed weaknesses in many of the qualitative responses provided by the whole group. These six were selected to represent exemplar embedded cases based on intern placement, certification level, and quality of qualitative responses. The qualitative responses from these six participants were coded and analyzed for patterns and themes using the a priori framework of TPACK. Qualitative data was then matched with individual participant responses to the PT-TPACK with special consideration of the TPACK construct. This data provided explanatory responses to the numerical interval data generated by the PT-TPACK instrument, specifically the movement along the spectrum of self-perceived preparedness to teach in a technology rich society. Moreover,

coding of the qualitative data and the identification of trends and themes across responses allowed for the telling of individual interns' narratives in comparison to the quantitative analysis.

The remaining 27 participants were not selected for qualitative analysis, but were considered a separate case. Quantitative analysis of the embedded group of 27 was included in the whole group analysis and added to the overall results, but this group did not provide qualitative data in quantity or quality that could have added to the analysis and conclusions of this study.

Rigor

Rigor in any academic study is of paramount concern. The researcher in this study took a pragmatic philosophical approach to this mixed methods research (Johnson & Onwuegbuzie, 2004). This philosophy values both the quantitative and qualitative research methods, and "offers a practical and outcome-oriented method of inquiry that is based on action and leads, iteratively, to further action and the elimination of doubt; and it offers a method for selecting methodological mixes that can help researchers better answer many of their research questions" (Johnson & Onwuegbuzie, 2004, p. 17).

A general assumption embedded in the methodological philosophy of this study was the recognition that there are things in nature that can be described by employing a quantitative approach, and there are emerging phenomena and cognitive constructs that can be explored by employing a qualitative approach (Johnson & Onwuegbuzie, 2004; Luft et al., 2011). Quantitative and qualitative data in this study were considered to have equal status and were collected concurrently. All data was used to form conclusions based on the research questions and the literature review.

Quantitative rigor is based on the validity and reliability of the instrument and the generalizability of the findings. The instrument utilized in this study for the quantitative portion of the survey had been statistically verified and determined reliable. The construct of generalizability was not relevant to this study as limitations of time and context bound this study as a case study. This study did not seek to infer a causal relationship; rather it explored possible factors and changes that occurred over a specified period of time for a particular group of people.

Qualitative rigor, or trustworthiness, relies on the research methods utilized to develop credibility, transferability, and dependability. The research design of this study was developed with a credible quantitative instrument that complemented the qualitative items developed in alignment with the research questions and a priori framework of TPACK. Although there was no prolonged exposure or observations as required with ethnographic or phenomenological research (Creswell, 2007), this multiple case study developed credibility by analyzing quantitative data in relation to qualitative item responses from multiple sources (interns) during a specified time and context. A rich description of the context of the study was provided to allow for transferability to similar contexts. Triangulation of data was inherent in this study because multiple methods of data collection warranted multiple methods of data analysis including statistical methods, qualitative coding, and matching.

Ethical Considerations

As with all research involving participants, there was some risk to the participants. In this case, there were few evident risks. Potential risks included an outcome of the analysis contrary to what the participants desired or predicted or the

identification of participants' information. The following measures were used to minimize the risk for all participating interns and the participating institution.

All data collected was kept completely confidential and anonymously coded to insure privacy of all participants. Names of participants and identifying information remained confidential and were not cited in the study or possible future publications. The privacy of those volunteering for the study was guarded with great care. Names of participants were changed and pseudonyms were used in all data collected and in all written and digital documents related to the study. In addition to the above precautions, all printed documents were kept in a locked safe and all digital files related to the study were password encrypted and saved on a secure server.

There were no evident ethical issues regarding the treatment phase of this study. The treatment phase was not adjusted, changed, or modified in any way. All data collection occurred before the internship experience began and concluded after 12-weeks of the first semester of the internship experience. Participation in this study was voluntary and participants provided consent to participate before any data was collected.

CHAPTER FOUR

Results

Introduction

This mixed methods multiple case study was designed to examine the impact of a 12-week internship on preservice teacher interns' perceived abilities to teach in a technology rich society, their understanding of the ways in which technology, pedagogy, and content infuse in the classroom, and their described utilization of technology. To examine these components, both quantitative and qualitative data for each participant was collected and analyzed. This chapter will report the data collected and will present results that emerged over the course of the study. Data was collected from 33 participants' responses to mixed methods surveys completed prior to the internship and again after the completion of one semester of a two-semester internship experience. The survey was distributed to all interns who began the first semester of their internship in the fall of 2014. Of the 62 possible participants, 42 completed the pre-internship survey administration, and from those, 33 completed the post-internship survey. Descriptive statistics and pertinent demographic data will be reported for the group of 33 intern participants. Additionally, six embedded cases were chosen to exemplify individual experiences in the internship. Each embedded case will be described, and quantitative findings as well as qualitative themes that emerged from open-response items will be presented for each case. An additional embedded case of 27 participants contributed to the whole group quantitative results, but these interns were not selected for further

qualitative analysis because of low response rates and limited explanations on the qualitative surveys. Results for both the whole group and the embedded cases were aligned with the research questions.

Research Questions

The data analysis was driven by the research questions below:

1. Does a one-semester (12-week) internship experience impact preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?
    a. Does intern placement contribute to the impact of preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?
    b. Does intern certification level contribute to the impact of preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?
2. In what way(s) does a one-semester (12-week) internship experience impact preservice teachers interns' understanding of technology and the infusion of technology with pedagogy and content?
3. In what way(s) does a one-semester (12-week) internship experience impact preservice teachers interns' described utilization of technology and the infusion of technology with pedagogy and content?

Demographic Information

Demographic data was gathered as a component of the pre-internship administration of the online survey. Participants in this study included 33 interns beginning the first semester of a two-semester internship. Of the 33 participants, 17 were seeking certification as elementary teachers (grades EC-6), six were seeking certification in all level special education (grades EC-12), four were seeking certification in middle level (grades 4-8), and six were seeking certification as secondary teachers, (grades 7-12)

in business, mathematics, social studies, or English. Thirty-one participants were female and two were male (See Table 3.2).

Six participants were purposefully chosen as individual embedded cases within this study and the other 27 interns were included in the whole group analysis as a separate case. Selection of the individual cases was based on factors relating to the research questions including certification level and district placement as well as quality and completeness of responses on the qualitative surveys. In addition, it was determined that these six interns' quantitative responses paired with their qualitative responses provided a window into the internship experience in relation to the interns' perceived preparedness to teach with technology. Descriptive information for each of the embedded case participants will be presented later in this chapter through profile description and analysis of each embedded case.

Quantitative Analysis

Whole Group Quantitative Analysis

The PT-TPACK instrument was used to gather data in order to quantify the participants' self-perceptions of their preparedness to teach in a technology rich environment. The PT-TPACK was administered in August 2014, before the interns were placed in their initial internship, and then a post-internship administration was conducted in November following the completion of 12 weeks of the internship. The PT-TPACK is an instrument that measures the self-perceptions of preservice teachers preparedness to teach in relation to the TPACK framework (Lux, 2010; Lux et al., 2011).

The six interpretable TPACK factors from the PT-TPACK (Lux, 2010; Lux et. al, 2011) instrument include Technology Knowledge (TK), Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Pedagogical Knowledge (TPK), Pedagogical Content Knowledge (PCK), and Technological Pedagogical and Content Knowledge (TPACK). These factors were verified and consistent with Kohler and Mishra's (2006) hypothesized TPACK framework. The participants of this study completed the PT-TPACK survey, and the six factors listed above were analyzed for group differences between the pre-internship and post-internship administrations. A multivariate Hotelling's T^2 test for a dependent sample was completed (Hotelling, 1951; Hotelling, 1957). This statistical procedure was employed because it allows for analysis of the difference between pre-internship and post-internship means for each factor without increasing the alpha or type one error rate. Analysis revealed no significant difference between the pre-internship administration and post-internship administration means for the six constructs of the PT-TPACK; $T^2=1.1635$ with a p-value of 0.3545, which is far greater than the traditional p-value of 0.05, in the sample (n=33) of preservice teachers' self-reported perceptions of readiness to teach in a technology rich environment. Although some change and a wide range of variation in response values occurred for individual respondents, as a whole, the sample did not reveal a significant change based on any constructs of the PT-TPACK instrument. No additional statistical procedures were conducted because they would lead to a higher probability of a type two error. Moreover, because there was no inferential change in the whole group over the one semester (12-week) internship, the results were not generalizable. Additional quantitative

analysis included only descriptive statistics of the interns who participated in this study. Table 4.5 displays descriptive statistics of the intern group for each construct.

Table 4.5

Whole Group Descriptive Statistics; PT-TPACK

Variable	N	Mean Difference	SD	Range	SE
PK	33	0.73	2.72	16	0.47
TK	33	1.06	3.33	18	0.58
CK	33	0.18	2.38	15	0.41
PCK	33	0.3	2.11	13	0.37
TPK	33	0.97	3.69	20	0.64
TPACK	33	1.48	5.16	29	0.90

The purpose of research question 1 was to explore the impact of the internship experience on interns' self-perceived preparedness to teach in a technology rich society. Within the TPACK framework, the construct of TPACK represents the best example of the necessary knowledge bases required of teachers who are prepared to teach in a technology rich society. Although each construct can be considered and explored independent of each other, TK, CK, PK, PCK, TCK, and TPK all interact within the TPACK construct. Each construct is integral to teaching, yet it is the TPACK construct that exemplifies the integration of knowledge bases needed to teach in a technology rich society (Mishra & Kohler, 2006). None of the constructs changed significantly, yet by isolating the TPACK construct and calculating the differences between the pre-internship administration and post-internship administration of the PT-TPACK, the participants' movement along the spectrum of self-perceived preparedness was demonstrated and thereby provided evidence relevant to the impact of the internship on interns' perceived preparedness to teach in a technology rich society. The descriptive statistics reported in Table 4.5 revealed that as a group these participants indicated some movement toward the

target of highest perceived preparedness in their PT-TPACK results. Figure 4.3 presents the whole group TPACK results from the pre-internship survey and post-internship survey along the spectrum of self-perceived preparedness. This revealed some change in the interns group's self-perceived preparedness to teach in a technology rich society. However, as stated previously, this change was not significant. Additionally, these results indicated that the interns as a group reported being prepared on both the pre-internship and post-internship surveys as their results on both administrations were in the top third of the self-perceived spectrum of preparedness in relation to the TPACK construct. Over the course of the internship, the interns' TPACK scores indicated movement toward the target of highest perceived preparedness in relation to the TPACK construct. Thus, the 33 interns in the intern group sample perceived themselves as mostly prepared to teach in a technology rich society.

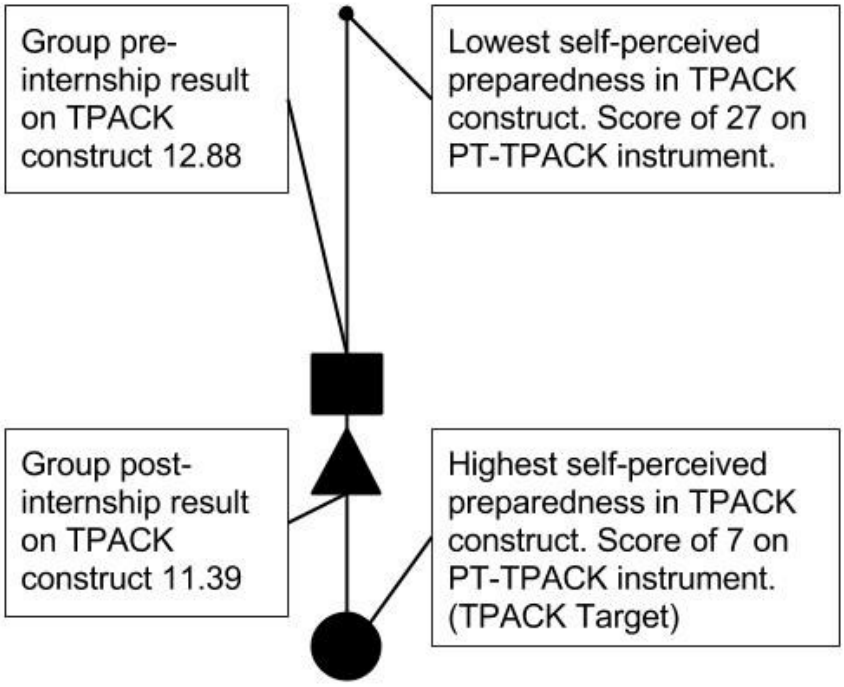

Figure 4.3. PT-TPACK overall group difference for TPACK construct by administration

Individual respondents within the whole group responded differently on each administration of the PT-TPACK within the TPACK construct. Figure 4.4 presents the individual scores on from the pre-internship PT-TPACK for the TPACK construct. The results indicated that all but five interns' results are above the median of 17.5. Further, 24 of the 33 interns reported TPACK scores in the top third of the spectrum of preparedness to teach in a technology rich society. The researcher considered the top third of the spectrum as representative of high self-perceived preparedness to teach in a technology rich society. Therefore, these results indicated that the majority of the individual interns perceived themselves as prepared to teach in a technology rich society as they entered the internship. Additionally, seven of the interns reported the highest level of self-perceived preparedness on the pre-internship PT-TPACK. Prior to their internship experience, these interns were at the target of highest self-perceived preparedness to teach in a technology rich society.

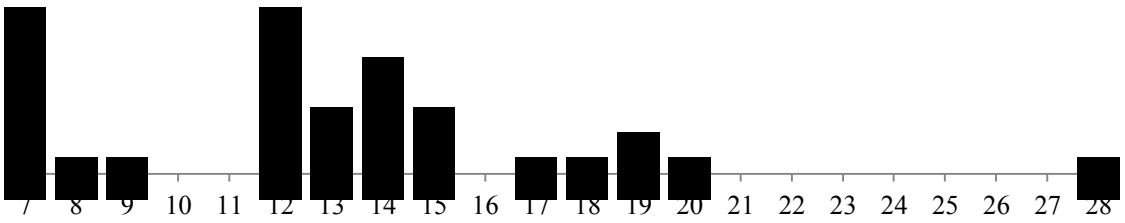

Figure 4.4. PT-TPACK pre-internship individual TPACK construct scores.

Table 4.5 displays the individual interns' post-internship PT-TPACK results for the TPACK construct. As with the pre-internship results, the bulk (n=27) of the interns' self-perceptions of their preparedness to teach in a technology rich society fell in the top third of the spectrum. Additionally, 13 interns reported perceiving themselves as having the highest level of preparation to teach in a technology rich society by reporting a score

of seven. The post-internship group analysis revealed an increase in the number of interns who reported meeting the TPACK target on the post-internship survey as only seven reported the same on the pre-internship survey.

Although the overall group statistics did not reveal a significant change, descriptive statistics indicated that individual interns' self-perceptions of their preparedness to teach in a technology rich society changed. Additionally, the pre-internship PT-TPACK results indicated that many of the interns felt prepared to teach in a technology rich environment by scoring in the top third of the spectrum of preparedness to teach in a technology rich society.

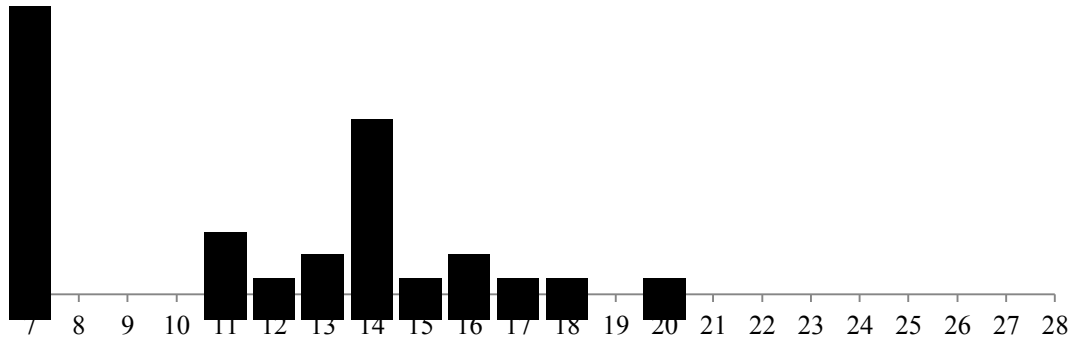

Figure 4.5. PT-TPACK post-internship individual TPACK construct scores.

The post-internship PT-TPACK group results revealed an increase in the number of interns hitting the target of highest self-perceived preparedness to teach in a technology rich society, thereby indicating that some change occurred for individual interns during the one-semester internship experience. Results from the whole group analysis indicated that out of 33 interns, over the course of a one-semester (12-week) internship experience, seven moved away from the TPACK target, nine showed no change, and 17 interns moved toward the TPACK target of highest self-perceived preparedness to teach in a

technology rich society. Of the interns whose scores indicated no change, six were at the TPACK target of highest self-preparedness to teach in a technology rich society.

Quantitative Data by District Placement

Research Question 1a was posed to investigate the factor of intern placement on change in the interns' perceived preparedness to teach in a technology rich society. Table 4.6 presents the descriptive statistics for change within the TPACK construct by district placement. Again, the TPACK construct exemplifies the necessary combined knowledge bases needed for teaching in a technology rich society.

Table 4.6

TPACK Construct Descriptive Statistics by District

District	Number of participants	Mean Difference	SD	Range
Beta ISD	17	0.88	3.90	15
Delta ISD	6	-0.5	2.95	9
Alpha ISD	10	3.7	7.35	25

The group mean differences suggested that the factor of district placement affected the self-reported TPACK of the interns; however, the large deviations from the mean indicated that the variation between respondents were too large to claim group differences. At the time of this study, Beta ISD (BISD) provided iPads for all students throughout the district in accordance with their technology plan. Alpha ISD (AISD) was in the first year of a three-year technology plan with the eventual goal of having one computer for every three students in the district. In addition, AISD had purchased various technologies at the campus level and the availability of these technologies varied by classroom. Delta ISD (DISD) did not have a technology plan but purchased some technologies at the campus level. On average, during the course of the internship, the

participants placed in BISD and AISD revealed movement toward the TPACK target.. DISD participants, however, reported movement away from the target of highest self-perceived preparedness in their self-reported TPACK. Although interns placed in each district indicated movement along the spectrum of preparedness to teach in a technology rich society, the amount and direction of the movement was clearly not a trend that could be inferred on the sample. This points to the need to interpret the interns' individual results within the case study.

Table 4.7 presents descriptive statistics for changes within the TPACK construct for the interns based on campus placement.

The data presented in Table 4.7 indicated some TPACK distinctions between the interns placed at different campuses, but small sample sizes and large deviations from the means rendered the data non-comparable. The Alpha One Elementary intern group (n=4) together had a high mean difference of 7.5 indicating movement toward the target of highest self-perceived preparedness on the TPACK construct, but the large standard deviation from the mean and the large range indicated variances between the interns placed at this campus. Data reported on all but three campuses, (Beta Three Elementary, Beta High School, and Delta Middle School) indicated movement toward the target of highest self-perception of preparedness or no movement along the spectrum based on the TPACK construct.

Table 4.7

TPACK Construct Descriptive Statistics by Campus

Campus Name	Number of participants	Mean Difference	SD	Range
Alpha One Elementary	4	7.5	10.47	25
Alpha Two Elementary	2	0.5	.071	1
Alpha Three Elementary	3	2	5.29	10
Alpha High School	1	0	0	0
Beta One Elementary	2	1.5	7.78	11
Beta Two Elementary	1	5	0	0
Beta Three Elementary	1	-2	0	0
Beta Four Elementary	3	2	3.61	7
Beta Five Elementary	1	1	0	0
Beta Six Elementary	1	7	0	0
Beta Middle School	3	1	1	2
Beta High School	5	-1.6	3.78	9
Delta Elementary	3	0	0	0
Delta Middle School	2	-3	4.24	6
Delta High School	1	3	0	0

The Beta High School group of interns (n=5) indicated a small movement away from the target of self-perceived preparedness on the TPACK construct. Of the five interns placed at this campus, the data revealed that two interns moved closer to the target by one point, one intern had no change, and the other two interns moved away from the target with differences of negative two and negative eight. There were large variances in these scores, but this may be an indicator that the five interns placed at Beta High School had individual lived experiences. Because the interns were placed at fifteen different campuses, the dispersion of interns among the schools hindered additional analysis of change based on campus placement.

Quantitative Data by Certification

Research question 1.b was posed to investigate changes in interns' perceived preparedness of their abilities to teach in a technology rich society based on their certification level. The participants in this study were seeking individual teacher certification at four levels. Table 4.8 presents descriptive statistics of and mean differences within the TPACK construct by certification level.

Table 4.8

TPACK Construct Descriptive Statistics by Certification Level

Certification	Number of Participants	Mean Difference	SD
Elementary (EC-6)	17	2.41	6.24
All Level Special Education (EC-12)	6	1.67	4.55
Middle Level (4-8)	4	1	0.82
High School (7-12)	6	-1	3.79

The greatest amount of movement toward the target of highest self-perceived preparedness occurred in the group seeking elementary certification, however the deviation in scores for this group indicated that there was no commonality of change within the certification level. For instance, those interns seeking certification as an elementary generalist in grades EC-6 (n=17) moved an average of 2.41 points toward the target of highest self-perceived TPACK, but one standard deviation from the mean was 6.24. This pattern continued in the group (n=6) seeking all level special education (grades EC-12) where average movement toward the target of highest self-perceived TPACK was 1.67, but one standard deviation was 4.55. The middle level certification level (grades 4-8) group (n=4) moved toward the target of highest self-perceived TPACK an average of

one point, but with only four participants there was a standard deviation of 0.82. Finally, the group seeking secondary certification (grades 7-12) (n=6) moved away from the target of highest self-perceived preparedness in the TPACK construct with an average of negative one point and a standard deviation of 3.79. These results revealed a wide variety of experiences and changes in the individual interns' responses. Because the participants' responses in the TPACK construct varied widely across all participants in all certification levels, it was important to examine individual cases to better understand the experience of the intern.

Case Analysis

All intern participants were provided the opportunity to respond to open-ended questions on the pre-internship and post-internship online survey instruments. The pre-internship instrument employed questions that were predictive of the interns' experiences and were intended to reveal factors contributing to their understanding and future application of TPACK. The post-internship instrument was developed to report the experiences that the participants had during the internship that revealed changes in their understanding and application of TPACK.

A decision was made to select six representative participants from the sample of 33 participants for the embedded portion of the study. This decision was made primarily because of low response rates from many participants on the qualitative questionnaire. Multiple participants did not respond to either the pre-internship administration or post-internship qualitative surveys leaving a dearth of data. In addition to considering the interns provision of pre-internship and post-internship qualitative data, when deciding to select the embedded cases described below, the researcher considered the quality of

interns' responses in relation to the questions posed as well as the interns' scores on the PT-TPACK instrument. Furthermore, consideration was given to the interns' results from both administrations of the PT-TPACK surveys. The research questions for this study included the factors of district placement and certification levels; therefore, secondary consideration included these factors in the selection of embedded cases. Finally, because these six cases were selected, the group of 27 interns who were not selected was considered a case. What follows is a discussion of all cases.

The embedded cases were purposefully selected (Creswell, 2007) to add to the discussion by providing rich data from which to draw conclusions regarding the interns' experiences. Although there were three school districts in which interns were placed, only interns placed in AISD and BISD were selected for individual study. Qualitative data from interns placed in DISD was incomplete and in most cases absent. Therefore holistic analysis of the six DISD interns was not possible; it was imperative that the participants selected as individual embedded cases provided rich qualitative data for analysis.

Demographic data from the embedded cases is provided in Table 4.9. To protect the individuals' identity, pseudonyms were assigned for each embedded case participant. The qualitative data from the six participants was coded using the a priori framework of TPACK. Embedded cases' open-ended responses were coded for each construct of the TPACK framework. Two coders viewed all responses and identified key words that indicated a construct from the TPACK framework. For instance, if a participant listed a technology that they knew about but did not list a pedagogy or allude to a content area, the response was coded as a TK response because it indicated Technological Knowledge. Sally's response of, "projector, smartboard or mobii, iPad, calculators" was coded as TK.

Table 4.9

Demographic Information for Embedded Cases

Name (pseudonym)	Age	Gender	Certification	Class Placement	Placement School
Sally	21	Female	7-12 Mathematics	Pre-Calculus	Beta High School
Jo	20	Female	EC-12 Special Education	Early Childhood	Beta Elementary
Rae	21	Female	4-8 English Language Arts	7th Grade English	Beta Middle School
Donna	21	Female	7-12 Mathematics	Algebra 1	Alpha High School
Kyla	21	Female	EC-6 Generalist	2nd grade	Alpha One Elementary
Kate	21	Female	EC-6 Generalist	Kindergarten	Alpha Two Elementary

An example of a response, provided by Kate, that was coded as the combined construct of TPACK is "For the more difficult lessons where I believed the students would have a harder time comprehending the content, I integrated technology to make the lesson more engaging and hands-on to help the students with comprehension." This response was categorized as TPACK because the respondent mentioned content and technology and alluded to pedagogical practices within the response.

The researcher and an unassociated third party who understands the TPACK framework independently coded the qualitative responses. The results of the coding were compared and calculated for inter-rater reliability based on the agreement of categorization for each response. The inter-rater reliability score was found to be 0.94. This score indicated a strong agreement between raters when coding categorical data (Landis & Koch, 1977). After meeting and discussing differences in results, the two coders came to full agreement on the coding of all the qualitative data.

Table 4.10 displays the pre-internship and post-internship coded responses by frequency and percentage for the embedded case group. Figure 4.2 displays the percentage of responses that fell under each construct of the TPACK framework for the pre-internship survey, and Figure 4.3 displays the same for the post-internship survey.

Table 4.10:

Response Frequency and Percentage for the TPACK Constructs

TPACK Construct	Pre-Internship response frequency/percentage	Post-internship response frequency/percentage
TK	(10)/33%	(11)/26%
PK	(5)/17%	(3)/7%
CK	(2)/6.6%	(2)/5%
PCK	(1)/3.3%	(1)/2%
TCK	(4)/13 %	(4)/10%
TPK	(6)/20%	(15)/36%
TPACK	(2)/6.6%	(1)/5%
Coded as NO CONSTRUCT	0	(5)/12%

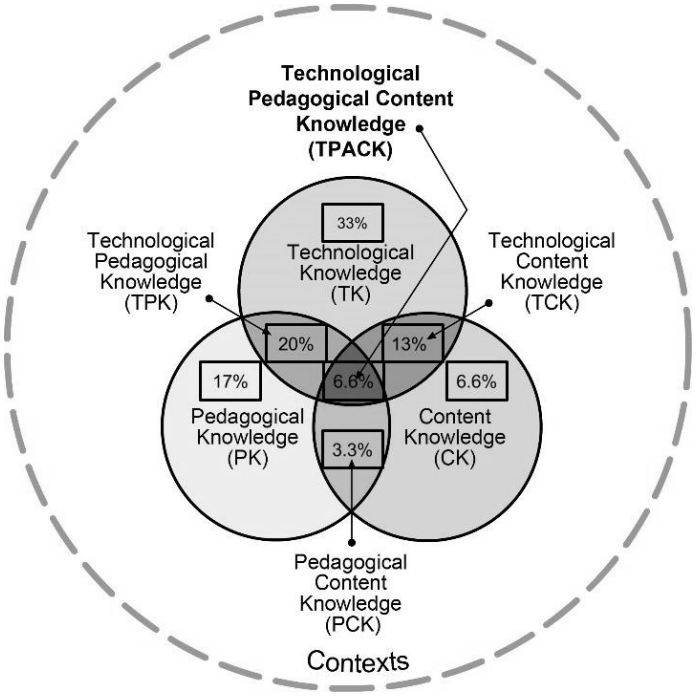

Figure 4.6. Embedded cases coded group qualitative responses for the pre-internship survey.

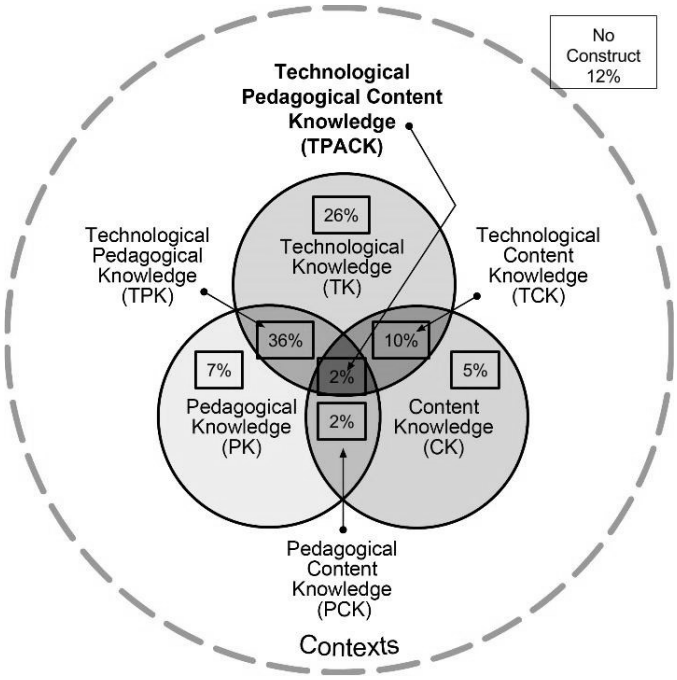

Figure 4.7. Embedded cases coded group qualitative responses for post-internship survey.

Collectively, the embedded case participants responded similarly on both the pre-internship and post-internship qualitative instruments, however there are some noted distinctions. First, the basic constructs of PK and TK both decreased in percentage of responses from the pre-internship to post-internship administrations, and the more complex construct built on these two, TPK, increased in percentage of responses for the embedded group. The pre-internship administration had 20% of the responses coded as TPK, and the post-internship administration had 36% of the responses coded as TPK. The TPACK construct decreased by one response or 4.6%, and all other constructs either decreased in percentage of responses or stayed relatively the same from the pre-internship survey to the post-internship survey. Twelve percent of the responses on the post-internship administration were coded as "no construct". Because little change was

observed through analysis of the group's qualitative responses in relation to the TPACK framework, it was necessary to further delineate and analyze individual embedded cases.

Embedded Case Analysis

The case analysis was conducted in alignment with an explanatory case study where the quantitative data was aligned to the qualitative data in order to develop a deep understanding of the phenomenon that occurred to a specific group of people at a specific time (Creswell, 2007). The first case that was recognized was the group of 27 interns. This group is a single case because they were not selected as individual representative cases. This decision came because there was an absence of qualitative data from these 27 interns. Within this group, multiple interns chose not to respond to the qualitative sections of either the pre-internship survey or the post-internship survey leaving large gaps of qualitative data that could not be analyzed. Additionally, multiple interns within this case group provided one or two word responses to the open-ended questions. These responses did not provide sufficient data to analyze. Possible reasons for the absence of data from this case group will be discussed in the limitations of this study. The quantitative descriptive statistics were analyzed along with the whole group statistics and separate analysis revealed no difference from the group findings.

The embedded six case interns' qualitative responses were matched with their responses on the PT-TPACK instrument in order to illuminate any change in the intern in relation to the TPACK framework over the course of the one- semester (12-week) internship experience. The qualitative items on the pre-internship survey matched the qualitative items on the post-internship survey and both aligned with the TPACK framework and the practice of teaching in a technology rich society. To report the

individual responses, tables and figures were created to display both quantitative and qualitative response data for each embedded case.

This section presents the results and analysis of each individual embedded case intern data from the PT-TPACK instrument as well as the qualitative instruments designed for this study. The PT-TPACK includes a four point Likert scale to assess each of the six domains of the TPACK framework (Lux, 2010; Lux et al., 2011). The instrument has 27 validated items that are broken into six sections in relation to the TPACK framework. Table 4.11 displays the number of items in a section along with the minimum and maximum interval scores an intern could have potentially responded for each construct.

As previously stated, the four point Likert scale for the PT-TPACK allows respondents to choose between "strongly agree, agree, disagree, and strongly disagree". Strongly agree corresponds to a values of one, agree corresponds to a value of two, disagree corresponds to a value of three, and strongly disagree corresponds to a value of four. Therefore, the lower the score in a specific construct the higher the confidence the participant reported related to that TPACK construct. Interval data allows for each construct to be observed as a linear spectrum of preparedness. For instance, the combined construct of TPACK, which is of most concern to this study, has a minimum possible score of seven; seven is considered to be the maximum self-perceived preparedness within the TPACK construct. Seven is therefore considered the target score. On the other end of the linear spectrum of the TPACK construct is the maximum total of 28. A score of 28 reveals the least measurable self-perception in the TPACK construct.

Table 4.11

Minimum and Maximum Interval Scores by TPACK Construct

Construct	Number of items	Minimum Total	Maximum Total
PK	4	4	16
TK	5	5	20
CK	3	3	12
PCK	3	3	12
TPK	5	5	20
TPACK	7	7	28

With the pre-internship/post-internship administration design, the differences between the totals for each section were calculated for each participant. If the difference between the pre-internship administration and post-internship administration resulted in a positive value, movement toward the target of highest self-perceived preparedness in the TPACK construct was indicated. Conversely, if the difference between the pre-internship administration and post-internship administration resulted in a negative value movement away from the target of highest self-perceived preparedness in the TPACK construct was indicated. By analyzing the pre-internship and post-internship quantitative survey results, the researcher was able to identify any change or movement along the spectrum of the TPACK construct. Individual embedded cases will be examined below.

Sally

At the beginning of this study, Sally was a twenty-one year old female beginning the first semester of a two-semester teaching internship. The internship experience represented the culminating piece of Sally's certification program. Sally was seeking certification as a secondary mathematics educator in grades seven through twelve. Sally's internship placement occurred in a Pre-Calculus class at Beta High School in Beta ISD.

Beta High School is a comprehensive public high school serving grades 9-12. Located in a suburban area in central Texas, Beta High School along with Beta ISD had a ubiquitous computing environment where they provided tablet-computing devices for all students and faculty for use in the classroom. In addition, Sally's Pre-Calculus classroom was outfitted with TI Graphing calculators for use in the mathematics program.

Sally's quantitative results. Figure 4.4 presents Sally's pre-internship and post-internship construct totals and table 4.12 displays the differences between Sally's totals. The negative differences presented revealed movement away from the target of highest self-perceived preparedness in each construct of the TPACK framework.

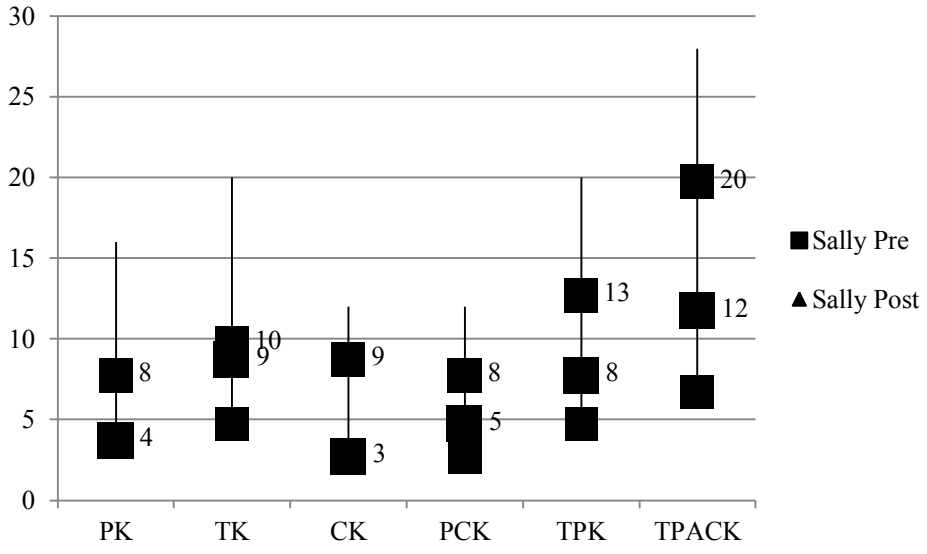

Figure 4.8. PT-TPACK results for Sally by construct and administration.

This indicated that Sally's self-perception of her preparedness to teach with technology had changed from the beginning to the end of the 12-week internship.

Table 4.12

Quantitative Differences on PT-TPACK for Sally.

PK	TK	CK	PCK	TPK	TPACK
-4	-1	-6	-3	-5	-8

Before beginning the internship, Sally reported that she felt prepared within each construct of the TPACK framework. Her pre-internship results indicated that she chose either "strongly agree" or "agree" for each response in each category. The pre-internship responses in the constructs of TK, PK, TPK, and TPACK allowed for some movement toward the target of highest self-perception of preparedness over the internship period. However her post-internship responses revealed movement away from the target of highest self-perception of preparedness to teach in a technology rich society based on the TPACK constructs. She chose "agree" or "disagree" on the post-internship administration. In each construct, Sally moved away from the construct target.

Sally's qualitative results. Table 4.13 displays Sally's response to each question posed on the qualitative instrument and the coding for each response, and table 4.14 reports the frequency and percentage of Sally's qualitative themes based on the a priori framework of TPACK. Based on the qualitative and quantitative results from the instruments used in this study, Sally's self-perceived preparedness to teach in a technology rich society changed over the course of the internship. Therefore, in relation to the first research question for this study, as an individual, Sally's internship experience did impact her self-perceived preparedness to teach in a technology rich society.

Table 4.13

Sally's Qualitative Responses

Question	Pre-Internship Response	Post Internship Response
Specific technologies that are used in the classroom.	projector, smartboard or mobii, iPad, calculators (TK)	iPads, document cameras, google docs, google forms, TI calculators (TK)
Experiences using technology	Modeling mathematics with math software programs, and using TI calculators to build a deeper understanding of the mathematics they are learning (TPACK)	Graphing activities, notes through doc cam, flipped classroom through iPad and Edmodo (TPK)
Rationale for providing learning experiences with technology.	Because it helps them to better understand mathematics and how everything is related. It has the ability to make math meaningful to them. (CK)	To better help my students understand the mathematics they were learning (CK)
How understanding of content impacts learning experiences with technology.	I expect that the better I understand the technology I'm using the better the outcome and student learning will be. (TK)	It helped (NO CONSTRUCT)
Classroom factors that affect incorporation of technology into learning experiences.	Availability of these technologies in my classroom, student abilities with technologies, and how well I prepare the lessons that use this technology (TPK)	My mentor teacher (NO CONSTRUCT)
Barriers that hinder the incorporation of technology.	N/A	The internet goes down sometimes, and some students have chosen not to have an iPad (TK)
Future plans to incorporate technology.	N/A	pretty similarly (None)

Sally's qualitative and quantitative responses complimented each other. The tone of Sally's free response items on the pre-internship survey administration was very confident, which correlated with her quantitative results. Sally's qualitative responses on the post-internship survey differed from the pre-internship survey responses; they were much shorter and less detailed.

Table 4.14

Sally's Qualitative Themes by Number and Frequency

TPACK Construct	Pre-Internship (Frequency)/Percentage	Post-Internship (Frequency)/Percentage
TK	(2)/40%	(2)/28%
CK	(1)/20%	(1)/14%
PK	0%	0%
TCK	0%	(1)/14%
PCK	0%	0%
TPK	(1)/20%	0%
TPACK	(1)/20%	0%
NON TPACK response	0%	(3)/44%

Although the number of responses for TK and CK remained the same from pre-internship to post-internship administrations, the post-internship administration had one response in the TCK field and three responses that did not fit in any construct of the TPACK framework. Additionally, although Sally had one response each for TPK and TPACK on the pre-internship administration, she did not have any responses within these same categories on the post-internship administration.

In relation to research question 1.a regarding the effect of intern placement on the intern's self-perceived ability to teach in a technology rich society, it is important to recognize that the district and school in which Sally experienced the internship had a ubiquitous computing environment where students and teachers each had computing devices. Though Sally and her students had access to iPads, there was no quantitative data provided indicating that her district placement had an effect on her self-perceived ability to teach in a technology rich society. Additionally, there were no distinguishing factors revealed in the qualitative data that district placement had an effect on Sally's self-perceived preparedness to teach in a technology rich society.

Research question 1.b examined the effect of certification level on the intern's self-perceived preparedness to teach in a technology rich society. Sally was seeking

certification as a secondary mathematics teacher. This certification level requires some specific technology knowledge in relation to her discipline, as it is common to use graphing calculators that are not used in other content areas or levels of mathematics instruction. This indicated that there is a need for Sally to have TCK (Feiman-Nemser, 1990). This was represented in Sally's qualitative responses as she responded that she intended to incorporate and subsequently did incorporate calculators in her classroom. Although calculators are a generally accessible technology that any teacher could use, their utilization in the secondary mathematics classroom requires additional understanding that is related specifically to the technological instrument and content. The construct of the TPACK framework was not included on the PT-TPACK but was evident in Sally's qualitative responses indicating that she has some unique understanding of technology needed for her discipline.

Research question 2 was posed to examine the ways in which the internship affected the intern's understanding of infusing technology with pedagogy and content. In regards to this question, there was little data from either the quantitative or qualitative responses to report movement toward the TPACK target. Sally's quantitative data in each construct of the TPACK framework indicated movement away from the target, and the explanatory items on the post-internship qualitative instrument were not answered with depth and left little to analyze. For instance, out of the seven possible responses on the post-internship survey, three could not be coded as being related to the TPACK framework.

There was little data from Sally to reveal any change in her understanding of infusing technology with pedagogy, however some movement away from the target of

self-perceived preparedness to teach in a technology rich society was noted. She wrote on the pre-internship survey that she wanted to provide experiences with technology to include "modeling mathematics with math software programs, and using TI calculators to build a deeper understanding of the mathematics they are learning." Her motivation for providing these experiences was, "it helps them to better understand mathematics and how everything is related. It has the ability to make math meaningful to them." In her post-internship response to the question of the experiences, she offered, "Graphing activities, notes through doc cam, flipped classroom through iPad and Edmodo". Her rationale for providing these experiences was, "to better help my students understand the mathematics they were learning." Sally's post-internship responses included less communication of depth, and her motivation to incorporate technology changed from making mathematics meaningful to understanding mathematics.

Research question 3 was posted to examine the ways the internship effected the utilization of technology. Sally reported using three additional specific technologies during the internship that she had not anticipated using prior to her internship experience. She reported that the main motivation for using technologies was direction and influence of her mentor teacher. Thus, the field experience allowed Sally to experience some additional technologies that she had not expected to utilize prior to the internship.

Summary of Sally's results. Sally, a secondary mathematics education major, spent the internship in a Pre-Calculus class at a school with a ubiquitous iPad-computing environment. Sally's quantitative responses indicated movement away from the target of highest self-perceived preparedness to teach with technology; a pattern that was also evident in her qualitative responses as Sally's post-internship responses were brief, not

explanatory, and were limited in their relation to the constructs of the PT-TPACK. Sally's movement away from the TPACK target may have been the result of being confronted with the complex and ill-defined realities of teaching (Woolfolk, 1998).

Sally's unique certification level required some additional TCK. Sally expected to incorporate discipline specific technologies, like a TI graphing Calculator, into her teaching. This indicated TCK and an understanding that her discipline has some specific technologies that enhance teaching within the discipline. The qualitative data in Sally's case complimented the results from the quantitative data. Forty-four percent of Sally's post-internship responses were coded as having no relation to the TPACK framework. Additionally, in response to the question regarding the influences on the use of technology in the internship, Sally reported on the post-internship survey that her mentor teacher was the only influence. Her rationale for providing students with experiences with technology indicated change in her understanding of student-centered incorporation of technology with pedagogy and content.

Though Sally was in a ubiquitous computing environment where all students had access to digital technology, the qualitative and quantitative responses provided did not reveal that this setting had any impact on Sally's understanding or utilization of technology. Sally's perceptions of herself as a being prepared to teach in a technology rich society changed over the course of the one-semester internship. Additionally, Sally became dependent on her mentor teacher for guidance in making decisions to include technology in her teaching.

Jo

At the beginning of this study, Jo was a twenty-year-old female beginning the first semester of her teaching internship. Jo was seeking certification as an all level, or all grades, special education educator. Jo began her internship placed in an early childhood (Pre-K) special needs classroom at Beta One Elementary in BISD. Although, BISD has included in their technology plan that all students will have an iPad or tablet-computing device, Jo's classroom did not assign iPads to the students. The students in Jo's class had moderate to severe disabilities that limited their ability to learn and function in a typical classroom environment. Therefore, the setting of Jo's internship assignment was far different than any other participant in this study.

Jo's quantitative results. Figure 4.5 presents Jo's pre-internship and post-internship construct totals and table 4.15 displays the differences between Jo's totals.

The values in Jo's results revealed movement toward the target, and in fact her results indicated that she was at the highest level, or the target, in each construct of the TPACK framework. This indicated that Jo perceived herself as more prepared to teach with technology at the end of the 12-week internship than at the beginning of the internship. Jo responded "agree" in response to each statement on the pre-internship administration and "strongly agree" to each statement of preparedness on the post–internship survey.

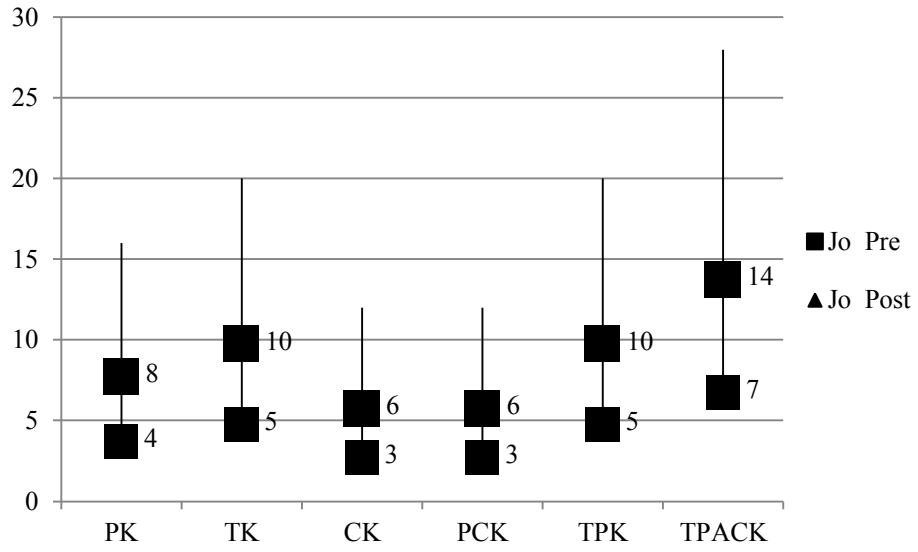

Figure 4.9. PT-TPACK results for Jo by construct and administration.

Table 4.15

Quantitative Differences on PT-TPACK for Jo

PK	TK	CK	PCK	TPK	TPACK
4	5	3	3	5	7

Jo's qualitative results. Table 4.16 displays Jo's response to each question posed on the qualitative instrument and the coding for each response, and Table 4.17 reports the frequency and percentage for each of Jo's coded responses. Jo's qualitative responses indicated change over the internship experience. Jo's coded themes on the pre-internship administration were mostly focused on the basic constructs of TK, CK, and PK. This changed on the post-internship administration where 43 percent of her responses were coded in the more complex TPK construct that combines TK and PK.

Table 4.16

Jo's Qualitative Responses

Questions	Pre-Internship Response	Post Internship Response
Specific technologies that are used in the classroom.	iPads, calculators, timers, any sort of communication device necessary for students' learning. (TK)	iPad, Big Mack, switch, Go Talk, Cheap Talk and DynaVox (TK)
Experiences using technology	Any experience that is connected with interactions with other students, or experiences related to their academic achievement. (PK)	Technology needed for communication of wants and needs (TPK)
Rationale for providing learning experiences with technology.	To best promote their learning and success in the classroom. (PK)	Those experiences are those most seen in a special education setting (CK)
How understanding of content impacts learning experiences with technology.	My hope is that my understanding of the content will help me create lesson plans that incorporate multiple teaching strategies that will maximize student learning and be effect for all students in the classroom. (PCK)	Aided my incorporation of technology into the classroom and into students individual lives (TPK)
Classroom factors that affect the incorporation of technology into learning experiences.	Having a group of students with a variety of needs and learning abilities. (CK)	Students needs' for communication (PK)
Barriers that hinder the incorporation of technology.		The schools access to certain technologies (TK)
Future plans to incorporate technology.		I plan on working in a self-contained special education setting, and technology will be used on a daily basis for each student. (TPK)

Table 4.17

Jo's Qualitative Themes by Number and Frequency

TPACK Construct	Pre-Internship (Frequency)/Percentage	Post-Internship (Frequency)/Percentage
TK	(1)/20%	(2)/29%
CK	(1)/20%	(1)/14%
PK	(2)/40%	(1)/14%
TCK	0%	0%
PCK	(1)/20%	0%
TPK	0%	(3)/43%
TPACK	0%	0%
NON TPACK response	0%	0%

Although the post-internship coded responses still had responses in the TK, CK and PK constructs, there was evidence that Jo's understanding changed over the course of the internship.

On the pre-internship survey, Jo indicated that she would use technology for academic achievement and interactions between students, however on the post-internship survey, the content of her responses focused on communication. This indicated that Jo perceived that technology, in the special education classroom, is most beneficial when used for communication of children's wants and needs. Jo mentioned some specific technologies as well, but because special education covers many disciplines, these technologies were not content specific.

Based on the reported information, Jo's self-perceived preparedness to teach in a technology rich society moved to the TPACK target over the course of the one-semester internship experience. The quantitative data in relation to research question 1 indicated that the internship experience impacted Jo self-perceived preparedness in relation to each construct of the TPACK framework.

Research question 1.a, was posed to examine the effect of intern placement on the intern's self-perceived ability to teach in a technology rich society. Jo's placement was in a school district where the district has a ubiquitous computing plan where all students and faculty had access to computing devices. Data was not collected to reveal the level at which students and teachers in the early childhood special needs setting had access to the computers. In response to the question about barriers to the use of technology, Jo responded that the school in which she was placed had limited access to certain technologies. This indicated that school placement might have affected her ability to incorporate technology into teaching.

Research question 1.b was posed to examine the factor of certification level on the internship experience. Jo was seeking certification in all level special education. This certification requires a different approach to teaching and the internship than traditional teacher preparation. In Jo's case, her placement was in an early childhood/pre-kindergarten setting with students who had moderate to severe disabilities. Thus, her internship experience was not the same as an intern in a traditional classroom. Some of the responses that Jo provided illuminated her need for understanding of discipline specific technology knowledge or TCK. The specific technologies that she utilized were geared toward the teaching of students with special needs. Although Jo should have had a general knowledge of all disciplines, the functional needs of her students were unique; therefore her knowledge of general technologies including assistive technologies that are unique to children with special needs was necessary for her chosen discipline.

Research question 2 was posed to investigate the ways in which the internship affected the intern's understanding of infusing technology with pedagogy and content.

Jo's qualitative responses indicated a change from technology incorporated for learning to a need for utilizing technology that assists with communication of students' wants and needs. On the pre-internship survey, Jo indicated that she wanted to incorporate technology to allow students to communicate with each other as well as offer, "experiences related to their academic achievement". On the post-internship survey, she indicated that she utilized technology for communication of students' wants and needs. Also, on the pre-internship survey, Jo indicated that she wanted her students to have experiences with technology so as to, "best promote their learning and success in the classroom". This revealed Jo's pre-internship understanding that technology can be incorporated for learning. Jo's post-internship rationale for using technologies was that, "Those experiences are the most seen in a special education setting". The absence of the learning ideal revealed that her understanding of the infusion of technology, pedagogy, and content became based on common practice instead of her own analysis of the learning that fit her students. This indicated a change from the use of technology as a medium for learning and collaboration to its use for communication of students' wants and needs. This may be a result of Jo's placement in an early childhood setting and her discipline being special education.

In relation to research question 3, which was posed to investigate the ways the internship effected the utilization of technology, Jo's responses indicated some change that corresponded to her special education level. On the pre-internship survey, Jo listed some general technologies and said that she would use, "any sort of communication device necessary for students' learning". On the post-internship survey, she listed the specific technologies that she used for communication with students such as, " Big Mack,

switch, Go Talk, Cheap Talk and DynaVox". This specificity indicated that the internship affected Jo's understanding of teaching with technology by allowing for opportunities to learn about specific technologies that were appropriate for the student population.

The quantitative findings for Jo revealed movement in her perceived preparedness to teach in a technology rich society, and her qualitative responses indicate some change in her understanding of how to use technology in a special education setting. The data indicated that the internship impacted on Jo's knowledge of specific technologies that apply to her teaching practices with special needs students.

Summary of Jo's results. Jo, an all-level special education major, spent the internship in an early childhood special needs classroom where over the course of a 12-week period, her perceived preparedness to teach with technology moved to the TPACK target. The quantitative results from the PT-TPACK indicated the highest self-perceived preparedness to teach in a technology rich society, and the qualitative data revealed some change in Jo's understanding of teaching special needs children with technology. Jo entered the internship with the understanding that the technology she used, as a special education teacher, should be suited to individual student needs. This was evidenced by her response to the question about factors that might influence the incorporation of technology into learning experiences; she responded, "Having a group of students with a variety of needs and learning abilities". This understanding was a key piece of Jo's TPACK. The theme of communication emerged in Jo's post-internship responses. She mentioned twice that she used technology for students' communication of wants and needs. The internship experience impacted Jo's knowledge of technologies that are appropriate for her discipline. Jo's PT-TPACK results indicated movement to the highest

self-perceived ability to teach in a technology rich society, and her qualitative data revealed changes in Jo's rationale for providing learning experiences for students with technology along with the application of technologies specific to the special education setting.

Rae

At the beginning of this study, Rae was a twenty-one year old female beginning her teaching internship and seeking certification as a middle school (grades 4-8) English/Language Arts (ELA) teacher. Rae was placed in a seventh grade ELA class at Beta Middle School in BISD. Beta Middle School has a 1:1 computing environment where each student is issued an iPad intended for educational use.

Rae's quantitative results. Figure 4.6 presents Rae's pre-internship and post-internship construct totals and table 4.18 displays the differences between Rae's totals. Rae's results indicated little movement between the first and second administrations of the PT-TPACK. The negative integers for both PK and TK indicated a movement away from the target in each construct, but the combined TPK and TPACK revealed movement toward the target of highest self-perceived preparedness to teach in a technology rich society. Additionally, Rae's results on the pre-internship PT-TPACK, within the TPACK construct, indicated that along the spectrum of self-perceived preparedness her, responses were on the lower half of the spectrum. Her post-internship responses indicated movement toward the target of highest self-perceived preparedness, and her score was in the upper half of the spectrum of preparedness.

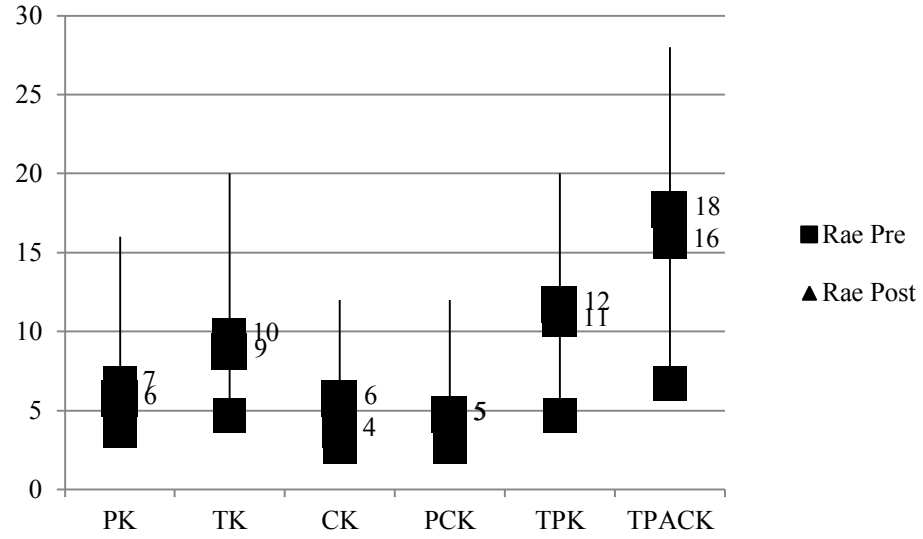

Figure 4.10. PT-TPACK results for Rae by construct and administration.

Table 4.18

Quantitative Differences on PT-TPACK for Rae

PK	TK	CK	PCK	TPK	TPACK
-1	-1	2	0	1	2

Rae's qualitative results. Table 4.19 displays Rae's responses to each question posed on the qualitative instrument and the coding for each response. Table 4.20 displays the frequency and percentage of Rae's coded qualitative responses. Little change was evident in the frequency of Rae's coded qualitative responses; however, on the pre-internship administration, Rae had one response in the TPACK construct yet there were no responses in the same construct on the post-internship survey administration. Additionally, the frequency of Rae's coded responses increased by one for TK, TCK, and TPK on the post-internship survey.

Table 4.19

Rae's Qualitative Responses

Questions	Pre-internship Response	Post-Internship Response
Specific technologies that are used in the classroom.	Interactive powerpoints, interactive whiteboards, clicker system (TK)	Ipads, document cameras, apple tv, various apps on the Ipad, and edmodo (TK)
Experiences using technology	I want my students to have experiences that involve them not only understanding technology, but also grasping a deeper level of understanding of the subject area. If I give a test review using technology then students will not only enjoy the review more, but they are also more likely to be able to recall the information. (TPACK)	I used technology to better explain to students their assignments, to post instructions, and to engage the students. (TPK)
Rationale for providing learning experiences with technology.	I want my students to have the experiences described above because today's society is technology driven. If I want to connect better with my students then I need to meet them where they're at, and a good way to do this is through technology. (TPK)	My rationale was that technology can often help engage the students in a new unit. It also helped me go get information out to the students quickly and effectively. (TCK)
How understanding of content impacts learning experiences with technology.	My understanding of the content I will be teaching will be impacted by the experiences above because by using technology, I will force myself to have a deeper understanding of what I am teaching. (TCK)	My understanding of content impacted the experiences listed above in a positive way. Using the technology often helped to enhance my understanding of the content. (TCK)
Classroom factors that affect the incorporation of technology into learning experiences.	What technology the school/district provides and the behavior of the students (TPK)	I was motivated to incorporate technology into my classroom when I was given a school issued iPad of my own, and also when I attended biweekly technology workshops. (TK)
Barriers that hinder the incorporation of technology.	N/A	The barriers that hindered my incorporation of technology are: sometimes the technology will not work, students are often distracted by technology, and sometimes using technology over-complicates things in an unnecessary way. (TPK)

(continued)

Questions	Pre-Internship Response	Post-Internship Response
Future plans to incorporate technology.	N/A	I plan on incorporating technology in the following ways. First, I will use edmodo often to keep my students updated on what is happening in class. I will use the document camera often to go over assignments, instructions, etc with students. I will also allow the students to use their iPads on occasion to complete assignments. (TPK)

Table 4.20

Rae's Qualitative Themes by Number and Frequency

TPACK Construct	Pre-Internship (Frequency)/Percentage	Post-Internship (Frequency)/Percentage
TK	(1)/20%	(2)/28%
CK	0%	0%
PK	0%	0%
TCK	(1)/20%	(2)/29%
PCK	0%	0%
TPK	(2)/40%	(3)/43%
TPACK	(1)/20%	0%
NON TPACK response	0%	0%

Rae's qualitative and quantitative data indicated little evidence of change in her self-perceived preparedness to teach in a technology rich society, and her data revealed that at the start of the internship she was near the middle of the spectrum of self-perceived preparedness to teach with technology. Her pre-internship qualitative responses indicated a strong desire to meet students where they are in order to be effective as a teacher. Additionally, Rae indicated that her understanding of the content was enhanced by the use of technology

Rae's quantitative responses indicated a slight movement toward the target on the post-internship survey's combined construct of TPACK. This increase in TPACK is

contrary to the movement found in the TK and PK constructs reported from the PT-TPACK instrument. In regards to research question one, the internship had a minimal impact on Rae's self-reported preparedness to teach in a technology rich society.

Research question 1.a was posed to examine the change in the intern's self-perceived preparedness to teach in a technology rich society based on the factor of intern placement. Rae's placement was in a school district where the district has a ubiquitous computing plan where all students and faculty had access to computing devices, specifically iPads. When asked about classroom factors that affected the infusion of technology into teaching, she mentioned a campus program where she was issued an iPad and attended bi-weekly professional development for technology integration. Rae was the only participant to mention ongoing professional development and a specific device dedicated to her as an intern, indicating that Rae's district and school placement may have contributed to her preparedness to teach in a technology rich society.

Research question 1.b was posed to examine the effect of the factor of certification level on the internship experience. Rae was seeking certification in English Language Arts for grades 4-8. The research did not produce any unique identifiers in the data that suggested Rae's certification contributed to her TPACK.

Research question 2 was posed to investigate the ways the internship affected the intern's understanding of infusing technology with pedagogy and content. Rae's qualitative responses from the pre-internship survey administration indicated that she had a desire to use technology to both motivate and help deepen students' understanding of content. "I want my students to have experiences that involve them not only understanding technology, but also grasping a deeper level of understanding of the

subject area." Her response indicated that Rae had a broad understanding of how technology could be incorporated into her classroom teaching and that this understanding could be considered student-centered. Her response to the same question on the post-internship survey was, "I used technology to better explain to students their assignments, to post instructions and to engage the students." Rae's response indicated change from her pre-internship student-centered understanding of technology's infusion with pedagogy and content and pointed toward a post-internship didactic, teacher-centered understanding of the use of technology. This finding indicated that Rae's understanding of the incorporation of technology with pedagogy and content in a student-centered classroom changed over the course of the internship.

Research question 3 was posed to investigate the change in interns' utilization of technologies in the classroom. In alignment with the findings from research question 2, Rae's expected use of technology and the digital items she actually used were different. Instead of using interactive PowerPoint and whiteboards, she used more iPad apps and Edmodo during her experience. Additionally, her actions of using technology to explain directions and to "get information out to the students quickly and effectively", complimented the change in Rae's understanding discussed in relation to research question 2. Rae's data indicated a movement toward a procedural use of technology, which is not a construct of the TPACK framework.

Summary of Rae's results. Rae, a middle school English Language Arts intern, spent the twelve week internship experience in a seventh grade English class in a school with a ubiquitous computing environment where her data indicated some movement in her self-perceived preparedness to teach in a technology rich society. Rae's quantitative

results from the PT-TPACK assessment revealed movement toward the target in the major construct of TPACK. Rae's TPACK score moved from 18 on the pre-internship survey to 16 on the post-internship survey. However, in both the TK and PK constructs, Rae's results indicated a small movement away from the targets. The minimal differences for each construct between the pre-internship survey and the post-internship survey indicated little change; therefore, it is logical to conclude that Rae's quantitative data did not indicate significant change over the course of a one-semester internship.

The pre-internship qualitative data that Rae provided indicated a deep desire to incorporate technology into the classroom as a tool that both engages students' attention and deepens their understanding. There were several technologies that Rae utilized during the course of the internship that she did not expect to use; this indicated an increased TK that was not reported in PT-TPACK. Yet, a change was revealed in the qualitative data as Rae's post-internship responses indicated a procedural use of technology with her students. She reported using technology to communicate necessary elements of assignments. This was in contrast to her reported pre-internship desire to deepen students' understandings.

Overall, Rae's quantitative data revealed that, on the spectrum of preparedness to teach in a technology rich society, she felt somewhat prepared on both the pre-internship and post-internship PT-TPACK but she had room for movement toward the TPACK target. This may be a result of realistic expectations of a novice teacher. Rae's qualitative data indicated some movement from pre-internship student-centered uses of technology to post-internship procedural uses of technology.

Donna

At the beginning of this study, Donna was a twenty-one year old female beginning her teaching internship. Donna was seeking certification as a secondary mathematics teacher for grades seven through twelve. Donna began her internship placed in an Algebra I classroom at Alpha High School in AISD. Alpha High School is a large comprehensive high school located in a school district that was in the beginning stages of a district wide technology plan. AISD allocated funds for technology infrastructure and digital devices for classrooms and campuses with a district-wide goal of three students per computer.

Donna's quantitative results. Figure 4.7 presents Donna's pre-internship and post-internship construct totals and Table 4.21 displays the differences between Donna's totals. Donna's responses indicated no change over time in relation to any of the PT-TPACK constructs; however, it is important to recognize that she responded with the highest confidence on the spectrum of preparedness in each construct on both the pre-internship survey and the post-internship survey. Donna chose "strongly agreed" for each statement on the instrument; which indicated that both before and after the twelve-week internship experience, Donna felt that she was very prepared to teach in a technology rich environment.

Donna's qualitative results. Table 4.22 displays Donna's responses to each question posed on the qualitative instrument and the coding for each response, and Table 4.23 displays the frequency and percentage of Donna's coded responses.

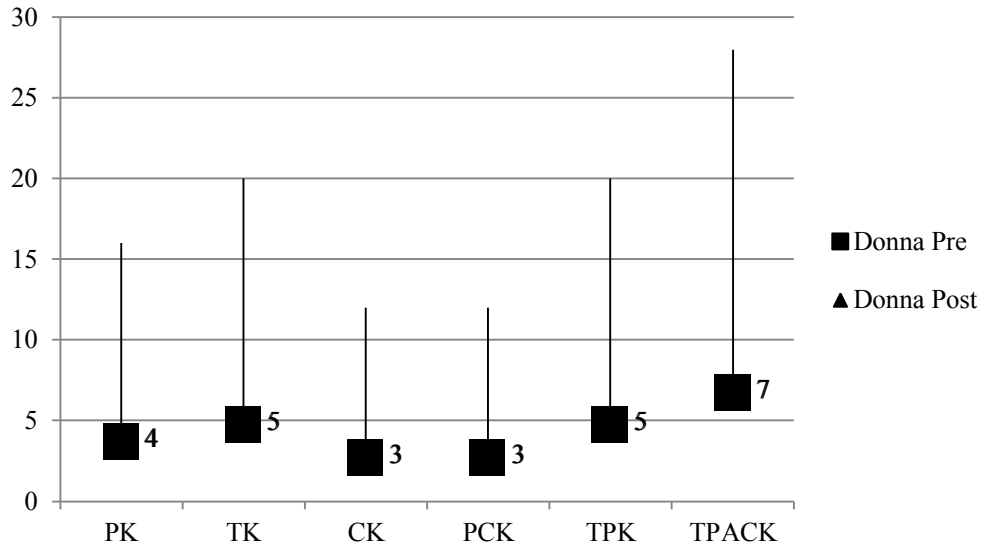

Figure 4.11. PT-TPACK results for Donna by construct and administration.

Table 4.21

Quantitative Differences on PT-TPACK for Donna

PK	TK	CK	PCK	TPK	TPACK
0	0	0	0	0	0

Donna's themes changed over the course of the internship. Her responses on the pre-internship administration of the qualitative instrument indicated a strong incorporation of technology and content with TK and TCK making up 80% of her responses. The post-internship administration responses revealed a change in focus to technology and pedagogy as evidenced by TK, PK and TPK making up 72% of the responses. In multiple responses on the post-internship survey, Donna mentioned student monitoring and engagement. Engaging students and monitoring their learning are pedagogical and classroom management issues (Shulman, 1987). Donna's qualitative themes indicated that over the course of the internship her understanding changed from

technology being used for content enrichment to technology being used for gaining students' attention and classroom management.

Table 4.22

Donna's Qualitative Responses

Questions	Pre-Internship Response	Post-Internship Response
Specific technologies that are used in the classroom.	Nspire, mobi, smartboard, powerpoint, clickers, QR code readers (TK)	Mobi, PowerPoint, projector, TI-Nspire, document camera (TK)
Experiences using technology	I want my students to be able to use the Nspires to see how different variables change a graph (TCK)	It allows me to be able to move around and keeps the students engaged (PK)
Rationale for providing learning experiences with technology.	It will help them be able to visualize graphing in a new way (TCK)	I wanted to be able to move about the classroom freely. It also allows the students to be engaged and see whats going on. (PK)
How understanding of content impacts learning experiences with technology.	It will greatly impact the experience for my students, if I was not familiar with the information then it would be hard for me to help them. (CK)	It allowed me to know the best "tricks" to teach them on the calculator (TCK)
Classroom factors that affect or effect the incorporation of technology into learning experiences.	Access to the Nspire (TK)	My mentor teacher already used these technologies and I thought they were very effective (NONE)
Barriers that hinder the incorporation of technology.	N/A	The Mobi would sometimes go out but we had a back up just in case (TK)
Future plans to incorporate technology	N/A	I plan on incorporating technology the same way in my future classroom. I thought it was an easy way to keep students engaged while I monitored the room. (TPK)

Table 4.23

Frequency of coded themes for Donna's qualitative responses

TPACK Construct	Pre-Internship (Frequency)/Percentage	Post-Internship (Frequency)/Percentage
TK	(2)/40%	(2)/29%
CK	(1)/20%	0%
PK	0%	(2)/29%
TCK	(2)/40%	(1)/14%
PCK	0%	0%
TPK	0%	(1)/14%
TPACK	0%	0%
NON TPACK response	0%	(1)/14%

Donna's quantitative data revealed no change in her self-perceived preparedness to teach in a technology rich society. In relation to research question 1, Donna reported the highest level of self-perceived preparedness to teach in a technology rich society both before and after the one semester internship.

Research question 1.a was posed to examine the factor of district placement on the intern's self-perceived preparedness to teach in a technology rich society. Although Donna's quantitative data did not highlight any difference from the beginning to the end of the internship, some qualitative responses revealed the influence of school and classroom placement on Donna's decision-making when incorporating technology. Donna reported that her mentor teacher had already used specific technologies. Donna thought these technologies were effective, so she chose to use them. The influence of the mentor teacher within the placement affected Donna's decision-making in relation to TPACK.

Research question 1.b was posed to examine the factor of certification level on the internship experience. Donna was seeking certification in 7-12 Mathematics. Donna's certification level, like Sally's, incorporates discipline specific technologies to teach the

content. For instance, Donna needed to know and reported knowledge of NSPIRES and graphing calculators. These devices are specific to mathematics instruction and are not used ubiquitously in all educational disciplines. This factor does not indicate change in Donna's self-perceived preparedness to teach in a technology rich society, but it relates to her need for discipline-specific TCK.

Research question 2 was posed to investigate how the interns' understanding of teaching with technology changed over the course of the internship. The qualitative evidence revealed that because Donna teaches mathematics, she needed to employ TCK in relation to the graphing calculators that she needed for instruction. As mentioned above, Donna's discipline-specific technology knowledge informed her understanding of technology. However, Donna's motivation for providing experiences with technology during the internship indicated some change from student-centered teaching to teacher-centered teaching. At the beginning of the internship, Donna indicated that she wanted to provide her students with technology experiences that would allow them, "to use the Nspires to see how different variables change a graph", so they could, "visualize graphing in a new way". On the post-internship administration, Donna described the technology experiences she offered her students as follows; "It allows me to be able to move around and keeps the students engaged". The post-internship responses revealed change in understanding of the incorporation of technology with pedagogy and content in a student-centered classroom, and the post-internship responses further revealed Donna's focus on procedural use of technology for classroom management as exemplified by her employment of technology to enhance her ability to move around the room and monitor students.

Research question 3 was posed to investigate the change in utilization of technology in the classroom. Donna's qualitative responses only highlighted minor changes in the utilization of technology. Donna had expected to use clickers and QR codes, but she did not report using either of these in the classroom. She did expect to employ a Mobi interactive whiteboard technology and then reported using it during her internship. This utilization of technology was informed by the change in focus from content enrichment to classroom management as discussed above.

Donna's responses revealed that her use of technology was informed by the content she was teaching, and her motivation for employing general digital technologies like interactive whiteboard technology, was based on the need to monitor student behavior and attention.

Summary of Donna's results. Donna, a secondary mathematics major, spent the internship in an Algebra I class at Alpha High school where she reported no quantitative gain in her preparedness to teach in a technology rich society. Although the quantitative data provided by Donna revealed no pre-internship to post-internship change, the PT-TPACK data indicated that before and after the internship, she was at the highest-level of preparedness. Therefore, although there was no change, Donna continued to perceive herself as very prepared to teach in a technology rich society.

Donna's responses on the qualitative instrument indicated change in motivation for the use of technology. The technologies she employed during the internship were similar to those she mentioned prior to beginning the experience. Overall there was very little change in themes or reported incorporation of technology into the classroom, however qualitative data indicated a change in Donna's motivation from a pre-internship

student-centered teaching with technology to a post-internship teacher-centered teaching with technology.

Kyla

At the beginning of this study, Kyla was a twenty one year old female beginning her internship as an elementary level intern. She was seeking certification as a generalist for early childhood through sixth grade. Kyla was placed in a second grade classroom at Alpha One Elementary School in Alpha ISD. This district was in the beginning stages of employing a district wide technology plan and currently provided funding for each school in the district to purchase technology and fulfill technology needs at the campus level.

Kyla's quantitative results. Figure 4.8 presents Kyla's pre-internship and post-internship construct totals and table 4.24 displays the differences between Kyla's totals.

Kyla's results from the PT-TPACK indicated change over time in all the constructs but TPK. Although the quantitative results indicated movement toward the TPACK target, the data revealed that Kyla perceived herself as moderately prepared to teach in a technology rich society at the end of the one-semester internship. In addition, the only construct that Kyla responded to with the highest level of preparation was on the post-internship administration for the PCK. Kyla's pre-internship TPACK construct data indicated that her self-perceived preparedness was in the lower half of the spectrum of preparedness to teach in a technology rich society.

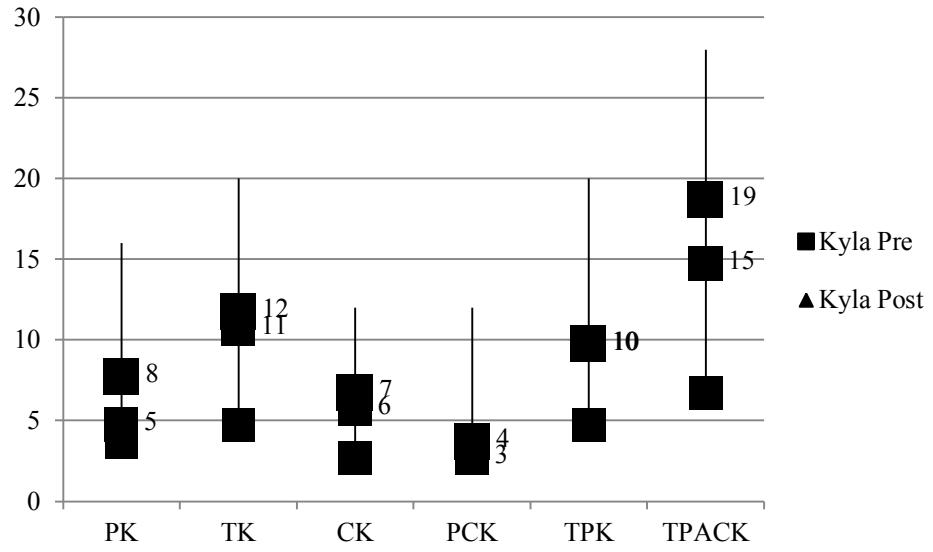

Figure 4.12. PT-TPACK results for Kyla by construct and administration.

Table 4.24

Quantitative Differences on PT-TPACK for Kyla

PK	TK	CK	PCK	TPK	TPACK
3	1	1	1	0	4

However, Kyla's post-internship TPACK construct results indicated that she moved to the upper half of the spectrum and toward the TPACK target. Therefore, the internship had some impact on Kyla's self-perceived preparedness to teach in a technology rich society.

Kyla's qualitative results. Table 4.25 displays Kyla's responses to each question posed on the qualitative instrument and the coding for each response, and table 4.26 displays the frequency and percentage of coded themes from Kyla's qualitative responses.

Table 4.25

Kyla's Qualitative Responses

Questions	Pre-Internship responses	Post-Internship Responses
Specific technologies that are used in the classroom.	Powerpoints, online games/tools, smartboard use, manipulatives, pictures/videos, etc. (TK)	Overhead projector, videos, Interactive World Maps, iPads for enrichment games, computer software for reading and math enrichment (TK)
Experiences using technology	I want students to be able to use technology to enhance their learning and also spark greater interest in the content. (TCK)	Allowing students to practice their learning through engaging iPad games, hands-on activities with science tools and technology, allowing students to monitor their own learning on accelerated reading (computer program) (TPK)
Rationale for providing learning experiences with technology.	I believe that this generation of students is very technologically advanced; therefore, it is important that they have good experiences wit technology. (TPK)	I believe that this generation of students is fascinated and so in tune with technology; therefore, it is important to show students that these tools can be helpful with learning as well. (TPK)
How understanding of content impacts learning experiences with technology.	I will use my knowledge of the content that I will teach, and extend it with different and engaging uses of technology. (TCK)	I definitely had to make sure that I knew the content that I was going to teach and incorporate. This helped me to be a master of the discipline that I was going to teach. (CK)
Classroom factors that affect or effect the incorporation of technology into learning experiences.	The classroom that I am placed in will have to have easy access to computers, a smart board, and online and tangible manipulatives. (TK)	As I began to observe the class, I noticed that the students enjoy using technology; therefore, I wanted to provide some learning experiences using technology. I knew that the students would enjoy these experiences. (TPK)

(continued)

Questions	Pre-Internship Response	Post-Internship Response
Barriers that hinder the incorporation of technology.	N/A	We have a limited amount of technology resources in our classroom. We have 4 computer and 8 iPads for 20 students. Also, I feel like we didn't really get a good list of resources to use for student learning. It would have been helpful if during our [University Name] classes we received some sort of list of helpful resources for different subject areas. (TK)
Future plans to incorporate technology.	N/A	I definitely want to engage students in technology to show students that technology can be fun and a helpful resource for learning. I want to use technology for enrichment activities, such as fun iPad games. (TPK)

Table 4.26

Kyla's Qualitative Themes by Number and Frequency

TPACK Construct	Pre-Internship (Frequency)/Percentage	Post-Internship (Frequency)/Percentage
TK	(2)/40%	(2)/29%
CK	0%	(1)/14%
PK	0%	0%
TCK	(2)/40%	0%
PCK	0%	0%
TPK	(1)/20%	(4)/57%
TPACK	0%	0%
NON TPACK response	0%	0%

Kyla's qualitative responses indicated a shift in themes from the pre-internship to the post-internship administrations of the survey. Before the internship, Kyla's responses focused on TK and TCK, but after the one-semester internship, Kyla's responses shifted to TK and TPK with 29% and 57% of the responses respectively. None of Kyla's responses were coded within the TPACK construct on either the initial administration or the post-internship survey administration.

Based on the quantitative data, and in relation to research question one, the internship had an impact on Kyla's self-perceived preparedness to teach in a technology rich society. Within the TPACK construct, Kyla's movement toward the TPACK target over the course of the internship was four points, indicating that after the internship she felt more prepared to teach when incorporating technology with pedagogy and content. Although there was a positive difference in the TPACK construct, Kyla's score indicated that she felt that there was room for movement toward the target of highest self-perceived preparedness, as she was eight points from the highest level of self-perceived preparedness on the post-internship PT-TPACK.

Research question 1.a was posed to examine the impact of district placement on the self-perceived preparedness to teach in a technology rich society. Kyla's quantitative results did not provide inferable information for this question, however her qualitative responses indicated that Kyla's school placement had some impact on the change of her self-perceived preparedness to teach in a technology rich society. Kyla responded that her classroom had limited technological resources, and this constrained her ability to incorporate technology with teaching. Thus physical and infrastructural aspects of Kyla's placement may have affected her incorporation of technology with content and pedagogy. Although Kyla reported that she felt that her classroom had limited technological resources, she was placed in a district that had the goal of one computer for every three students. Kyla reported that they had four computers and eight iPads for use in her classroom, and this put the ratio of computing devices to students at three devices for every five students, a ratio much higher than the goal of the district plan. This indicated that although the computing environment was not ubiquitous, the amount of available

technology was, at least according to AISD, ample. Although Kyla's perception of lack of technology was presented as a barrier to her ability to teach with technology, this was not evident in the overall findings, and this indicated that district placement was not a contributing factor for change in Kyla's self-perceived preparedness to teach in a technology rich society.

Research question 1.b was posed to examine the impact of certification level on interns' preparedness to teach in a technology rich society. Kyla was seeking certification as an elementary generalist (grades EC-6). There is no evidence that the factor of certification area/level effected Kyla's self-perceived preparedness to teach in a technology rich society.

Research Question 2 was posed to investigate the impact of the internship on the intern's understanding of teaching in a technology rich society. Kyla's qualitative responses provided rich descriptions, more so than other participants in this study. Before the internship, Kyla described her motivation for providing experiences for students to learn with technology. She predicted that students would have high technological abilities and would be interested in technology. When responding to the inquiry of her rationale for incorporating technology, Kyla stated, "I believe that this generation of students is very technologically advanced; therefore, it is important that they have good experiences [with] technology". In addition, she wanted technology to enhance student learning and interest in the content she was teaching. Kyla reported on her pre-internship survey, "I want students to be able to use technology to enhance their learning and also spark greater interest in the content". After the one semester internship, Kyla's understanding was similar but somewhat amplified on the post-internship administration, "I believe that

this generation of students is fascinated and so in tune with technology; therefore, it is important to show students that these tools can be helpful with learning as well". Furthermore, Kyla reported that she saw technology as a tool for enrichment and motivation and would continue to utilize it for these purposes in the future. These responses indicated little change in Kyla's understanding of technology and its infusion with pedagogy and content.

Research question 3 was posed to investigate the impact of the internship on the utilization of technologies in the classroom. Kyla expected to use PowerPoint, online games and tools, and online manipulatives, pictures, and videos. She reported that during the internship she used similar technologies. Kyla indicated that she was able to allow students to practice skills they had acquired and to interact with content through the use of iPad games, science technology, and accelerated reader. Kyla incorporated technology into her pedagogy by allowing students to use technology to "monitor their own learning".

Kyla's data suggested a dedication to the motivational and enrichment factors offered through the use of technology in the classroom. She felt limited by lack of resources during the internship but she had the desire to engage students by incorporating technology for enrichment. In addition, Kyla's data indicated that the construct of CK was a key factor; she had to be a "master of the discipline" in order to effectively teach with technology. Moreover, Kyla's qualitative responses on the post-internship administration leaned heavily toward TPK. With the reported strength in TPK and her understanding that she must be a "master of the discipline", Kyla's data pointed to movement toward the TPACK target both qualitatively and quantitatively.

Summary of Kyla's results. Kyla, an elementary education major, spent her internship in a second grade classroom where, based on her PT-TPACK scores, her self-perception moved toward the TPACK target that exemplifies self-perceived preparedness to teach in a technology rich environment. Kyla had a difference of positive four points in the key construct of TPACK where the necessary knowledge domains combine for the needed elements of teaching in a technology rich society (Mishra & Koeheler, 2006). Although there was some movement toward the TPACK target as revealed through the PT-TPACK data, there was room for further movement toward the TPACK target.

Kyla's qualitative responses mirrored the movement revealed through the quantitative responses. Kyla, unlike the previous participants, did not report using technology as a procedural tool for communication and classroom management; instead she indicated that her use of technology was to have students interact with content and self-monitor their learning.

Kate

At the beginning of this study, Kate was a twenty-one year old female beginning her internship as an elementary level intern. She was seeking certification as an elementary generalist (grades EC-6). Kate was placed in a kindergarten class at Alpha Two Elementary School in Alpha ISD. This district was in the beginning stages of a district wide technology plan and provided funding for each school in the district to purchase technology and fulfill technology needs at the campus level.

Kate's quantitative results. Figure 4.9 presents Kate's PT-TPACK pre-internship and post-internship construct results and Table 4.27 displays the differences between

Kate's totals. Kate's quantitative results did not reveal change in her self-perceived preparedness to teach in a technology rich society. However, her results for each construct were close to the target of highest self-perceived preparedness on both the pre-internship and post-internship survey administrations, thereby indicating that Kate perceived herself as prepared to teach in a technology rich society, with little room for movement toward the TPACK target.

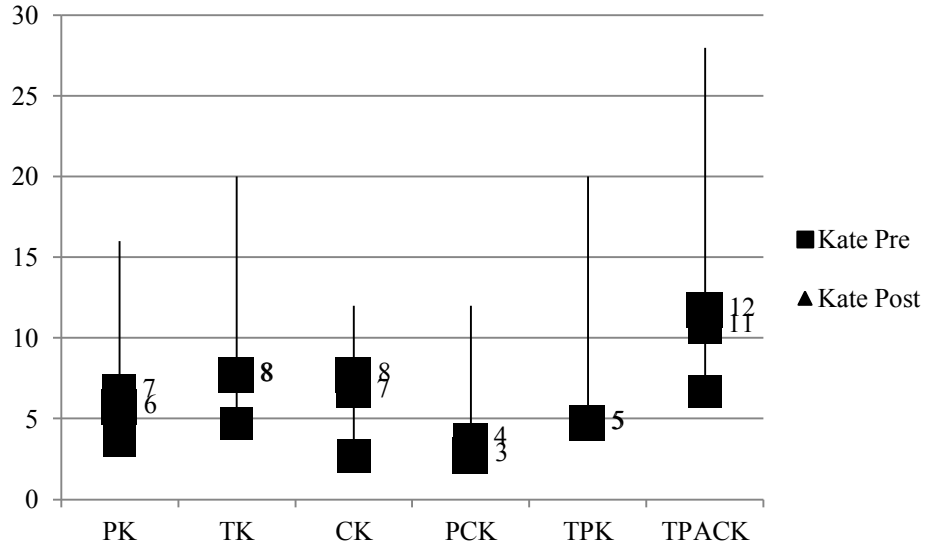

Figure 4.13. PT-TPACK results for Kate by construct and administration.

Table 4.27

Quantitative Differnces on PT-TPACK for Kate

PK	TK	CK	PCK	TPK	TPACK
-1	0	1	-1	0	1

Kate's qualitative results. Table 4.28 displays Kyla's responses to each question posed on the qualitative instrument and the coding for each response, and Table 4.29 displays the frequency and percentages of coded themed responses from Kate's qualitative responses. The data quantitative revealed change between Kate's pre-internship and post-internship

coded themes based on the TPACK framework. Forty percent of the qualitative data from the pre-internship administration were coded as PK while none of the post-internship responses were in the PK construct.

Table 4.28

Kate's Qualitative Responses

Questions	Pre-Internship Responses	Post-Internship Response
Specific technologies that are used in the classroom.	Computers and/or iPADS, possibly smart boards, online scavenger hunts, books or texts on tape (TK)	YouTube videos, iPad games, interactive computer games, Lexia or Starfall websites (TK)
Experiences using technology	I want my students to be engaged and understand the power of learning through technology. I want my students to be prepared for our society when technology is so much more integrated. I want them to have fun and feel as if I am keeping their interests in mind when I teach. (TPK)	My students were able to not only learn the content I had prepared for them but also they were able to receive practice using technology that is so present in our society now. (TCK)
Rationale for providing learning experiences with technology.	I loved school as a child and I want my students to love it like I did. I believe the technology experiences will show them that learning is fun and it doesn't have to be all tests and textbooks--it can be fun, too! (PK)	The students are going to see so much technology the farther along they go in their educational careers and I believe it is beneficial to start the students off young with integrated technology in order to lay the ground work for future grades. (TPK)
How understanding of content impacts learning experiences with technology.	I will understand what technologies will best enhance the content and what will be overkill. I will know what to look for when preparing my lessons. (TPACK)	For more difficult lessons where I believed the students would have a harder time comprehending the content, I integrated technology to make the lesson more engaging and hands-on to help the students with comprehension. (TPACK)
Classroom factors that affect or effect the incorporation of technology into learning experiences.	The school budget, STAAR testing prep, time, differing student interests (PK)	Most [activities] now include some type of technology so it makes sense to include it (TPK)

(continued)

Questions	Pre-Internship Responses	Post-Internship Response
Barriers that hinder the incorporation of technology.	N/A	TIME, resources as my PDS (NONE)
Future plans to incorporate technology.	N/A	I want to use technology as much as I can in my lessons. The students respond very well to it and are able to sit and listen as long as they are using it. I do not want my classroom to just be me talking to my students but I want them to use technology to help them understand the concept. (TPK)

Instead, the post-internship administration data revealed an increase in the frequency of responses coded in the TPK category; from twenty percent on the pre-internship survey to forty-four percent on the post-internship survey. This indicated a shift toward the combined knowledge of TPK.

Table 4.29

Kate's Qualitative Themes by Number and Frequency

TPACK Construct	Pre-Internship (Frequency)/Percentage	Post-Internship (Frequency)/Percentage
TK	(1)/20%	(1)/14%
CK	0%	0%
PK	(2)/40%	0%
TCK	0%	(1)/14%
PCK	0%	0%
TPK	(1)/20%	(3)/44%
TPACK	(1)/20%	(1)/14%
NON TPACK response	0%	(1)/14%

In relation to research question one, quantitative results indicated that the internship had little to no impact on Kate's self-perceived preparedness to teach in a technology rich society. The quantitative results displayed in Table 4.27 and Figure 4.13 indicated that Kate perceived herself as prepared in each construct of the TPACK

framework at the beginning of the internship experience, and her post-internship scores were similar in each construct.

Research question 1.a was posed to examine the impact of intern placement on self-perceived preparedness to teach in a technology rich society. Neither the quantitative data nor qualitative data suggested the factor of district placement had an impact on Kate's self-perceived abilities to teach in a technology rich society. In response to the question regarding barriers against incorporating technology Kate briefly mentioned available resources at her campus, but she did not expand with added information. Thus, no individual conclusions could be drawn from the responses in relation to the impact of intern placement.

Research question 1.b was posed to examine the impact of certification level on interns' self-perceived preparedness to teach in a technology rich society. Kate was seeking certification as an elementary generalist and was placed in a kindergarten classroom; however, none of the data provided in Kate's the quantitative or qualitative responses revealed an impact based on her certification level.

Research question 2 was posed to investigate the impact of the internship on the intern's understanding of teaching in a technology rich society. The qualitative data provided some evidence of change in Kate's understanding of teaching in a technology rich society over the course of the internship. At the beginning of the internship, Kate's motivation for using technology was to engage and motivate students and keep them interested in the content. Kate wanted to prepare students for the society she believed was forthcoming: Kate stated on the pre-internship survey; "I want my students to be prepared for our society when technology is so much more integrated". On the post-internship

survey, Kate recognized that her students were engaging with and being affected by technology in the present; Kate stated,, "They were able to receive practice using technology that is so present in our society now." She responded, on the pre-internship survey, that she desired that her students have fun while at school. For instance, when asked to describe the technology experiences she wanted to provide for students she said, "I want them to have fun and feel as if I am keeping their interests in mind when I teach". On the pre-internship survey, Kate indicated that she used technology to reinforce student learning through practice and hands-on learning; "I integrated technology to make the lesson more engaging and hands-on to help the students with comprehension". Kate's responses indicated that her understanding of the incorporation of technology with pedagogy and content changed from using technology for fun and motivation, to using technology for reinforcing learning. This indicated a movement toward a students-centered motivation for teaching with technology.

Research question 3 was posed to investigate the impact of the internship on the utilization of technologies in the classroom. Kate expected to use computers, iPads, online scavenger hunts, and other digital resources. She reported teaching with digital videos and employing digital games both on tablet computing devices and computers. Kate's utilization of technology changed only in the applications she utilized.

Kate's findings were similar to Kyla's in that technology was seen as a motivational tool in the classroom. Technology was used to reinforce the content that was taught and to keep students motivated. It also provided "hands on" or virtual manipulative experiences. There was evidence that the internship affected Kate's understanding of the incorporation of technology with content and pedagogy beyond

motivation to reinforce learning. She responded that she wants to use as much technology as possible in the future because students respond well to technology and she does not want to be a strictly didactic teacher.

Summary of Kate's results. Kate, an elementary education major, spent her internship in a kindergarten classroom where, based on her PT-TPACK scores, there was little to no evidence of movement in her perceived preparedness to teach in a technology rich society, but she perceived herself as prepared to teach with technology. There was shift from PK to TPK in Kate's qualitative coded responses, but her understanding and impetus for incorporating technology stayed steady throughout the internship experience and was focused on student motivation. There was evidence in her qualitative responses that Kate's understanding changed to include student-centered teaching through the use of technology. Overall, Kate's responses on both the qualitative and quantitative instrument indicated a high level of self-perceived preparedness and a personal understanding of how and why she incorporated technology into teaching.

Summary

This chapter reported quantitative and qualitative data in alignment with mixed methods case study design (Creswell, 2007; Yin, 2009). The quantitative results from the PT-TPACK were not significant and did not reveal large-scale change in preservice teachers' self-perceived abilities to teach in a technology rich society. In addition, the factors of district placement and certification level were considered not significant. A decision was made to investigate qualitative responses from six exemplar participants because the intern group provided limited qualitative responses. The findings from the

holistic analysis of each embedded case indicated that individual participants had singular experiences that impacted their understandings and utilizations of technology in various ways. Out of the six embedded exemplar cases, four reported using technology for communication or procedural, teacher-centered teaching, and two utilized technology for student-centered teaching. Data from the individual embedded cases further indicated that there was some change over the course of the internship; however, there were no consistent patterns of significant change that occurred as a result of the internship experience. Individual embedded cases within this study revealed a variety of change based on personal responses. Both movement toward the TPACK target of self-perceived preparedness to teach in a technology rich society and movement away from the TPACK target were reported in relation to the individual interns and their perceptions of teaching in a technology rich society. These results contributed to the discussion of findings, conclusions, and recommendations found in the following chapter.

CHAPTER FIVE

Findings, Conclusions, and Implications

Introduction

This study was conducted to explore changes in preservice interns during a one-semester internship experience in relation to their self-perceived preparedness to teach in a technology rich society. The understanding that digital technologies are influencing the way people live, communicate, learn, and work is becoming ubiquitous, but the practice of teaching with technology is slow in comparison to the quick adoption of technological solutions to problems that exist in other areas of society (Berry, 2011; Bullock, 2004; Collins & Halverson, 2009). Teacher preparation programs are charged with the responsibility of training beginning teachers to teach in this technology rich society. These beginning educators will likely be teaching for the next 30 years, influencing the students of the future, but the teaching practices employ are often rooted in the past, and these practices are typically based on their own experiences in K-12 classrooms (Koh & Frick, 2009; Loundsbury, 1956). It is imperative that educators are prepared to teach in a technology rich society so that they may prepare future generations for life in this ever-evolving technologically rich society. Because the internship, the pinnacle of a teacher education program, is considered by many the most important part of teacher preparation (Cuenca, 2010; Darling-Hammond, Barron, Pearson, Schoenfeld, Stage, Zimmerman, Cervetti, & Tilson, 2006; Levine, 2006), this event in the process of teacher preparation

should be studied in light of the technological advancements that are changing how people live, communicate, and learn; and thus teach.

Summary of the Study

This research was conducted with first semester teaching interns at a university in central Texas that requires a two-semester internship of all preservice teachers involved in the teacher preparation program. The participants in this study completed a pre-internship survey in late August and a post-internship survey in November. Each survey administration included a quantitative instrument that assessed the interns' self-perceived preparedness to teach in relation to the TPACK framework (Lux, 2010; Lux et al., 2011; Mishra & Koheler, 2006). The pre-internship instrument contained qualitative questions used to gather data regarding the interns' predictions of what their experience in the internship might be like in relation to teaching with technology. After 12-weeks of the internship, the participants completed a post-internship survey that included the quantitative instrument described above and qualitative questions designed to explore the interns' experiences in relation to teaching with technology. Each component of the survey was developed and all data was analyzed in relation to the study research questions.

This mixed methods study was founded on the following research questions:

1. Does a one-semester (12-week) internship experience impact preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?
    a. Does intern placement contribute to the impact of preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?
    b. Does intern certification level contribute to the impact of preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?

2. In what way(s) does a one-semester (12-week) internship experience impact preservice teachers interns' understanding of technology and the infusion of technology with pedagogy and content?

3. In what way(s) does a one-semester (12-week) internship experience impact preservice teachers interns' described utilization of technology and the infusion of technology with pedagogy and content?

Thirty-three (n=33) participants completed both surveys and were included in the omnibus quantitative analysis. A Hotelling's T^2 test for a multivariate dependent sample (Hotelling, 1957) was conducted and it was determined that the quantitative group results were not statistically significant and did not reveal a group difference in the participants' self-reported perceived preparedness to teach in relation to the TPACK framework. Further statistical procedures were not conducted because after the result of the omnibus test revealed no significant difference, the chance of committing a type two error would have increased exponentially. Additional descriptive analyses of the sample were conducted based on descriptive statistics. Descriptive statistics indicated large variations between participants' responses to the PT-TPACK instrument. Additionally, descriptive statistics indicated that intern placement might have had some effect on interns' individual PT-TPACK scores. However, because of the small sample size and limited statistical power as well as large variations between participant responses, the focus of the study shifted to individual participants.

Six participants were selected as embedded cases and the group of 27 was considered a case as well. The case group of 27 added to the analysis of descriptive statistics but because of absence of data points in their qualitative responses, these participants could not be analyzed further. This was a limitation of this study. These individual embedded cases were purposefully chosen based on the quality of qualitative responses for both administered surveys, results from the quantitative instrument, as well

as the interns' placements and certification levels. A limitation of this study that will be discussed later was the poor response rates and minimal qualitative data provided by the group of 27 interns. This limitation led to the selection of the six exemplar embedded cases.

Once individual cases were chosen, the qualitative data for each case was coded in relation to the TPACK framework. Coding revealed that the qualitative responses of the embedded case group primarily (33%) fell in the TK category before the internship, yet the bulk of the post-internship responses (36%) for the embedded case group fell within the TPK construct. Thus, the six participants in the embedded case group began to meld their technology knowledge into their pedagogical knowledge during the course of the 12-week internship experiences. Additionally, the quantitative and qualitative data for each individual embedded case was analyzed to better understand the personal experience within the internship in relation to teaching with technology. The following section will detail the major findings within each of the research questions as revealed from evidence provided through quantitative and qualitative analysis of the whole group and the six embedded cases.

Findings, Conclusions, and Discussion

The findings will be reported in relation to the research questions that formed the foundation of this study. Each research question will be listed and the findings, conclusions, and discussion related to the research question will be presented.

Research Question 1

Does a one-semester (12-week) internship experience impact preservice teacher interns' perceived preparedness to effectively teach in in a technology rich society?

Finding. Over the course of a one-semester internship experience, the intern group revealed a slight movement toward the TPACK target on the spectrum of self-perceived preparedness to teach in a technology rich society, however this change was not significant.

The quantitative analysis of the intern participant group's (n=33) PT-TPACK responses revealed no significant differences between the pre-internship and post-internship responses for any of the TPACK constructs. Although data from some interns indicated large movements toward the TPACK target on the PT-TPACK instrument, data from other interns indicated movement away from the TPACK target after the first semester of their internship experience. Overall, the group's collective TPACK score revealed an average movement toward the TPACK target of 1.48 in the TPACK construct. The whole group pre-internship mean for the TPACK construct was 12.89, and the post-internship mean for the TPACK construct was 11.41. A score of seven in the TPACK construct indicates the TPACK target that represents the highest self-perceived preparedness to teach in a technology rich society. The opposite end of the spectrum of self-perceived preparedness to teach in a technology rich society is indicated by a TPACK construct score of 28. Thus, although little group movement was indicated, the interns, as a group, reported moderate preparedness to teach in relation to the TPACK construct, but overall the general perception from the group was that they were prepared to teach in a technology rich society.

Finding. Over the course of a one-semester internship, data revealed large variances in the levels and types of impacts on individual interns' perceived preparedness to teach in a technology rich society.

The group quantitative data revealed no significant difference from the group means, however there were large variations in the responses of individual interns. For instance, the difference between one intern's pre-internship to post-internship TPACK construct was 21 indicating movement from the furthest point on the spectrum of self-perceived preparedness to teach in a technology rich society to the TPACK target on the spectrum. In contrast, another intern at the same campus reported a TPACK pre-internship to post-internship difference of negative four, indicating this participant moved away from the TPACK target. Thus, these two interns at the same campus revealed a 25-point range in their self-perceived TPACK. A review of the constructs' standard deviations revealed that this pattern of large variances continued throughout the responses to all constructs of the TPACK framework. Examination of the embedded cases provided additional support for the individuality of the TPACK responses.

These findings indicated that analysis of the whole group change during the internship experience might be problematic. This led to the conclusion that the internship experience should not be measured through group differences because its success in developing teachers prepared to teach in a technology rich society is very individualized (Knowles & Cole, 1996). The quality of the internship is dependent on many factors including the intern him/herself, the internship context, and relationships with those involved in the internship experience.

The internship experience is situated and contextualized in terms of individual interns. The participants in this study each had separate lived internship experiences as evidenced by their qualitative and quantitative responses. This was supported by the data within each embedded case as presented in Chapter Four. For instance, although Sally was seeking the same certification as Donna (7-12 mathematics), they were each placed in different districts and classrooms and taught different levels of mathematics, and their motivations to incorporate technology into their teaching were very different. Although they participated in the same undergraduate teacher education program, Sally wanted to incorporate technology so her students could better understand mathematics, although Donna wanted to incorporate technology for classroom management purposes.

Although programs develop teachers in the plural sense, it is highly important that each preservice teacher engaging in the capstone of their preservice training receive the individual attention necessary for their personal success. Knowles and Cole (1996) wrote

> Most field experiences are too short, too structured, too focused on the immediacy of classroom action, and too detached from the personal; consequently, they often provide little more than superficial, 'rites of passage' experiences. Field experiences that are not constructed to take into account, celebrate, and nurture human individuality and complexity run the risk of preparing teachers with more technical than introspective orientations and with intimate knowledge of non-individualistic learning opportunities. These teachers who will essentially continue to teach as they were taught, with little understanding of either the pedagogical or the personal principles underlying such practices. (p. 654-655)

The dispositions and development of the individual preservice teacher must be of paramount importance to teacher education departments especially as interns begin their internship in a professional setting. Knowles and Cole (1996), with consideration of Kagan (1992), suggested that field experiences be founded in "inquiry into self, contexts, relationships, and ongoing professional development"

(p. 665). The conclusion from this study that the success in preparing preservice teacher to teach in a technology rich society is very individualized corresponds with the understandings presented by Kagan (1992) and Knowles and Cole (1996). There are many factors that contribute to the success of the internship and the growth of the intern including contexts, relationships, professional development, and intern self-inquiry, and each factor is highly complex.

I suggest that the internship be viewed as a formative venture for both the intern and the university. Although it is important for interns to learn school and classroom procedures and behavior management, the development of a holistic pedagogy that includes student-centered teaching is paramount, and teaching with technology must be an additional consideration. In addition to Kagan's (1992) suggestion that each intern experience be founded in context, inquiry, relationships, and ongoing professional development, I suggest that the interns' preparedness to teach with technology becomes a focus for the development of individual interns.

Research Question 1.a

Does intern placement contribute to the impact of preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?

Finding. Over the course of a one-semester internship the factors of district placement and district technology implementation strategy had no effect on the interns' perceived preparedness to teach in a technology rich society.

Quantitative results from the PT-TPACK instrument did not reveal significant changes in self-perceived preparedness to teach with technology for the interns' placed in any of the three districts. Descriptive statistics, displayed in Table 4.6 for the three districts, revealed a difference in mean of 3.7 for AISD (n=10) with a standard deviation of 7.35, a mean difference of 0.88 for BISD (n=17) with a standard deviation of 3.90, and a mean difference of negative 0.5 for DISD (n=6) with a standard deviation of 2.95 on the TPACK construct. These mean differences indicated movement toward the TPACK target for interns placed in AISD and BISD and movement away from the TPACK target for interns placed in DISD. However, because of the variances of scores and numbers of interns in each district, along with the low statistical power as presented in chapter 4, the mean differences between groups did not provide data to infer any trends based on district placement.

Interns were placed in the three districts listed above. At the time of this study, BISD was in the second year of implementing a district wide technology plan intended to provide one iPad per student in the district making it a ubiquitous computing environment (Beta Independent School District, 2013). At the time of this study AISD was in the first year phase of implementing a district-wide technology plan that was intended to increase teacher professional development, purchase computing devices for student use at a ratio of one computer for every three students, and increase connectivity and infrastructure (Beta Independent School District, 2014). Similar to AISD, DISD purchased technology at each campus for use in the classroom. However, at the time of this study, DISD did not have a district-wide technology plan.

Descriptive statistics reported above revealed some differences in the interns' group responses on the PT-TPACK based on district placement, but the data was inconclusive because of small sample sizes and large variations of responses within districts. The six selected embedded cases provided support for the finding that district placement did not affect the interns' perceived preparedness to teach in a technology rich society.

The six embedded cases were placed in either AISD or BISD; three were placed in each district. There was no evidence that the one-to-one iPad initiative in BISD had any affect or difference over the non-ubiquitous tablet-computing environment of AISD in relation to the interns' self-perceived preparedness to teach in a technology rich society. One of the responses from Sally indicated that although iPads were offered to students in BISD, some students chose not to use them. Also, five out of six of the embedded case interns responded that lack of resources and infrastructure issues were at times barriers to incorporating technology into lessons. These participants were placed in both AISD and BISD, and based on these responses, it can be concluded that simply providing an iPad or tablet-computing device for each student did not change the teacher's preparedness to teach in a technology rich society (Ertmer, Addison, Lane, Ross, & Woods, 1999).

Finding. Over the course of a one-semester internship, the factor of campus placement had no effect on the interns' perceived preparedness to teach in a technology rich society.

Quantitative data indicated that there were large variations within and between campuses. As reported in Chapter Four, interns were placed at fifteen different campuses

in the central Texas area. Each campus housed five or less interns, and within each campus, variations in TPACK construct scores indicated that the campus itself was not a contributing factor for change in group means of the interns' self-perceived preparedness to teach in a technology rich society. For instance, Alpha One Elementary School had four interns with an average movement toward the TPACK target among interns of 7.5 and a standard deviation of 10.47. In contrast, Alpha Three Elementary School had three interns with an average movement toward the TPACK Target of 2, and a standard deviation of 5.29. The campus with the most interns was Beta High School. The five interns at Beta High School reported movement away from the TPACK target with a mean difference of negative 1.6 and a standard deviation of 3.78. Individual interns from Beta High School had TPACK construct mean differences of of -8, -2, 0, 1, and 1. These descriptive statistics for each campus revealed that there were no patterns of change that were consistent within or across campuses. This reinforces the understanding that the internship is an individualized and change within the internship is contingent upon factors in directly related to the intern.

The results from this study indicated that for this group, in these settings, the districts and campuses were not factors that contributed to change in the interns' perceived preparedness to teach in a technology rich society. I am not suggesting that the setting is not a contributing factor to the development of the intern in relation to teaching in a technology rich society, but that the district and campus level settings were not contributing factors to changes within the TPACK construct for interns in this study. Although the districts in this study had different technology plans, it was evident that students and faculty at each campus had access to technologies, but the variations in

experiences within each campus and district indicated that even when situated in similar settings, interns can have very different experiences and perceptions of their own preparedness to teach in a technology rich society. Although group change based on intern placement was not observed, the qualitative finings agree with literature that supports the notion that the setting is a factor in interns' development (Huang & Waxman, 2009).

Also in support of literature, the interns reported that barriers to incorporating technology and teaching centered around the lack of access to resources and consistent connectivity at their campus, confirming the claim made by VanSlyke-Briggs, Hogan, Waffle, and Samplaski (2014); "Preservice teachers can become frustrated when technology applications they explore in coursework on campus cannot be implemented in the classroom, due to limitations in the support and technology available in public school buildings" (p.130).

The setting of the internship is highly influential to the growth of the intern (Grossman, Ronfeldt & Cohen, 2012). In this study, setting was analyzed in relation to the district, campus, and classroom placement of the teaching interns. Because this study was focused on the intern and their self-perceived preparedness to teach in a technology rich society, the classroom settings in which the participants interned were not analyzed in relation to student demographics, but rather in relation to the technology integration strategy of the school district and the application of technology in teaching in the classroom.

The setting is an important factor and the people who were in the same setting as the intern also contributed to the interns' perceptions of the environment. The overall

culture of a school and the dispositions of the people with whom the intern comes in direct contact contribute to the success of the internship (Huang & Waxman, 2009), including the mentor teacher. Because of this, the setting of intern placement should be carefully considered, and intern placement decisions should be made based on the individual intern's needs for developing as a teacher in a technology rich society. The teacher education faculty must know and take the intern's strengths and weaknesses into account as they consider the intern's specific placement, and they must work with the district and school in order to place them where they can best grow and develop (Grossman, 2010; Grossman, et al., 2012).

Research Question 1.b

Does certification level contribute to the impact of preservice teacher interns' perceived preparedness to effectively teach in a technology rich society?

Finding. Over the course of a one-semester internship, the factor of certification level had minimal impact on the pre-service teacher' perceived preparedness to teach in a technology rich society.

Because the omnibus Hotelling's T-squared test did not reveal significant differences between group means, group differences by certification level could not be inferred. However, descriptive data suggested that, within the sample, the interns seeking certification in secondary and middle level changed less than those seeking elementary certification. Interns seeking certification as elementary generalist (grades EC-6) had a mean difference of 2.41 and a standard deviation of 6.23 on the TPACK construct of the PT-TPACK instrument. Interns seeking certification in middle level education (grades 4-

8) had a group mean difference of 1.0 with a standard deviation of 0.82. Interns seeking certification in all level special education (grades EC-12) had a group mean difference of 1.67 and a standard deviation of 4.55. Interns seeking certification in secondary education (grades 7-12) had a group mean difference of negative one and a standard deviation of 3.79. Thus, these results not only indicated that the internship had a slightly greater impact on the elementary intern group than on the middle or secondary intern groups, but they also illustrated large variations within each of the certification groups. Once again, the results pointed to the individuality of the internship experience and that each intern had a different experience in the internship regardless of his/her certification level.

Qualitative data revealed that TCK was a factor in interns' understanding of teaching in a technology rich society. This construct was not considered statistically valid and was not included as an individual construct on the PT-TPACK (Lux, 2010; Lux et al., 2011). Certification at the middle and secondary levels are content specific, yet elementary certification is not. Thus, the middle and secondary certificate interns in the embedded individual cases revealed understanding in their TCK construct, and this, in turn, may have affected the interns' TPACK. Sally and Donna, both seeking certification in secondary (grades 7-12) mathematics, indicated that they would use graphing calculators during the internship. This technology was not mentioned by other interns and is used specifically in secondary mathematics classrooms. Additionally, Jo was seeking certification in all level (grades EC-12) special education, and her qualitative results indicated that her TCK changed over the course of the internship to the use of technology that was used for students with special needs. It is important that all interns develop TCK,

but it is especially important that interns at the middle and secondary certification levels develop TCK in order to be prepared to teach in a technology rich society.

Additionally, in relation to certification level, qualitative data revealed some patterns of change among the six embedded cases in the rationale for providing students experiences with technology. The data from the two interns seeking certification as elementary generalists revealed movement toward student-centered teaching when infusing technology with pedagogy and content, but data from the four interns who were seeking certification at other levels indicated change toward teacher-centered teaching in their understanding of the infusion of technology with pedagogy and content. The impact of this will be explored in the discussion of research question 3.

Based on the results in relation to certification level, I recommend that additional research be conducted exploring differences on the change in interns' self-perceived preparedness to teach in a technology rich society based on certification level. Specifically, a researcher could question, "How do elementary interns differ in their TPACK development in contrast to middle level or secondary interns?" I also suggest that the development of preservice teacher TCK be analyzed and addressed within holistic development of the teacher education program. Although Lux et al. (2011) considered pedagogy to be the driving factor for incorporating technology, the results of this study pointed to the need to identify and teach current discipline specific technologies.

Research Question 2

In what way(s) does a one-semester internship experience impact preservice teachers' understanding of technology and the infusion of technology with pedagogy and content?

Finding: The one-semester internship impacted the interns' understanding of the infusion of technology with pedagogy and content in small and differentiated ways.

The embedded case group's qualitative coding revealed slight changes in the frequencies of coded responses from TK and PK to TPK, but the results did not reveal a movement toward the TPACK target. Further examination of the qualitative responses from the embedded cases revealed differentiated change in the interns' understanding of technology and its infusion with pedagogy and content based on their rationales for providing students with technology-based learning experiences.

Over the course of the internship, all of the embedded case interns' reported qualitative data indicated changes in their motivations for teaching with technology. Sally's pre-internship to post-internship rationale for providing experiences with technology revealed a change toward teacher-centered motivation for using technology in that she no longer indicated a desire to use technology to show relationships and make mathematics more meaningful to students. Jo's data also indicated change in her understanding as her pre-internship to post-internship rationale revealed a movement toward choosing experiences that are common practice without reporting analysis of student needs. Rae's responses also indicated a change her pre-internship rationale was to meet students "where they are at" and in her post-internship rationale, was to deliver instructions to students through technology. Donna's data also indicated change in her

motivation to incorporate technology in her classroom; on the pre-internship survey she desired to have students visualize graphing in a new way, but on the post-internship survey her rationale for incorporating technology was for classroom management and monitoring students. Both Kyla and Kate's rationale statements revealed change toward a more student-centered approach to teaching with technology. Kyla, on the pre-internship survey, wanted to provide positive experiences with technology, but change was revealed on her post-internship survey in that she added that her desire was to show students that technology helps with learning. Kate reported similar change in that her pre-internship rationale was focused on having fun whereas on the post-internship survey she wanted to provide experiences with technology that set a foundation for future learning.

The six embedded cases revealed some change in understanding of the infusion of technology, pedagogy and content and a distinction between certification levels was recognized. The two interns who were both seeking certification as elementary generalists (Grades EC-6) moved toward a student-centered motivation and use of technology in teaching. The four interns in the embedded case group represented the other certification levels. These interns moved toward a procedural use of technology in teaching. Although this finding is interesting, no data was provided to allow conclusions to be drawn as to why the elementary generalist interns revealed change in motivation toward student-centered teaching with technology and the others did not. Perhaps the change was due to a commonality for all preservice teachers seeking elementary certification, but it is most likely that these two interns revealed changes in their motivation based on the individualization of their lived experiences.

Professional educational literature on technology often encourages the use of technology for student-centered instruction (Jonassen, 1995; Jonassen, 2008; Jonassen, Howland, Moore, & Mara, 2003; Spaulding, 2015; Yang, 2014) where the student uses technology in discovery, manipulation of ideas, and constructing knowledge. Additionally, this is one of the core tenets of the participating university's teacher education program. However, when teachers in the field incorporate technology into teaching, a teacher-centered approach continues to prevail (Ertmer, 2005; Kumar & Vigil, 2011). The results described above confirm the occurrence of this phenomenon as four of the six embedded case interns indicated a pre-internship desire to use technology for student-centered learning but the post-internship descriptions indicated teacher-centered or procedural implementations of technology. It is important to recognize that the interns' understanding of technology and its infusion with pedagogy and content, regardless of whether that understanding was student-centered or teacher-centered, was likely impacted by modeling from the mentor teacher (Smagorinsky, Jubiak and Moore, 2008). In fact, both Sally and Rae reported that their was the main influence on their decision to incorporate technology into the classroom.

Previous research indicates that the mentor teacher is possibly the greatest factor of influence on the intern during the internship (Butler & Cuenca, 2012; Colton, 1992; Feiman-Nemser, 1996). The mentor teacher spends the most time with the intern as the intern observes, learns, and enacts teaching under the mentorship of this person who has considerable influence over the "values, opinions, and perspectives of prospective teachers" (Butler & Cuenca, 2012, p. 297). Although four of the embedded case interns did not specifically mention the influence of their mentor teacher on their understanding

and incorporation of technology, because the mentor teacher was the model for teaching, he/she directly and indirectly guided the interns' use of technology within the placement.

Because the mentor teacher plays a significant role in the development of the intern (Cochran-Smith & Zeichner, 2010), the selection and training of the mentor teachers is paramount to the success of the intern (Butler & Cuenca, 2012; Clarke, Triggs, & Nielsen, 2014; Grossman et al., 2012). I recommend that the university continue to spend considerable time and effort in the selection and training of mentor teachers. Additionally, in order to meet the needs of interns learning to teach in an ever changing technology rich society, the university should provide technology specific professional development to ensure that mentor teachers integrate technology within their pedagogy and content in a student-centered manner. Perhaps, to capitalize on interns reported high TPACK scores; interns could lead professional development for mentor teachers in a reverse mentorship role (Koulopoulos & Keldsen, 2014). Because of the importance and significance of the mentor teacher, the mentor teacher role should be continually elevated and they should be selected because their practice is congruent with the theory that is taught at the university (Koerner, Rust, & Baumgartner, 2002; LaBoskey & Richert, 2002).

Research Question 3

In what way(s) does a one-semester internship experience impact preservice teacher interns' described utilization of technology and the infusion of technology with pedagogy and content?

Finding. A one-semester internship had a varied impact on the interns' described utilization of technology, and variations between the interns' pre-internship predictions regarding anticipated technology use and post-internship statements of actual technology utilizations were influenced by actual and perceived contextual barriers.

Each embedded case intern reported differences between their anticipated and actual technology utilizations. For instance, Sally predicted using a projector, a smart board, an iPad, and calculators, and she reported actually using iPads, Google Drive, Calculators, and a document camera. Similarly, Rae's utilization of technology was different from her prediction. She had predicted using interactive PowerPoint, interactive whiteboards, and clickers, but the technology she actually reported using included none of these predicted items. Rae reported using iPads, document cameras, Apple TV, and Edmodo. Although each intern reported using different technologies than they predicted, the variance in change was wide and not consistent across the embedded intern group.

The utilization of technology within the internship was influenced by multiple factors. Five out of six of the embedded cases reported that lack of equipment or connectivity was a barrier to the use of technology in the classroom. "The barriers that hindered my incorporation of technology are: sometimes the technology will not work, students are often distracted by technology, and sometimes using technology over-complicates things in an unnecessary way" reported Rae. Kyla perceived that the amount of technology available in the classroom was a barrier, yet she also reported that she had 12 digital devices for 20 students. Thus, this perception may have been unfounded as the amount of devices exceeded AISD's technology plan to have one computer for every three students.

As mentioned before, the single most influential factor in the internship is the mentor teacher (Butler & Cuenca, 2012; Colton, 1992); thus, this factor may have been a barrier to the utilization of technology in the classroom. Two of the interns within the embedded case group indicated that their mentor teacher was the main influence in decisions to incorporate technology into teaching. The decision to incorporate technology into the classroom must therefore be in alignment with the mentor teacher's understanding and belief structures regarding technology, as they are the gatekeepers during the internship (Cuenca, 2011). If the mentor teachers had limited TPACK and only permitted the intern to teach with technology as the mentor teacher would, (Koh & Frick, 2009) the innovative student-centered incorporation of technology with pedagogy and content by interns cannot be expected, rather it must be modeled or at lease permitted by the mentor teacher.

Finding. Over the course of a one-semester internship, interns revealed no correlations between the technologies they learned in required technology classes and the reported technologies utilized in the internship.

Each of the interns in this study participated in two lab style courses early in their preservice teacher preparation program. Both of these courses focused on building technological skills for use in the classroom environment, and the researcher taught multiple sections of these courses. Based on the interns' successful completion of these technology courses, the interns had previous experience with general information communication technologies that are used in the school environment. Moreover, although the interns had completed the technology skills courses, additional instruction on melding technology with content and pedagogy in classroom settings was to occur within

instructional methods courses. It is unclear to what degree this occurred as faculty members who teach the methods courses express varied levels of skill and desire to incorporate technology into their courses.

Examination of the qualitative data revealed that the students did not report incorporating specific technologies that they learned in the instructional technology courses. In fact, only two of the technologies that the interns reported using, interactive Power Point and Google Docs, could have been directly associated with the courses. The interns also reported using iPads, and, although an iPad is a technology device that was introduced in the technology courses, specific applications were not discussed and the ways in which the interns used the iPads in relation to pedagogy and content were not clear.

Based on these findings, I recommend that student-centered technology integration be required within the internship. As interns create lesson plans and develop units of study for students, a dedication to the incorporation of technology used for student discovery, evaluation, and creation (Jonassen, 2008) should be emphasized. As mentioned in the recommendations for research question two, one way to encourage this would be for the university to provide ongoing professional development that supports student-centered incorporation of technology with pedagogy and content. Additionally, intern supervisor observations used for evaluation of the intern by the university should evaluate student-centered uses of technology aligned with content and pedagogy. Additionally, informal observations and coaching sessions with both the mentor teacher and intern supervisor should include support of all of the TPACK constructs.

Additional Findings

The following findings did not directly correlate to the research questions, but did, however, illuminate perspectives about the internship experience and the interns' perceived preparedness to teach in a technology rich society.

Finding. The University's supervising teachers had no impact on the incorporation of technology, the infusion of technology with pedagogy and content, or the interns' perceived preparedness to teach in a technology rich society.

There was no data reported by the interns that indicated any influences from the intern supervisors. Although each participant had a supervising instructor from the university who performed official observations, provided feedback, and met with the interns once a week (University, 2013), the data from this study confirmed previous literature that the intern supervisor lacks influence on the intern during the internship experience (Fives et al., 2007; Grossman et al., 2012; Oh et al., 2005).

I recommend that the university select and train intern supervisors to acquire and/or maintain a high TPACK. The university should also continue to promote the development of a strong relationship between the university supervisor and the mentor teachers. Addressing these factors would assist in the development of the intern's TPACK and use of technology in the classroom (Conderman et al., 2005; Grossman et al., 2012). Additionally, the intern supervisor should spend considerable time in formative observations of the intern and in team planning sessions with the intern and mentor teacher in order to meld the procedures of the K-12 classroom with the theory of best practices, including technology, from the university.

The focus of this study was the impact of the internship on interns' self-perceived preparedness to teach in a technology rich society. Data was only gathered in relation to the experience of the internship in and teaching with technology. The intern supervisor is considered by the literature as a contributing factor within the internship experience (Cochran-Smith & Zeichner, 2010); however, other researchers question the depth of this impact (Fives et al., 2007; Grossman et al., 2012; Oh et al., 2005). The data from this study revealed that the intern supervisor, for these participants, was not a factor in changes that occurred during the internship in relation to teaching in a technology rich society. It is important to note, once again, that the majority of interns from this study had high levels of self-perceived preparedness to teach in a technology rich society and thus the small changes observed were not fully explained. It is possible that the intern supervisors did not challenge interns' high self-perceptions, because the actions they saw were aligned with the intern supervisors' expectations. The suggestion to increase the viability of the intern supervisor role is supported by literature (Fives et al., 2007; Grossman et al., 2012; Oh et al., 2005) and may be a possible means of strengthening the university's goal of "enhancing student learning through teacher quality at all levels" (University, 2013, p. 4).

Finding. The length of the internship may have contributed to the change in the interns' self-perceived preparedness to teach in a technology rich society.

Many traditional teacher preparation programs require a one-semester student teaching experience, but some programs that utilize a Professional Development School (PDS) model require a yearlong internship for their preservice teachers (Darling-Hammond, et al., 2005). The university in which this study took place utilizes a PDS

model and requires a year-long (two-semester) internship experience for all preservice teachers. This study reports data collected over one semester of internship, however all the interns involved in this study had an additional semester of internship to complete. This may have impacted the interns' responses. Additionally, the PDS model employed at the school provides early field experiences for preservice teachers throughout the teacher preparation program. It was safe to conclude that based on the group results of the pre-internship PT-TPACK survey, the group felt mostly prepared to teach in a technology rich society. This indicates that the pre-service teacher education program was successful in preparing these teachers for their culminating field experience.

There are competing views on the debate about the length of the internship and its benefits for interns. Spooner, Flowers, Lambert, and Algozzine (2008), in a study comparing interns who participated in a year-long internship and interns who participated in a single semester internship, reported that although no significant difference was found in the interns perceived abilities to teach, interns who participated in the yearlong internship had better relationships with their mentor teacher and greater knowledge of policies and procedures. Additionally, Griffiths (2010) found that teachers who participate in a yearlong internship compared to a traditional fifteen-week internship felt more prepared to teach and had higher self-esteem in relation to their teaching. Additionally, Silvernail and Colstello (1983) reported that interns who participated in a yearlong internship had reduced anxiety for independent teaching compared to their counterparts in a traditional one-semester internship program. In a qualitative study of the first year of a yearlong graduate internship program for preservice teachers, all

stakeholders agreed that the longer internship had benefits that outweighed the potential negatives (Colvin & Ridgewell, 2014).

Some reports suggest that the length of the internship is less relevant than the quality of the of the internship experience (Grossman, 2010). Similarly, Ronfeldt & Reininger (2012) reported that the longer the internship, the less beneficial the time/length of the internship is for the intern; Thus, the focus of the internship should be on the quality of the experience as opposed to the length of the internship experience.

In relation to this study, the intern's recognition of the length of the internship may have informed their responses. It is possible that they thought there was more to learn and experience, as they had only completed half of their required internship when the post-internship survey was completed. The benefits of a yearlong internship as described above do not include the inclusion of TPACK or teaching with technology because there is an absence of literature that investigates the internship in relation to technology. Therefore, it cannot be concluded that the length of the internship would have a positive, negative, or neutral effect on the interns' self-perceived abilities to teach in a technology rich society; however, previously noted benefits of the yearlong internship may have added effect on the interns in this study. Further research is needed that explores the relationship between the length of internship and the development interns' TPACK.

Summary of Conclusions and Recommendations

This study investigated the impact of a one-semester internship on interns perceived preparedness to teach in a technology rich society as well as their understanding and use of technology in the classroom setting. The quantitative data did

not produce inferable statistically significant results, but several conclusions and recommendations were presented in relation to the particular group of interns and current literature regarding preservice teachers and technology integration. The internship experience is very individualized and its success or failure to develop preservice teachers is differentiated and based on multiple factors (Darling-Hammond et al., 2005; Kagan, 1992; Knowles & Cole, 1996). These factors that influence the intern and the internship experience in relation to technology and teaching include setting, infrastructure, available devices, cooperating teachers, intern supervisors, the intern's perceptions and philosophies regarding teaching, the interns' technological understandings and the amount of time in the internship (Darling-Hammond et al., 2005).

I suggest that the internship experience be viewed in relation to the individual intern and his/her needs for growth and development (Knowles & Cole, 1996) in all constructs of the TPACK framework (Mishra & Koehler, 2006). Additionally, I suggest that the selection of mentor teachers could include some evaluation of their ability to model student-centered technology integration into their pedagogy and content, so as to reinforce the best possible development of the intern.

Student-centered use of technology should be considered a requirement of the internship and be included in formal observations. In addition, the presence of the intern supervisor should become more prominent and should include formative observations and support for the inclusion of student-centered technology integration with pedagogy and content. Therefore, the intern supervisor should also receive training specific to TPACK to assure the development of a high TPACK and the ability to effectively collaborate with both the intern and the mentor teacher in relation to the TPACK

construct. Another way to increase the connection between the intern supervisor, mentor teacher, and intern is to encourage team planning with all three parties. All this is to increase the preparedness of the intern to teach effectively in a technology rich society.

Preservice teachers need a cohesive preparation program that integrates technology, pedagogy, and content in order to develop their TPACK and use that knowledge to teach in a technology rich society (Darling-Hammond et al., 2008). Based on the high TPACK construct scores on the pre-internship PT-TPACK survey, there is evidence of this occurring at the participating university. Therefore, this suggestion reiterates the bulk of literature regarding teacher education programs. Many standard teaching practices have gone unchanged since the industrial revolution (Ravitch, 2001), and changes in the way we live, think, and learn because of technology (Turkle, 2011) spurs a need for change in how we teach and develop teachers (Presnsky, 2001). Teacher education programs must not only incorporate an individualized personal inquiry and professional development approach to the internship (Knowles & Cole, 1996), but they must also incorporate technology as a contextualized medium (Talbert & Trumble, 2014) within all classes and the internship. Many teachers view technology as a tool to use in order to complete a task, but people in the world outside of education incorporate technology as an extension of themselves (Clayton, Leshner, & Almond, 2015; Koivisto, 2014). It is imperative that technology be incorporated into all aspects of preservice teacher preparation so that beginning teachers are prepared to teach students who view technology as an extension of themselves. Therefore, I suggest that the faculty at the participating university consider a discussion of adding technology to the core tenets of the program. Conceptual agreement between the faculty and staff at the university toward

the integration of technology would add to the TPACK of the students; the preservice teachers could thus become even more prepared as they enter and traverse the internship.

Van Slyke-Briggs, et al. (2014) discussed the ways that coursework can distract from interns' incorporation of technology within their lesson design and development: "By the time pre-service teachers begin their student teaching experience, the often have a preferred style of planning and communication which they have developed from their prior preparatory coursework and experiences. If the technology does not mesh with their typical planning process, it can create a disconnection between the practicality and the implementation of the technology" (Van Slyke-Briggs et.al, 2014, p.137). The development of coursework throughout a teacher education program must integrate the entire TPACK framework, and there should be a seamless incorporation of technology in methods courses. This means that all teacher education faculty must embrace the incorporation of technology with pedagogy and content, model, and instruct preservice teachers in the best practices of technology use. Additionally, and in direct relation to the data in this study, emphasis on incorporating technology to allow students opportunities to construct understanding rather than to simply communicate and monitor behavior is imperative. Incorporating technology in classroom environments should move beyond the procedural, up Bloom's taxonomy (Anderson, Krathwohl, & Bloom, 2001), to evaluation and creation.

Although many methods course teacher education faculty and instructors may incorporate technology into their instruction, a renewed focus on developing teacher education curricula in light of the pervasiveness of technologies in culture is needed. Additionally, teacher education faculty should continually investigate ways to prepare

preservice teachers for the ever-changing environment of education in a technology rich society. Although there were issues with connectivity and access to technologies found in this study, there is a continued emphasis toward access and use of technologies in the K-12 setting (Office of Educational Technology, 2015). Therefore, teacher educators should approach teaching with a forward-looking disposition so that beginning teachers can have a forward-looking disposition. Teacher educators should encourage innovative exploration with technologies with an emphasis on student-centered pedagogy throughout the teacher education program (Darling-Hammond et al., 2008). This will help prepare students for this ever-changing world (Berry, 2011; Turkle, 2012). As stated previously, I believe that the addition of technology within the key tenets of the program would assist in these endeavors.

Implications for Future Research

There is a need for continued research on the change in the preservice teacher and the culminating field experience component of teacher education programs in relation to technology integration. This study adds to the literature in regards to teacher change and TPACK during the internship, but there continues to be a need for study of causal change in interns' knowledge during the internship experience. One conclusion from this study was that the success of the internship is highly individualized. The context in which the intern is placed as well as the intern's perceptions and experience effect the development of the intern. Extensive research regarding overall intern development with respect to TPACK during the internship is needed.

It is possible for this study to be replicated in various situations. Replication of this study would add to the overall understanding (Yin, 2009) of the internship

experience and change in interns in relation to their self-preparedness to teach in a technology rich society. Replication studies may also adjust certain aspects of this study including analysis of both the quantitative and qualitative instruments. Because the TPACK construct was considered most important, using instrumentation that only includes this construct may be appropriate and may increase the response rates by decreasing the number of items on the overall survey. Additionally, the qualitative instrument may also be altered in future studies to fit the specific situation in which the study is completed. Another adjustment for future studies could include the entirety of a yearlong internship experience. This would add to the literature regarding the impact of the length of the internship on the interns' self-perceived preparedness to teach in a technology rich society. Finally, any replication of this study should include larger sample sizes in order to increase statistical power.

As mentioned earlier, additional research is needed in the area of intern development based on certification level and in relation to the change of interns' self perceived preparedness to teach in a technology rich society. While this study did not reveal significant differences in change based on intern certification levels, the qualitative results from the embedded cases indicated slight differences between interns seeking certification as elementary generalists and the other certification areas in relation to the development of student-centered technology integration. This should be explored in future research.

Future studies that would also add to the literature could include both quantitative and qualitative studies that report best practices as well as longitudinal studies that follow beginning teachers throughout their career. Research that would contribute to a deeper

understanding and support for intern TPACK development could explore the TPACK of mentor teachers, intern supervisors, and university faculty. This could be done with a number of the instruments described in Chapter Two. Additionally, research that may apply to the internship and technology integration could include the effect of reverse mentoring as it is quite possible that the interns may have higher TK than many of the mentor teachers (Prensky, 2010).

Limitations

This study was conducted during the first semester of a two-semester internship program. Preservice teaching interns participating in this study completed the post-internship survey at the end of the first semester. Many traditional teacher education programs have only a one-semester internship or student teaching experience; therefore the viability of data from a one-semester internship would be applicable to other programs. The data, however, was not significant and could only be discussed in light of the individuals and the sample. Moreover, this study was designed to examine change in the TPACK over the course of a one-semester internship, but this change may have been accounted for at the time of the survey. Therefore, the length of this study limited the results of this study. Some researchers consider one semester to be an adequate amount of time to analyze teacher change (Jones & Vesilund, 1996; Joram & Gabriele, 1998), but others propose that a longer period of time is necessary in order to adequately measure change in teachers' beliefs (Cadule & Moran, 2012; Hanrahan & Tate, 2001; Kagan, 1992; Richardson, 1996; Smith, 1997). This study only investigated change during the internship and could only relate to this specific phenomenon, which is a part of the teacher education program at the participating university. This study only observed a

portion of the fully developed program for preservice teacher preparation and was limited by the time frame of 12 weeks. This may have not been an adequate time frame to analyze change in interns' self-perceptions.

The extensive literature review from this study revealed a gap in the literature in relation to the development of preservice teachers during the internship experience in relation to teaching with technology. Although this study sought to narrow this gap, the absence of literature limited the correlation of finding to any cannon of direct relation. Another possible limitation of this study was response rate and quality of qualitative responses. Many participants, specifically those in the group of 27, chose to not complete the qualitative portion of the surveys, and multiple participants offered only fragmented answers to the qualitative survey questions, this left a dearth of data points from the group of 27 that limited the qualitative analysis. Because of this, a determination was made to select and utilize data from six embedded cases for additional analysis. This limited the amount of viable data from which to form conclusions. An additional limitation is that the data analyzed in this study was self-reported and self-perceived by the intern participants. This data only revealed the interns' perceptions and may not represent their ability or competency to teach in a technology rich society.

Moreover, it was recognized that the participants began the internship experience with a high level of self-perceived preparedness in relation to the TPACK construct. It was also revealed that the mentor teacher had an impact on the interns' utilization of technology. An additional limitation may have been that the mentor teachers who mentored the interns in the practice of teaching may have themselves not been prepared

with a high TPACK, yet the study did not explore mentor teachers' technology specific perspectives or abilities.

Conclusions

This study was conducted to explore change that occurred during the teaching internship of preservice teacher interns in relation to their self-perceived preparedness to teach in a technology rich society. The TPACK framework (Mishra & Koehler, 2006) was identified as an a priori framework that exemplifies the knowledge bases that are essential for teaching in a technology rich society. To analyze interns' perceptions, the PT-TPACK instrument (Lux, 2010; Lux, et.al, 2001) was chosen as a quantitative instrument to measure change over the course of a one-semester internship. Qualitative questions aligned with the TPACK framework were combined with the quantitative instrument in a pre/post design. The results of the quantitative analysis were not significant and could not be generalizable. Therefore, a decision was made to analyze the data generated by six exemplar embedded cases for changes that occurred over the course of the one-semester internship.

The results of this mixed-method multiple case study revealed a need for further analysis of the internship experience in relation to the TPACK framework and the use of technology during the internship experience. The data generated by the interns in this study indicated some individual changes; yet, overall there was little change in the interns' perceived preparedness to teach in a technology rich society.

It was recommended that the partnership between the teacher education program and public schools continue, and selection of mentor teachers who integrate student-centered technology instruction in their classroom becomes a high priority. It was also

recommended that the intern supervisor role be elevated and he/she should support the intern in the required incorporation of student-centered technology with pedagogy and content. Additionally, it was recommended that technology integration become part of the fabric of the preservice teacher program. Instructional technology should be integrated throughout the coursework in methods and pedagogy in addition to courses focused on technology skill development.

This study identified a gap in the literature regarding the internship or student teaching experience and the change in self-perceived TPACK. I set out to investigate the change that occurred in preservice teacher interns' understanding and actions in relation to their self-perceived preparedness to teach in relation to the TPACK framework. The results indicated little change, however, suggestions were made that may result in positive outcomes for preservice teachers' preparedness to teach in a technology rich society.

APPENDIX

APPENDIX

Combined PT-TPACK and Qualitative Instruments

Demographic Data Collection

What is your nine-digit bear ID?

Are you male or female?

- Male
- Female

How old are you?

- Less than 20 years old
- 20
- 21
- 22
- 23
- 24
- 25 years or older

What Texas teaching certification are you studying to acquire?

- Generalist EC-6
- Generalist EC-6 Dual GT Certification
- Generalist EC-6 Dual Special Education Certification
- EC-12 Physical Education (Sports Pedagogy)
- EC-12 Special Education
- 6-12 Business
- 7-12 Social Studies
- 7-12 Science
- 7-12 Life Science
- 7-12 Math
- 7-12 English/Language Arts
- 4-8 Social Studies
- 4-8 Science
- 4-8 Math
- 4-8 English/Language Art

PT-TPACK Instrument

Technology is a wide-ranging term that can mean different things to different people. For the purpose of this study, technology is used to refer to digital tools and resources such as computers, the Internet, podcasts, blogs, interactive whiteboards, educational software, iPods and other handheld devices.

Please read each item carefully and then rate to what extent you agree with the statement using the scale below. Each statement will be about your teacher preparation program and how it **has** prepared or **is** preparing you.

My Teacher Preparation Program prepared me with:

	Strongly Agree	Agree	Disagree	Strongly Disagree
1. An understanding of pedagogy, or teaching methods (e.g., designing instruction, assessing students' learning).	○	○	○	○
2. Knowledge of the practices, strategies, and methods of teaching I will use as a teacher.	○	○	○	○
3. The knowledge and skills I will need in assessing student learning.	○	○	○	○
4. The concepts and skills necessary to motivate students to learn	○	○	○	○

My Teacher Preparation Program prepared me with:

	Strongly Agree	Agree	Disagree	Strongly Disagree
5. Knowledge of hardware, software, and technologies that I might use for teaching.	○	○	○	○
6. The knowledge and skills to use technology in my everyday life.	○	○	○	○
7. The understanding needed to recognize that technology may support and improve everyday life and that it may not.	○	○	○	○

	Strongly Agree	Agree	Disagree	Strongly Disagree
8. The skills and understanding to decide where technology can be beneficial to achieving an objective.	○	○	○	○
9. The skills and understanding to decide where technology can be detrimental to achieving an objective.	○	○	○	○

My Teacher Preparation Program prepared me with:

	Strongly Agree	Agree	Disagree	Strongly Disagree
10. A comprehensive understanding of the subject matter I will need to teach.	○	○	○	○
11. An understanding of how knowledge in my discipline is organized.	○	○	○	○
12. Knowledge of preconceptions and misconceptions in my subject area, and how they can be addressed instructionally.	○	○	○	○

My Teacher Preparation Program prepared me with:

	Strongly Agree	Agree	Disagree	Strongly Disagree
13. An understanding that there is a relationship between content and the teaching methods I use in the classroom.	○	○	○	○
14. The skills and methods needed to provide multiple representations of content in the form of analogies, examples, demonstrations, and classroom activities.	○	○	○	○
15. The strategies I will need to adapt material to students' abilities, prior knowledge, preconceptions, and misconceptions.	○	○	○	○

My Teacher Preparation Program prepared me with:

	Strongly Agree	Agree	Disagree	Strongly Disagree
16. An understanding of how teaching and learning change when particular technologies are used.	○	○	○	○
17. An understanding of how technology can be integrated into teaching and learning in order to help students achieve specific pedagogical goals and objectives.	○	○	○	○
18. An understanding of how to adapt technologies to better support teaching and learning.	○	○	○	○
19. The skills and understanding needed to reconfigure technology and apply it to meet instructional needs.	○	○	○	○
20. An understanding that in certain situations technology can be used to improve student learning.	○	○	○	○

My Teacher Preparation Program prepared me with:

	Strongly Agree	Agree	Disagree	Strongly Disagree
21. The knowledge of how to effectively integrate educational technologies to increase student opportunities for interaction with ideas.	○	○	○	○
22. The knowledge and skills necessary to flexibly incorporate new tools and resources into content and my teaching methods to enhance learning.	○	○	○	○
23. Teaching methods that use technology to teach content and provide opportunities for learners to interact with ideas.	○	○	○	○

24. An understanding of what makes certain concepts difficult to learn for students and how technology can be used to leverage that knowledge to improve student learning.	○	○	○	○
25. An understanding of how to integrate technology to build upon students' prior knowledge of subject matter topics.	○	○	○	○
26. An understanding of not just know how to operate classroom technologies, but of the knowledge needed to incorporate technologies into my particular content area or grade level to enhance student learning.	○	○	○	○
27. Strong technological pedagogical content knowledge (TPACK). This knowledge includes knowledge of how to integrate the use of educational technologies effectively into curriculum-based learning.	○	○	○	○

Pre-Internship Open-Ended Qualitative Items

The questions below are open-ended questions that ask about your understandings and expectations as you enter the internship experience.
Please answer each question completely by typing in the box.

- List the specific technologies you plan to incorporate into your teaching practice this semester.
- What classroom experiences do you want your students to have that involve the incorporation of technology?
- Why do you want your students to have the experiences described above?
- How do you expect your understanding of the content you will be teaching to impact the experiences you described above?
- What classroom factors do you expect to affect your ability to incorporate the above experiences?

Post-Internship Open-Ended Qualitative Items

The questions below are open-ended questions that ask about your understandings and experiences as from the internship experience.

Please answer each question completely by typing in the box.

- List the specific digital technologies you incorporated into your teaching practice this semester.
- Describe the classroom experiences you offered your students that incorporated technology?
- What was your rationale in providing the experiences above?
- How did your understanding of content impact the experiences described above?
- What factors motivated and assisted you to incorporate technology into your classroom experiences?
- What barriers were in place that hindered the incorporation of technology into your classroom experiences?
- Based on your experience this semester, how do you plan on incorporating technology into your future classroom practice?

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