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REIMAGINING TECHNOLOGY PREPARATION FOR PRE-SERVICE TEACHERS: EXPLORING HOW THE USE OF A VIDEO SELF-ANALYSIS INSTRUCTIONAL COMPONENT, BASED ON THE EVIDENTIAL REASONING AND DECISION SUPPORT MODEL, IMPACTS PRE-SERVICE TEACHERS' TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE

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Abstract

Teachers often teach on their own in their individual classrooms and thus have to mostly rely on themselves to reflect on their teaching practices and make improvements. This study explores how the use of a video self-analysis instructional component, based on the evidential reasoning and decision support model (ERDS), impacts pre-service teachers' technological pedagogical content knowledge (TPACK). Using the explanatory sequential mixed methods design, the researcher first collected quantitative data. The collection of qualitative data then followed. This two-step process helped explain and elaborate on the quantitative results of this study. Participants in this study were 21 pre-service teachers enrolled in the third and final required technology integration courses during the 2016 fall semesters. Data sources used for this study included surveys, videotaped teaching samples, reflective essays, and semi-structured interviews.

Results from the study indicate statistically significant improvements in participants' self-perceptions towards their content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and overall TPACK. Except for TK, the self-perception of all TPACK domains statistically significantly increased with medium to large effect sizes. Every participant in this study (n=21/21) cited that their ERDS guided video self-analysis was beneficial in informing their technology integration lesson planning process because the videos enabled them to observe their actual teaching practices. As a result, the pre-service teacher participants were able to critically assess their TPACK strength and limitations. In addition to changing participants' TPACK perceptions, the participants also applied the lessons learned from their ERDS guided video self-analysis to actually change and improve their technology integration

skills. For example, 85.7% (n=18/21) of the participants actually changed their instructional behaviors based on their self-prescribed action plan they outlined in their technology-enhanced lesson plans.

The findings from this study suggest that the use of an ERDS guided video self-analysis instructional component was beneficial in helping pre-service teachers improve their ability to teach with technology because 1) it helped them challenge their own preconceptions of their TPACK; 2) enabled them to critique their own teaching and technology integration skills and; 3) provided them with authentic and accurate depictions of technology integration skills (e.g., videotaped lessons) so they could accurately prescribe a specific plan of action to improve their future technology-enhanced lessons. While this is only one study within a specific context, the results from this research suggest it may be worthwhile for scholars and teacher educators to continue examining the effects of using an ERDS guided video self-analysis instructional approach to improve teachers' TPACK and technology integration skills.

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Table of Contents

List of Illustrative Materials

Tables

Figures

Chapter 1: Introduction

Background

Technological progress has consistently driven remarkable advances in the U.S. economy. However, primary and secondary education in the United States (known as K–12) has yet to fully embrace the use of technology compared to other sectors in our economy (Collins & Halverson, 2018; Batane & Ngwako, 2017; Chatterji & Jones, 2012). In an effort to better prepare students to compete in the global economy, K-12 schools in the United States invest billions of dollars each year in educational technologies to help teachers and students teach and learn at their highest potential (Hollands & Escueta, 2017). As a result, teachers and students now have more access than ever to educational technologies. However, simply having access to educational technologies does not automatically translate into improved instruction or enhanced learning outcomes (U.S. Department of Education, 2017; Lei, 2010). Recent studies suggest that a major reason why teachers are not teaching with technology is due to the fact they were not adequately prepared to do so (U.S. Department of Education, 2017; Arrastia-Chisholm, Torres, & Tackett, 2017; Rodriguez, Adams, & Zimmer, 2016; Banas & York, 2014).

Due to the accessibility and ubiquity of instructional technologies in K-12 schools over the past two decades, scholars, researchers, and practitioners have shown considerable interest in designing and developing instructional strategies that can help teachers improve their ability to teach with technology (Kafyulilo, Fisser, & Voogt, 2016; Hofer & Grandgenett, 2012; Koehler & Mishra, 2005a, 2005b). Teachers' ability to effectively teach with educational technologies is vital, because studies show that teaching with technology can help enhance students' learning

(Beetham & Sharpe, 2013; Gulek & Demirtas, 2005; Wenglinsky, 1998), students' academic achievement (Cheung, 2013; Lei, 2010; Schacter, 1999), and students' classroom engagement (Abrami, 2001; Wankel & Blessinger, 2013).

The importance and benefits of teaching with technology has been emphasized in many public discussions, national policies, and in the field of Teacher Education. For example, the fourth National Education Technology Plan titled: *Transforming American Education: Learning Powered by Technology*, which was released by the U.S. Department of Education's Office of Educational Technology (OET) in 2010 (U.S. Department of Education, 2010) called for the integration of educational technologies into the entire U.S. education system in order to "enhance student learning, accelerate and scale up the adoption of effective practices, and use data and information for continuous improvement" (U.S. Department of Education, 2010, p. v). However, even with initiatives and efforts designed to help teachers adopt educational technologies such as Preparing Tomorrow's Teachers to use Technology (PT3) and Enhancing Education Through Technology (EETT), teachers are still not effectively teaching with educational technologies (U.S. Department of Education, 2017; Harris & Walling, 2014; Mouza, Karchmer-Klein, Nandakumar, Yilmaz Ozden, & Hu, 2014).

Since the OET released its national education technology plan in 2010, little has changed in terms of pre-service teachers' technology integration skill development. Seven years later, the OET released a revised national education technology plan titled: *Reimagining the Role of Technology in Education* (2017). In the revised plan, they once again called for teacher preparation programs in the United States to reimagine their current technology education instructional approach. This report highlighted the need for teacher preparation programs to revamp their current educational technology preparation paradigm because graduates from these programs continue to “feel unprepared to use technology to support student learning as they transition to teaching and using technology effectively in the classrooms” (U.S. Department of Education, 2017, p. 8).

Over the past decade, there has been a growing trend in the field of Teacher Education where scholars have made it a point of emphasis to prepare the next generation of educators via a practice-based teacher education paradigm (Grossman, 2018; Forzani, 2014; Zeichner, 2012). Practice-based teacher education (PBTE) is an approach to preparing novice and pre-service teachers that focuses on the importance of developing their ability to enact teaching practices (Kavanagh, Metz, Hauser, Fogo, Taylor, & Carlson, 2019). For example, this approach “prioritizes mediated clinical experience and focuses on preparing teachers to enact instruction” (Kavanagh et al., 2019, p.1). Through the PBTE instructional approach, supporters of this paradigm hope to bridge the gap between what teachers learn during their teacher preparation training (i.e., theory) to the realities of authentic learning and teaching environments (i.e., practice). Scholars such as Grossman (2018), have strongly support undertaking the practice-based teacher education instructional paradigm because of how it can help support novice teachers in learning how to become effective educators. Examples of the core practices and principles within practice-based teacher education paradigm include facilitating whole-class discussion, eliciting student thinking, and maintaining classroom norms (Grossman, 2018). As a result, scholars and instructional technologists in the field of Teacher Education have also begun inquiries into further advancing pre-service and in-service educators’ technology integrations knowledge and skills through alternative instructional approaches that contain the core principles of practice-based teacher education (e.g., Leblanc, 2018; Koh, Chai, & Lim, 2017; Jang & Lei, 2015).

Problem Statement

Because of the importance of preparing future educators to effectively teach with technology, teacher preparation programs “should focus explicitly on ensuring all educators are capable of selecting, evaluating, and using appropriate technologies and resources to create experiences that advance student engagement and learning” (U.S. Department of Education, 2017, p. 28). In an effort to prepare the next generation of teachers to meet the challenges of teaching in a 21st century classroom, 98% of teacher preparation programs in the United States now mandate their pre-service teachers to receive some form of training on educational technologies (AACTE, 2013, p. 10). However, scholars suggest there is still a critical need to continue researching and exploring alternative instructional strategies that can further develop pre-service teachers’ technology integration skills (U.S. Department of Education, 2017; Bennett, Agostinho, & Lockyer, 2015; Shin, 2015; Sprague & Katradis, 2015).

The need to explore alternative instructional strategies is a consequence of the fact that pre-service teachers are graduating unprepared to effectively teach with technology (U.S. Department of Education, 2017; AACTE, 2013; Banas & York, 2014; Ottenbreit-Leftwich, Brush, Strycker, Gronseth, Roman, Abaci, & Plucker, 2012; Niess, 2011). For example, 50% of in-service teachers cite the lack of training from their undergraduate teacher preparation programs as one of the biggest barriers to incorporating technology into their teaching (Bill & Melinda Gates Foundation, 2012). Currently, teacher preparation programs are embracing the collaborative learning paradigm as an instructional strategy to improve pre-service teachers’ technology integration skills (Kafyulilo et al., 2016; Tondeur, Pareja Roblin, van Braak, Voogt, & Prestridge, 2016; Johnson, 2014; Lee, Smith, & Bos, 2014; Kim, Kim, Lee, Spector, & DeMeester, 2013). However, the teaching profession is well documented as a solitary profession

(Cheruvu, Souto-Manning, Lencl, & Chin-Calubaquib, 2015; Elliott, 2014) where teachers often teach and prepare their lessons by themselves (Lowrie, 2014; Darling-Hammond, Wei, Andree, & Orphanos, 2009). Due to the fact that the teaching profession is not collaborative in nature (Burke, Schuck, Aubusson, Buchanan, Louviere, & Prescott, 2013; Ingersoll & Smith, 2003), teachers have to mostly rely on themselves to reflect on their teaching practices and make improvements.

As technology continues to evolve and change, it may be beneficial for teacher preparation programs to prepare the next generation of teachers to become self-reliant and reflective technology integrators. By training the next generation of educators to self-critique, self-analyze, and self-direct their technology integration skills, teachers would be empowered to continuously adapt and transform their instruction using new and emerging instructional technologies. However, effectively teaching with technology is a complex process (Koehler & Mishra, 2009), and there is a prodigious need to explore alternative instructional strategies that can further advance teachers' abilities to effectively teach with technology (U.S. Department of Education, 2017; AACTE, 2013; Koehler & Mishra, 2009; West & Graham, 2007). To reflect the realities and solitary nature of the teaching profession, it is imperative for educational scholars to research instructional strategies that extend beyond the current collaborative learning instructional paradigm.

Purpose of Study

Building upon the earlier scholarship of educational technology researchers, this study investigates how a video self-analysis instructional component, in a teacher preparation program, influences pre-service teachers' perceptions towards their technology integration skills, and their actual technology integration abilities. The influence of this instructional approach is examined by observing pre-service teachers' perceptions towards their technological, pedagogical, content knowledge (TPACK), and their actual instructional behaviors while teaching with technology. The context for this study is within an undergraduate one-credit technology integration course, offered within a School of Education located in the northeast United States.

The video self-analysis instructional approach is being further investigated because it enables teachers to see their teaching in an "objective light" (Sewall, 2009, p. 14), "provides actual records rather than uncertain recollections" (Kong, Shroff, & Hung, 2009, p. 546), allows teachers to critically examine their own instruction (Sherin & van Es, 2005; Snoeyink, 2010), and helps teachers develop strategies to improve future instruction by becoming reflective practitioners (Fadde, Aud, & Gilbert, 2009; Pellegrino & Gerber, 2012).

Additionally, this study specifically aims to build upon the previous research of Jang and Lei (2015). In their study, Jang and Lei (2015) explored the *impact* of using a video self-analysis instructional approach to help pre-service teachers improve their ability to teach with instructional technologies. The findings from their study suggested that this instructional approach was beneficial in helping pre-service teachers improve their abilities to teach with technology (Jang & Lei, 2015). However, their study did not investigate *how* the use of the video self-analysis instructional approach influenced pre-service teachers' technology integration abilities. As a result, this research seeks to extend Jang and Lei's (2015) initial findings by exploring how this instructional approach influences pre-service teachers' TPACK and their actual instructional behaviors while teaching with technology.

What is technology integration? While technology education scholars often use the term *technology integration*, a clear standard definition for the term does not exist. For example, some scholars argue that the term *technology integration* should be defined by how a teacher uses technology in their classroom (e.g., simple internet searches of low-level integration; adopting digital simulations, multimedia presentations of high-level integration) (Cuban, Kirkpatrick, & Peck, 2001), while other scholars believe the term should be understood and defined by how teachers leverage technology to help students solve problems (Ertmer, 2005; Lim, Teo, Wong, Khine, Chai, & Divaharan, 2003).

While there are numerous definitions of technology integration, this study adopted Koehler and Mishra's (2009) definition due to its lucidity and its acceptance within the educational technology research community. These authors define technology integration as "a complex interaction among three bodies of knowledge" (i.e., content, pedagogy, and technology), where learning is enhanced through the teacher's meaningful and purposeful adoption of educational technologies (Koehler & Mishra, 2009, p. 60).

Theoretical Frameworks

Learning Framework: Social Cognitive Theory (SCT)

The underlying theory used to contextualize this study was based on Bandura's (1986) social cognitive theory. Social cognitive theory is often used in research "to guide the development of extensive research programs and to design instructional–learning materials, systems, and environments" (Martin, 2004, p. 135). Furthermore, this theory was used because it adopts an agentic perspective that personal growth can occur through self-development, adaption, and change (Bandura, 2001). Bandura (2005) later elaborated on the concept of social cognitive learning through the lens that people are "self-organizing, proactive, self-regulating, and self-reflecting" (Bandura, 2005, p. 9).

At its core, social cognitive theory is based on imitative and observational learning (Watson, 2017). Bandura (1977) once argued that most humans learn through this approach and that people can't construct behaviors based only on their own lived experiences. Bandura (1977) further elaborated this concept by stating people learn through observations because it helps people code information in their minds, which in turn can help them enhance their own personal development by forming new ideas. However, not all observations are alike. For example, Bandura (1977) expressed that observational learning occurs via four specific sub-processes. The four sub-processes are *attention, retention, production*, and *motivation*. Bandura (1977) stressed the importance and significance of keeping one's *attention* during the observational learning process so that people can accurately and critically assess the observed behavior. To facilitate this process, participants in this study were asked to analyze their personal teaching vignettes. In regards to *retention*, Bandura (1977) cited that this theory would not work unless a person can accurately remember what they observed. To facilitate the retention sub-process, participants in this study used videotaped recordings of their individual teaching samples where they could observe and analyze accurate depictions of their teaching and technology integration skills. The third stage in Bandura's observational learning process is *production*. This stage involves the transfer of observed behaviors that have been retained mentally, into the construction of future behaviors and actions (Watson, 2017). To aid this process, this study used guiding observation and reflective frameworks so that participants in this study could create a specific course of action to improve their future technology integration. During the *motivation* stage, the person is tasked to select a specific course of action from the range of possible actions. The action the person selects is often related to internal and external motivations and the degree of effort that one might perceive necessary to expend (Watson, 2017).

One of the major features of the social cognitive theory is its emphasis on one's own cognitive processes (Bandura, 1997). As a result, self-efficacy, which is the most influential construct within the social cognitive theory. For instance, if a person believes in “one’s capability to perform certain actions is based on cognitive processes such as perception, attention, and memory. The cognitive construal of past performances, situational factors, and one’s knowledge and skills all influence how much one will perceive to be capable of attaining a certain performance level” (Eun, 2019, p.76). Bandura's (1997) seminal research suggests that people with high levels of self-efficacy persist in the face of numerous obstacles, and are more apt to accept innovative ideas. As a result, teachers with high levels of self-efficacy tend to be more receptive to embrace changes if it's related to their professional teacher development (Eun, 2019). In addition to a teacher's perceptions of their self-efficacy, this theory suggests one other major construct that determines future teacher performance is outcome expectations (Bandura, 1977, 1997). According to Bandura (1997), outcome expectation is a judgment of the likely consequences certain actions will produce. For example, a teacher may have a strong belief in self-efficacy to effectively integrate technology into their instruction. However, if that teacher is a part of a department, school, or district that does not value or believe in the potential benefits of teaching with technology, then adopting instructional technologies into their classroom instruction might produce ostracism, which may, in turn, lead to less than desirable outcomes from this teachers perspective (i.e., not integrating or teaching with technology). Scholars such as Eun (2019) have further surmised that within the social cognitive theory, “self-efficacy is a stronger predictor of future behavior than outcome expectations” (p.77). As a result, this theory was used to contextualize this study to better understand how the use of an evidential reasoning and decision support (ERDS) guided video self-analysis instructional approach, impacted pre-service teachers' technological pedagogical content knowledge (TPACK). Further description of this theory is presented in chapter two and elaboration of how this theory informed the design of this study is presented in chapter three.

Design Framework: Evidential Reasoning and Decision Support (ERDS)

For this research, the evidential reasoning and decision support (ERDS) model served as the framework to inform the design of this study. ERDS is a framework for teachers to collect, analyze, interpret, and act on emergent classroom practices using video evidence to systematically capture, identify, analyze, and adapt their teaching practices using guiding protocols and rubrics (Recesso, Hannafin, Wang, Deaton, Shepherd, & Rich, 2009). This framework facilitates this process through an iterative four-stage process centered around using video data to plan, monitor, and improve teachers' professional growth (Recesso et al., 2009; Bryan, Recesso, & Seung, 2008). For example, the first phase of the ERDS model requires participants to identify triggers or a specific focus area they want to improve upon. For this study, the participants' trigger or focus area was to effectively integrate technology into their instruction. During the second phase, participants’ teaching samples were digitally recorded as a means to collect and capture evidence. In this study, participants’ reflective essays and action plans were collected as supplementary evidence. In phase three, participants used a guiding protocol, such as Hofer et al., (2011) TPACK observational rubric, to facilitate their ability to filter, analyze, and interpret their technology integration skills. Lastly, during the fourth and final phase, participants applied their lessons learned from phase three to develop a specific action plan that they undertook to improve their subsequent technology-enhanced lesson. Moreover, this framework was used for this study because it has been shown to help teachers self-analyze their instructional practices so that they can learn about and facilitate their own teacher development (Rich & Hannafin, 2009b). A more detailed introduction of the ERDS framework is presented in chapter two.

Reflective Framework: Gibbs Reflective Cycle

Reflection is often used in teacher education as an instructional strategy to help teachers improve their teaching skills and abilities (Black, 2015; Sherin et al., 2014; Fadde et al., 2009). However, for reflections to be meaningful and helpful, they are often guided by reflective frameworks with theoretical foundations (Vong, 2017). To help teachers analyze and interpret the evidence they collect from the *interpretation stage* within the ERDS framework; Recesso et al., (2009) suggest that a reflection framework should be used to help guide and assist teachers' reflection process. For this research, the Gibbs reflective cycle (1988) was used to provoke thoughtful reflections from the pre-service teacher participants' through its six-stage reflective cycle. The six stages are *description, feelings, evaluation, analysis, conclusion*, and *action plan* (Gibbs, 1988). This reflective cycle framework considers a teacher's emotional experience to be an important factor within their reflective process. As a result, this assumption led Gibbs to include a component that prompts teachers to identify their emotions and feelings during their teaching experience. Furthermore, the Gibbs reflective cycle (1988) includes a conclusion and action plan reflective prompts to help teachers take action after their reflective essays. A more detailed description of the Gibbs reflective cycle (1988) is presented in chapter two.

Measurement Framework: Technological Pedagogical Content Knowledge (TPACK)

Technological pedagogical content knowledge (TPACK) is a framework for the knowledge base teachers need to effectively teach with technology (Voogt et al., 2013; Mishra & Koehler, 2006; Pierson, 2001). For the past 12 years, the TPACK framework has gained national and international traction among educational technology scholars and instructional technologists because it illustrates the complex act of teaching with technology in an organized and visually attractive manner (Lubke, 2013). As described by Voogt et al. (2013), the TPACK framework stems from the belief that teachers can become better technology integrators by carefully aligning the following three knowledge domains: content, pedagogy, and technology, in their teaching. TPACK was specifically developed to provide teachers and teacher educators with a detailed description of the complex interactions among three major bodies of knowledge (i.e., content knowledge, pedagogical knowledge, technological knowledge) needed to effectively teach with technology (Koehler & Mishra, 2009; Pierson, 2001). To better understand the "complex interplay of these three bodies of knowledge" (Mishra & Koelher, 2006, p. 1025), the three lenses of pedagogical knowledge (PK), content knowledge (CK), and technological knowledge (TK) were joined together to create three additional knowledge domains: pedagogical content knowledge (PCK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK) (Koehler & Mishra, 2009). The combination of these six unique knowledge domains produced the seventh knowledge domain and the technology integration model known as TPACK. For this research, the TPACK framework was selected because it provides teachers and teacher educators with a detailed description of the complex interactions among three major bodies of knowledge (i.e., content knowledge, pedagogical knowledge, technological knowledge) needed to effectively teach with technology (Koehler & Mishra, 2009;

Pierson, 2001). Further description of this framework's strengths and limitations is presented in chapter two.

Research Questions

The accessibility and ubiquity of video-recording technologies (e.g., smartphones, tablets, camcorders) and video sharing platforms (e.g., YouTube, Instagram, Facebook, Vimeo) have made it possible for teachers to record, monitor, analyze, and store samples of their own instruction. While video has long been used in education to help facilitate learning (Grossman 2005), we know relatively little about how video self-analysis influences pre-service teachers' perceptions towards their technology integration, and their actual technology integration abilities. This study seeks to build on the lessons learned from previous scholars who have examined video analysis impact on teacher preparation (Nagro, Rosenberg, Carran, & Weiss, 2016; Osmanoglu, 2016; Jang & Lei, 2015, Fadde & Sullivan, 2013; Chase Martin & Sadera, 2011; Sherin & van Es, 2005; Sharpe et al., 2003), by investigating how an ERDS guided video self-analysis instructional component influences pre-service teachers' perceptions towards their technology integration abilities, and their actual technology integration behaviors. In order to examine this topic, this study addresses the following research questions:

1. How do pre-service teachers perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses?
2. How does the use of video self-analysis, guided by the ERDS model, inform pre-service teachers' technology integration planning?

3. Do pre-service teachers change their instructional behaviors after their ERDS guided video self-analyses?

Study overview. The participants for this research were pre-service teachers of senior academic standing who were enrolled in a mandatory technology integration course during the spring 2016 academic school semester. Participants were tasked to design, develop, and teach two 10-minute lessons where technology was integrated into their instruction. The participants then delivered their lessons to the other research participants, who roleplayed as the lesson's targeted audience (e.g., elementary students). Each lesson was video-recorded and uploaded onto the course Blackboard site, where participants were able to watch and self-analyze their videotaped instruction. During their self-analysis, the participants analyzed their instructional strengths and limitations while teaching with technology. To facilitate this process, the participants used a validated technology integration assessment rubric developed by Hofer, Grandgenett, Harris, and Swan (2011) to self-assess their technology integration abilities. Based on their findings, the participants wrote reflective essays using the Gibbs reflective cycle (1988) framework and developed an action plan that would improve their future technology-enhanced lesson. After the participants developed their action plans, they taught their technology-enhanced lesson for a second time.

Pre- and post- surveys were administered to measure pre-service teachers' perceptions of their TPACK before and after their video self-analysis. Participants' reflective essays, action plans, videotaped lessons, and interviews were also collected and assessed for evidence of pre-service teachers' TPACK. The data was then cleaned, coded, triangulated, and analyzed using constant comparative analysis to determine how an ERDS based video self-analysis instructional approach influenced pre-service teachers' technology integration planning, instructional behaviors, and TPACK (Boeije, 2002; Dye, Schatz, Rosenberg, & Coleman, 2000; Glaser, 1965).

Summary. Teacher effectiveness has rapidly risen to the top of the education policy agenda, as experts in the field of Teacher Education have become convinced that effectively preparing future teachers is one of the most important factors in determining future student achievement (Darling-Hammond, 2017). As a result, the field of Teacher Education has emphasized preparing the next generation of educators via a collaborative, practice-based, practice-focused, and practice-centered instructional paradigm in recent years (Darling-Hammond, 2017; Snyder, Hemmeter, & Fox, 2015). While scholars have made significant contributions towards the field of Teacher Education through the lens of practice-based teacher education (PBTE); additional research exploring alternative instructional approaches that focus on preparing the future teachers via a practice-based instructional lens is needed (Darling-Hammond, 2016; Zeichner, 2012). As a result, this study investigates how an ERDS guided video self-analysis instructional component influences pre-service teachers' perceptions towards their TPACK, and their actual technology integration abilities.

In this chapter, the background information for this study is provided. In addition, the problem statement, study's purpose, theoretical frameworks, and research questions were described and outlined above. In Chapter two, a review of the literature relevant to the research is presented. Chapter three outlines and elaborates on the study's research methodology. Chapters four, five, and six presents the study's results and findings via specific research questions. The final chapter, Chapter seven, describes the study's conclusions, limitations, and recommendations for future research.

Chapter 2: Literature Review

The purpose of this dissertation is to determine how an ERDS guided video self-analysis instructional approach influenced pre-service teachers' technology integration practices. This literature review provides support for the underlying hypothesis of this study: that the use of video self-analysis, guided by the ERDS model, has the potential to positively influence pre-service teachers' technology integration skills and technological pedagogical content knowledge (TPACK). The benefits of the video self-analysis instructional approach have been well documented in the field of education and human development (Osmanoglu, 2016; Fadde & Sullivan, 2013; Chase Martin & Sadera, 2011; Recesso et al., 2009; Sherin & van Es, 2005). However, there has been limited research examining its influence on facilitating teachers' TPACK and technology integration skills. This study seeks to build upon and contribute to the existing body of literature by investigating how an ERDS based video self-analysis instructional approach influences teachers' technology integration skills.

Technology in Education: An Overview

The earliest reference to educational technology was made by W.W. Charters in 1948 (Saettler, 1990). However, even before 1948, educational technologies began to be introduced to the general public. For example, during the 1920s, radios and audio recording machines were used to inform and teach the public about local and national events, while also being used in schools as a medium for teaching (Nmungwun, 2012). A decade later, film and motion pictures became the preferred medium as a means for children, youth, and adults to consume information (Nmungwun, 2012; Cuban, 2003). As technology continued to advance during the 1950s, home televisions became the primary medium where people turned to for their news and entertainment (Cuban, 2003). During the 1960s, IBM created the first computer designed to run programs and tasks (Freiberger & Swaine, 1999). Twenty years later, personal computers were introduced, and they soon became fixtures in homes and in schools across the country (Freiberger & Swaine, 1999). Soon thereafter, during the 1990s, the World Wide Web was created (Cuban, 2003).

The emergence of the internet and new instructional technologies subsequently led educational organizations at the local, state, and federal levels to encourage teachers to actively teach with instructional technologies. As expressed by Bakir (2016), “these organizations have devoted extensive amounts of time, money, and effort to develop and integrate different frameworks and policies to encourage the use of technology in teacher training and K-12 settings” (p. 21). As a result, the field of Teacher Education has also shifted their instructional paradigm to better prepare teachers for the rigors and challenges of teaching in a 21st-century learning environment.

Over the past decade, there has been a growing trend in the field of Teacher Education where scholars have been investigating ways of focusing teachers’ professional training via a practice-based teacher education paradigm (Grossman, 2018; Forzani, 2014; Zeichner, 2012). For example, scholars such as Grossman (2018), have strongly support undertaking the practice-based teacher education instructional paradigm because of how it can help support novice teachers in learning how to become effective educators. Examples of the core practices and principles within practice-based teacher education paradigm include facilitating whole-class discussion, eliciting student thinking, and maintaining classroom norms (Grossman, 2018). As a result, scholars and instructional technologists in the field of Teacher Education have also begun inquiries into further advancing pre-service and in-service educators’ technology integrations knowledge and skills through alternative instructional approaches that contain the core principles of practice-based teacher education (e.g., Leblanc, 2018; Koh, Chai, & Lim, 2017; Jang & Lei, 2015).

Federal Initiatives, Reforms, and Policies

Preparing teachers to effectively teach with technology first became a national priority when the National Commission on Excellence in Education released a report titled: *A Nation at Risk: The Imperative for Educational Reform* in 1983 (Bakir, 2016). In the report, the commission recommended that all high school students be required to take at least one technology course (i.e., computer course), during their high school career, as part of their graduation requirements (National Commission on Excellence in Education, 1983). Then, during the late 1980s, the U.S. Department of Education's Office of Technology Assessments (OTA) took a proactive approach to examine the status of technology integration in teacher education programs by publishing a report titled: *Power On! New Tools for Teaching and Learning* (U.S. Congress, 1988). This report was significant because it showed that "the vast majority of those now teaching or planning to teach have had little or no computer education or training" (U.S. Congress, 1988, p. 18). The report then went on to suggest that teacher preparation programs in the United States should explore new ways to teach with these new and emerging technologies. Seven years after the initial report, the OTA released another report titled: *Teachers and Technology: Making the Connection.* While the report examined the importance of training teachers on how to use and teach with technology, it also highlighted that leaders within the field of teacher education did not view technology as a tool that can facilitate students' learning (U.S. Congress, 1995).

National Technology Plans

In 1996, the U.S. Department of Education released its first national technology plan titled: *Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge* (U.S. Department of Education, 1996). This plan stressed the importance of improving the technology integration paradigm employed in teacher preparation in the United States. Specifically, the technology plan emphasized that pre-service teachers should not only learn how to use technology but be able to enhance their students learning via instructional technologies. Following this initial plan, the U.S. Department of Education published four subsequent plans in 2000, 2004, 2010, and 2016.

The 2000 national technology plan titled: *E-Learning: Putting a World-Class Education at the Fingertips of All Children*, focused on the idea that technology was an essential component of school improvement, and that students needed to begin developing 21^{st}-century literacy skills (U.S. Department of Education, 2000). The 2004 national technology plan titled: *Toward a New Golden Age in American Education: How the Internet, the Law and Today's Students Are Revolutionizing Expectations*, focused on online instruction and virtual learning environments. Based on their research, they cited that K-12 students were not using instructional technologies to facilitate their learning. A major factor as to why students were not using instructional technologies was due to their teachers were not using them. The report further cites that teachers were reticent to teach with the instructional technologies because they felt they were not adequately prepared to do so (U.S. Department of Education, 2004). The fourth national technology plan published in 2010, and titled: *Transforming American Education: Learning Powered by Technology*, focused on teacher preparation programs by stating that "technology should be used in the preparation and ongoing learning of educators to engage and motivate them in what and how they teach" (U.S. Department of Education 2010, p. 16). The most recent national technology plan titled: *Reimagining the Role of Technology in Education*, was originally published in 2016, but was later revised in 2017, focuses on preparing teachers to maximize the various instructional technologies available at their disposal to engage, motivate, and facilitate students' learning (U.S. Department of Education, 2017). In addition, the report goes on and states that "to realize fully the benefits of technology in our education system and provide authentic learning experiences, educators need to use technology effectively in their practice… furthermore, education stakeholders should commit to working together to use technology to improve American education" (U.S. Department of Education, 2017, p. 3).

International Society for Technology in Education (ISTE) Standards

In addition to the national technology plans outlined by the U.S. Department of Education, teacher preparation programs, education accreditation agencies, and national teacher preparation organizations needed a framework to define the specific skills, concepts, and knowledge teachers need to effectively teach with technology (ISTE, 1998). To address this critical need, a non-profit organization called The International Society for Technology in Education (ISTE) was formed in 1998 (ISTE, 1998). That year, ISTE published its first set of technology standards for K-12 students called the National Education Technology Standards for Students (NETS). These standards helped inform teacher educators and in-service teachers with the specific technological knowledge and skill their students needed in order to thrive in a technology-driven society (ISTE, 1998).

From these standards, ISTE developed two additional technology standards: one for teachers (NETS for Teachers), and another for school administrators (NETS for Administrators)

(ISTE, 2007). The standards set for teachers by ISTE “established the groundwork for teacher education programs and defined the fundamental concepts, knowledge, skills, and attitudes for applying technology in schooling” (Bakir, 2016, p. 24). The ISTE standards also provided a guiding framework of what new teachers should be able to do with technology upon entering the classroom (ISTE, 2000). School administrators also have a set of ISTE standards that describes the specific technological knowledge and skills they need in order to effectively adopt instructional technologies into their schools. Due to the rapid advancements in technology (e.g., apps, tablets, online tools, MOOCS), the NETS standards have frequently been revised (in 2007, 2008, and 2009) in order to meet the needs of contemporary students, teachers, and school administrators (McQuirter & Meeussen, 2017).

ISTE’s influence on teacher preparation programs. Unfortunately, even with the adoption of ISTE standards and mandates by national accreditation institutions, an examination by the NCATE Task Force on Technology and Teacher Education discovered that pre-service teachers were seldom required to teach with technology within their teacher preparation training (NCATE, 1997). In their report, the NCATE Task Force on Technology and Teacher Education concluded that teacher preparation programs “must close the teaching and learning technology gap between where we are not and where we need to be, and prepare their students to teach in tomorrow’s classrooms” (NCATE, 1997, p. 3).

To help teacher preparation programs enhance and accelerate their ability to meaningfully train the next generation of teachers to effectively teach with technology, the task force provided three major recommendations. First, explore alternative instructional strategies to stimulate more effective uses of technology. Second, think about alternative strategies that can improve the accreditation process so that it meets the needs of 21st-century learners and teachers. Third, create institutional buy-in by increasing technology use throughout the entire teacher preparation program (NCATE, 2007). In 2013, the NCATE merged with another organization called the Teacher Education Accreditation Council (TEAC) and later changes its name again to the Council for the Accreditation of Educator Preparation (CAEP). While the name of the organization has changed, CAEP continues to adopt the ISTE standards, and emphasizes the importance of "identifying the skills, knowledge, and approaches that students, educators, and leaders need to possess to be successful in the digital age" (Bakir, 2016, p. 25). Based on the recommended technology standards set by ISTE, the CAEP now requires teacher education programs in the United States to align their technology education programs with the ISTE standards as part of their accreditation process (Bull, Patterson, Mansaray, & Dunston, 2016).

Teacher Education and Technology Preparation

Over the past two decades, scholars around the world have been researching instructional strategies that can help pre-service teachers improve their ability to teach with technology (U.S. Department of Education, 2017; Admiraal, van Vugt, Kranenburg, Koster, Smit, Weijers, & Lockhorst, 2016; Koh & Divaharan, 2011). Recent initiatives such as the Common Core Standards (CCS) and new teaching standards from the Council for the Accreditation of Educator Preparation (CAEP) have continued the advocacy for educational technology scholars to place more emphasis in researching new instructional strategies that can help prepare teachers to effectively teach with technology (CAEP, 2013; Common Core State Standards Initiative, 2010). In an effort to facilitate this process, 98% of teacher preparation programs in the United States now mandate their pre-service teachers to receive some form of training on educational technologies (AACTE, 2013, p. 10).

In the past, technology courses offered by teacher preparation programs often focused on teaching pre-service teachers computer literacy skills (Zhao, Pugh, Sheldon, & Byers, 2002). Today, these courses cover basic technological skills (Admiraal et al., 2016; AACTE, 2013; Belland, 2009), and also provide instructional strategies that can help pre-service teachers to teach effectively with technology (Koh & Chai, 2014). At their earliest conception, teacher preparation programs typically taught their pre-service teachers about technology integration through a single, stand-alone technology course (Honawar 2008; O’Bannon & Puckett 2007; Hargrave & Hsu 2000; Handler & Strudler, 1997). However, studies have shown that single, stand-alone technology courses are not effective in preparing pre-service teachers to meaningfully teach with instructional technologies (Bakir, 2015; Tondeur, Braak, Sang, Voogt, Fisser, & Ottenbreit-Leftwich, 2012; Wachira & Keengwe, 2011; Pope, Hare, & Howardy, 2002).

Due to the ineffectiveness of single, stand-alone technology courses, educational technology scholars began experimenting and researching alternative instructional approaches. Research has suggested that teacher preparation programs predominately employ one of ten instructional strategies to facilitate pre-service teacher technology integration skills (Brenner & Brill, 2016; Kay, 2006). The instructional strategies are: single technology course; offering mini-workshops; integrating technology in all courses; modeling how to use the technology; using multimedia; encouraging collaboration among teachers, mentor teachers, and faculty; practicing technology in the field; focusing on education faculty; focusing on mentor teachers in K-12 settings; and improving access to software, hardware, and/or technical support (Kay, 2006, p.

383). Through his research, Kay (2006) opined that the “jury is still out on which strategies work best” (p. 397). However, he emphasized the importance of conducting additional research that focuses on how teachers can change their actual technology integration skills and behaviors.

A few years later, Ottenbreit-Leftwich, Glazewski, and Newby (2010) conducted a meta-analysis examining the efficacy of various instructional approaches that teacher preparation programs were using in order to prepare pre-service teachers to effectively teach with technology. Based on their findings, Ottenbreit-Leftwich et al. (2010) proposed that teacher preparation programs consider including the following instructional approaches: “hands-on technology skill-building activities, practice with technology integration in the field, technology integration observation or modeling sessions, authentic technology integration experiences, and technology integration reflections” (p. 10).

However, scholars such as Darling-Hammond, Hammerness, Grossman, Rust, and Shulman (2005), Kay (2006), and Bakir (2015) have noted that a universal technology preparation model does not exist, and that teacher preparation programs should consider designing their technology education courses using a combination of instructional best practices. To help teachers become better technology integrators, the U.S. Department of Education also suggests that teacher preparation programs should consider integrating a technology preparation component throughout pre-service teachers’ teacher preparation programs (U.S. Department of Education 2010). For example, research conducted by Hutchison and Colwell (2016) suggest that pre-service teachers were better prepared to teach with technology if their instructors at teacher preparation institutions actively planned technology-rich lessons, and modeled effective technology use during the course of their teacher preparation training. Another example of how teacher preparation programs have addressed this issue is by prescribing three by one-credit technology integration courses that are taken at different stages of the pre-service teachers' undergraduate teacher preparation program. This instructional approach was designed to strategically build upon each one-credit course to develop and prepare pre-service teachers to meaningfully teach with technology, based on their current knowledge, skills, and abilities (e.g., Mouza, 2017; Jang & Lei, 2015; Tai & Schmidt-Crawford, 2015; Johnson, 2014; Lu, 2013; Lu & Lei, 2012).

Practice-Based Teacher Education

Over the past decade, practice-based teacher education (PBTE) has become more prevalent, debates about its contribution have emerged (Kavanagh et al., 2019). Practice-based teacher education (PBTE) is an instructional approach that prepares novice and pre-service teachers to focus on the importance of developing their ability to enact teaching practices (Kavanagh et al., 2019; Grossman, 2018). For example, this approach "prioritizes mediated clinical experience and focuses on preparing teachers to enact instruction" (Kavanagh et al., 2019, p.1). Examples of the core practices and principles within the PBTE paradigm include facilitating whole-class discussion, eliciting student thinking, and maintaining classroom norms (Grossman, 2018). As a result, scholars and instructional technologists in the field of Teacher Education have also begun inquiries into further advancing pre-service and in-service educators' technology integrations knowledge and skills through alternative instructional approaches that encourage their students to practice teaching with technology (e.g., Leblanc, 2018; Koh, Chai, & Lim, 2017; Jang & Lei, 2015).

While the term *practice* may seem straightforward to the general public, scholars in the field of Teacher Education are divided on its meaning, in the context of PBTE. For example, scholars such as Grossman (2018) and Ball and Forzani (2009) define the term as “the specification of particularly influential routine activities in teaching, like facilitating discussion or modeling” (Kavanagh et al., 2019, p.1). While scholars such as Schutz, Danielson, and Cohen (2019) define the term as “the design of teacher learning experiences that engage novices in approximating teaching for the purposes of improvement” (Kavanagh et al., 2019, p.2). Regardless of which approach scholars have examined, recent research suggests that providing novice and pre-service teachers with opportunities to practice teaching (e.g., with technology) during their formative teacher preparation years, has a positive influence on a teacher's future classroom behaviors (Kavanagh & Rainey, 2017).

While scholars have suggested that providing opportunities for pre-service teachers to practice teaching is very beneficial (Grossman, 2018; Kavanagh & Rainey, 2017; Jang & Lei, 2015), Kavanagh et al. (2019) highlight the importance of having novice and pre-service teachers practice teaching in settings of reduced complexity. For example, instead of encouraging inexperienced teachers to effectively teach with technology in an actual classroom setting with real students; scholars have suggested that novice teachers practice teaching with technology in a safe, nurturing, and relatively lower stress environment such as in a microteaching lesson (Kavanagh et al., 2019; Grossman, Compton, Igra, Ronfeldt, Shahan, & Williamson, 2009). In the context of preparing teachers to effectively teach with technology, principles of PBTE have been used by scholars and have engendered positive results by providing pre-service teachers with generative opportunities to practice teaching with technology (e.g., Zhou, Xu, & Martinovic, 2017; Canbazoglu Bilici, Guzey, & Yamak, 2016; Jang & Lei, 2015).

Barriers to Technology Integration

It was once believed that teachers were not integrating technology into their classroom instruction because they did not have access to technology. However, a study conducted by the National Center for Education Statistics (NCES) revealed that 99% of teachers in the United States now have access to computers and the internet in their schools (NCES, 2010). Nevertheless, research suggests that teachers are still not integrating technology into their classroom instruction for various reasons. For example, teachers have cited that it takes too much time (Morehead & LaBeau, 2005); technological issues (Ertmer, 1999); negative experiences using technology in the classroom (Doering et al., 2003); lack of school administrative support (Bauer & Kenton, 2005); don't know how to effectively teach with technology (Gray et al., 2010; Bauer & Kenton, 2005; Moursund & Bielefeldt, 1999); and negative perceptions towards teaching with technology (Doering et al., 2003).

Ertmer (1999) classified and differentiated these types of technology integration barriers into two categories: *first-order barriers* and *second-order barriers*. According to Ertmer (1999), *first-order barriers* are "extrinsic to teachers and include lack of access to computers and software, insufficient time to plan instruction, and inadequate technical and administrative support" (p. 48); and *second-order barriers* are "intrinsic to teachers and include beliefs about teaching, beliefs about computers, established classroom practices, and unwillingness to change" (p. 49). While it has been well documented that reducing first-order barriers can create an environment conducive for technology integration (Ertmer, 2005; Norris, Sullivan, & Poirot, 2003), teachers must also have the pertinent technological, pedagogical and content knowledge to meaningfully integrate and teach with instructional technologies (Mishra & Koehler, 2006; Shulman, 1987).

Although teachers may not face all of these barriers, encountering just one barrier has been demonstrated to significantly impact a teacher's ability to integrate technology into their instruction (Ertmer, 1999; Hooper & Reiber, 1995). While first and second-order barriers still exist today, they are far less prevalent than they were a decade ago. For example, access to instructional technologies and technology infrastructure is no longer a major concern or impediment for schools or teachers (Dolan, 2016; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). However, scholars have expressed concern that some schools in rural and urban districts still don't have the necessary technology infrastructure and resources for teachers to effectively teach with technology (e.g., Delgado, Wardlow, McKnight, & O'Malley, 2015).

While the overwhelming majority of K-12 learners and teachers in the United States typically have access to technology resources such as computers, tablets, mobile technology carts, and technology labs (U.S. Department of Education, 2017), teachers have not embraced integrating technology into their classroom instruction (U.S. Department of Education, 2017; Thomas & O'Bannon, 2013). Research conducted by Teo, (2015), Ertmer et al., (2012), and Koszalka (2001) suggest second-order barriers such as teacher attitudes towards teaching with technology, influence their technology integration skill development and their decision to teach with technology.

While today's teacher preparation graduates are often more digitally savvy compared to their predecessors (Wang, Hsu, Campbell, Coster, & Longhurst, 2014), and more comfortable using technology in their daily lives (Thomas & O'Bannon, 2013); helping teachers' overcome negative attitudes and stereotypes towards teaching with technology remains a significant barrier to overcome (Teo, Milutinović, & Zhou, 2016; Ertmer et al., 2012; Kopcha, 2012). For example, smartphones are often seen as a useful and indispensable technological tool in our society.

However, research suggests teachers are often reticent to incorporate technologies such as smartphones into their own instruction (Thomas & O'Bannon, 2013). Common cited arguments against using technology in the classroom are the fear of classroom disruption and cheating (Thomas & O'Bannon, 2013; Campbell, 2006). Paradoxically, the very same teachers who actively use technology in their daily lives, such as smartphones, still have reserved attitudes toward integrating technology into their classroom instruction (Ottenbreit-Leftwich, Ertmer, & Tondeur, 2015).

Factors influencing teachers' technology integration. To better understand why teachers feel underprepared to effectively teach with technology, this research examined the literature and discovered five major factors that influence teachers' instructional technology preparation. The five factors are outlined and described in the table below (Table 1).

Table 1

Factors influencing teachers' technology integration

Factors	Description
(1) Reserved attitudes towards teaching with technology	Teachers have positive beliefs about the role technology can have in facilitating their students' learning, but they have reserved attitudes towards using technology to teach (Teo, 2015).

Factors	Description
(2) Inadequate preparation to facilitate learning via technology	Teacher preparation programs are not adequately preparing pre-service teachers to use technology to facilitate subject matter learning (U.S. Department of Education, 2017; Chai, Koh & Tsai, 2013).
(3) Limited opportunities to practice teaching with technology	Teacher preparation programs are not providing pre-service teachers with enough opportunities to practice teaching with technology (U.S. Department of Education, 2017; Mouza et al., 2014).
(4) Insufficient opportunities to reflect on teaching with technology	Teacher preparation programs are not providing teachers with generative opportunities to reflect on their experiences teaching with technology (Black, 2015; Dayan, Breuleux, Heo, & Nong, 2015; Sprague & Katradis, 2015).
(5) Not preparing for the realities of the teaching profession	There is a current disconnect between how pre-service teachers are trained and developed to teach with technology (stand-alone technology courses, collaborative learning paradigm) (Sprague & Katradis, 2015); relative to the realities of the teaching profession (e.g., teachers often teach alone and in isolation) (Jang & Lei, 2015).

Research has shown that a teacher’s attitude towards teaching with technology is a significant factor in whether they will actually adopt instructional technologies into their instruction (Teo, 2015; Koszalka, 2001). While it has been well documented that reducing first-order barriers can create an environment conducive for technology integration (Norris, Sullivan, & Poirot, 2003), teachers must also have the pertinent technological, pedagogical and content knowledge to meaningfully integrate and teach with instructional technologies (Mishra & Koehler, 2006; Shulman, 1987). However, it is important to note that even when teachers have access to technology, and have the necessary technological, pedagogical, and content knowledge; effective technology integration still requires teachers to believe that teaching with technology is helpful and beneficial (Ertmer, 2005). Some research even suggests that a teacher’s attitude, belief, and perception towards teaching with technology often predict, reflect, and determine their actual instructional technology integration behaviors (Wilkins, 2008; Pajares, 1992). More recently, scholars have re-examined this phenomenon and reaffirmed that a teacher’s pedagogical beliefs and their technological knowledge and skills are deeply interconnected (Yurdakul, 2018; Voogt, Fisser, Pareja Roblin, Tondeur, & van Braak, 2013).

In an effort to better promote and facilitate teachers’ technology integration practices in the classroom, it has been suggested that second-order barriers to technology integration should be identified and overcome (Ertmer, 2005), and that promoting positive teacher beliefs towards using and teaching with instructional technologies could help overcome second-order barriers (Ertmer, 2005; Hew & Brush, 2007).

Technology Integration Models and Frameworks

In an effort to help improve teachers' instructional technology integration skills, scholars and teacher preparation programs have experimented with alternative instructional strategies such as design teams and collaborative learning groups to help pre-service teachers develop their technology skills and build positive attitudes towards teaching with technology (Ottenbreit-Leftwich, Ertmer, & Tondeur, 2015; Johnson, 2014; Kafyulilo, Fisser, & Voogt, 2014; Koh & Divaharan, 2011; Kurt, Akyel, Koçoğlu, & Mishra, 2014). However, research suggests that there is still an information gap between what is taught in these technology education courses, and the types of training pre-service teachers actually need in order to develop their technology integration skills (Dunleavy & Dede, 2014; Thornburg & Collins, 2014).

To help improve teachers' technology integration skills, research has advocated for teacher educators to provide their pre-service teachers with opportunities to design technology-enhanced lessons (Kramarski & Michalsky, 2015); provide ample opportunities to practice teaching with technology (Mouza et al., 2014; U.S. Department of Education, 2010); and provide the pre-service teachers with generative opportunities to reflect on their experiences teaching with technology (Ertmer, 1999). Due to the complexities of preparing teachers to effectively teach with technology, there is a continuous need to investigate new instructional approaches that can facilitate this process (Polly & Rock, 2016; U.S. Department of Education, 2010; Koehler & Mishra, 2009; West & Graham, 2007).

In an effort to help facilitate teachers' technology integration skill development; scholars, researchers, and practitioners have been exploring instructional models aimed at helping educators enhance their students learning by meaningfully integrating technologies into their classroom instruction (Schmidt, Baran, Thompson, Mishra, Koehler, & Shin, 2009; Mishra &

Koehler, 2006). In the past, technology integration models treated technology as an isolated component, rather than an essential part of effective teaching (Mishra & Koehler, 2006; Zhao, Pugh, Sheldon, & Byers, 2002). For example, early technology integration models such as Hooper and Reiber's (1995) *teaching with technology* model viewed teachers' technology integration development through an isolated and linear lens. Hooper and Reiber (1995) believed that teachers must systematically navigate through five phases: (1) familiarization, (2) utilization, (3) integration, (4) reorientation, and (5) evolution; in order to successfully teach with technology (Table 2).

Table 2

Hooper and Reiber's (1995) five phases for technology integration (pp.156-158)

Phase(s)	Description
Familiarization (1)	The familiarization phase is concerned with one's initial exposure to and experience with technology.
Utilization (2)	The utilization phase, in contrast, occurs when the teacher tries out the technology or innovation in the classroom.

Phase(s)	Description
Integration (3)	The integration phase occurs when a teacher consciously decides to designate certain tasks and responsibilities using educational technologies.
Reorientation (4)	The reorientation phase requires that educators reconsider and reconceptualize the purpose and function of their classrooms' educational technologies.
Evolution (5)	The evolution phase is when teachers understand that they need to continuously evolve and adapt to meet the challenges of teaching.

Through their research, Hooper and Reiber (1995) discovered that teachers often do not progress past the *utilization* phase. When the researchers further explored the phenomenon of *why* most teachers do not progress past the *utilization* phase, Hooper and Reiber (1995) observed that teachers would often become frustrated at the first sign of trouble (e.g., technical problems, software malfunctions, technological knowledge deficiencies), and would stop teaching with technology soon after. While Hooper and Reiber's (1995) teaching with technology model provided scholars with an initial framework describing the progressive linear steps needed to effectively integrate technology into instruction, other scholars have theorized that a teacher's adoption of educational technologies is influenced by their perceptions of the *added value* of teaching with educational technologies (Zhao & Cziko, 2001). To better understand this phenomenon, Zhao and Cziko (2001) have developed the perceptual control theory model (PCT) as a framework to "better understand teachers' adoption of technology" based on their individual instructional goals (p. 5).

In Zhao and Cziko's (2001) PCT model, the researchers laid out three specific conditions that are needed in order for teachers to effectively teach with technology (Table 3).

Table 3

Descriptions of conditions for the perceptual control theory model (Zhao & Cziko, 2001, p. 6)

Condition(s)	**Description**
1	The teacher must believe that technology can more effectively achieve or maintain a higher-level goal than previously seen.
2	The teacher must believe that using technology will not cause disturbances to other higher-level goals that he or she thinks are more important than the one being maintained.
3	The teacher must believe that he or she has, or will have, the ability and resources to use technology.

Although Zhao and Cziko's (2001) PCT model provides descriptions of specific conditions needed to effectively integrate technology into instruction, their model, much like Hooper and Reiber's (1995) teaching with technology model, does not provide a detailed framework that explicitly describes the various knowledge and skills teachers need to effectively teach with technology. Due to the limitations in these technology integration models, instructional technology scholars have continued their explorations with alternative technology integration models that would provide teachers and teacher educators with an explicit and descriptive roadmap outlining the knowledge teachers need in order to effectively teach with technology (e.g., substitution, augmentation, modification, and redefinition –SAMR model).

While the above-mentioned technology integration frameworks all have their strengths and limitations, this study used the technological pedagogical content knowledge conceptual framework (TPACK) to examine pre-service teachers' technology integration knowledge and skills, because of its relationship with the five factors influencing teachers technology preparedness. In the section below, history and a detailed description of the TPACK framework are outlined. Furthermore, a rationale as to why this specific model was used is provided.

Technological Pedagogical Content Knowledge (TPACK)

Technological pedagogical content knowledge (TPACK) is a conceptual framework for the knowledge base teachers need to effectively teach with technology (Voogt et al. 2013; Mishra & Koehler, 2006; Pierson, 2001). Voogt et al. (2013) expressed the framework "stems from the notion that technology integration, in a specific educational context, benefits from a careful alignment of content, pedagogy and the potential of technology, and that teachers who want to integrate technology in their teaching practice, therefore, need to be competent in all three domains" (p. 109).

Building upon Shulman's (1986) seminal pedagogical content knowledge (PCK) model, Pierson (2001), and Mishra and Koehler (2006) developed a technology integration framework called technological pedagogical content knowledge, also known as TPACK. Pierson (2001) and Mishra and Koehler (2006) both believed that Shulman's (1986) PCK model did not adequately reflect the knowledge needs of a 21st century teachers, and hypothesized that a third knowledge domain (i.e., technological knowledge-TK) was needed in order to prepare the next generation of educators to effectively teach in a technology pervasive society (Mishra & Koehler, 2006; Pierson, 2001). This framework consists of six unique knowledge domains that engender the constructs of TPACK (Figure 1). The six knowledge domains are technological knowledge (TK), pedagogical knowledge (PK), content knowledge (CK), technological pedagogical knowledge (TPK), pedagogical content knowledge (PCK), and technological content knowledge (TCK). The amalgamation of these six knowledge domains became what we know today as TPACK (Koehler & Mishra, 2009).

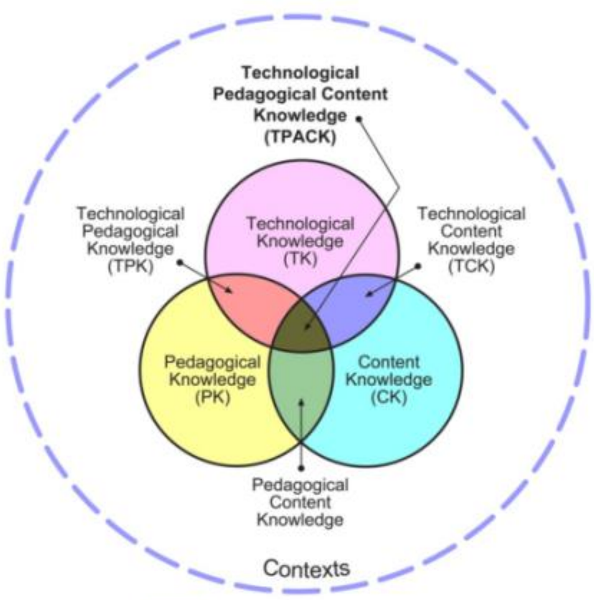

Figure 1

Technological pedagogical content knowledge (Koehler & Mishra, 2009)

The technological pedagogical content knowledge model (TPACK) was specifically developed to provide teachers and teacher educators with a detailed description of the complex interactions among three major bodies of knowledge (i.e., content knowledge, pedagogical knowledge, technological knowledge) needed to effectively teach with technology (Koehler & Mishra, 2009; Pierson, 2001). To better understand the "complex interplay of these three bodies of knowledge" (Mishra & Koelher, 2006, p. 1025), the three lenses of pedagogical knowledge (PK), content knowledge (CK), and technological knowledge (TK) were joined together to create three additional knowledge domains: pedagogical content knowledge (PCK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK) (Koehler & Mishra, 2009). The combination of these six unique knowledge domains produced the seventh knowledge domain and the technology integration model known as TPACK. The following table contains descriptions of each knowledge domain embedded within the TPACK framework.

Table 4

Knowledge domain descriptions – TPACK framework (Koehler & Mishra, 2009, pp. 63-67)

Knowledge Domains	Description
Technological Knowledge (TK)	An understanding of technology that is broad enough to apply productively to particular technologies.
Pedagogical Knowledge (PK)	Knowledge about the process and practices of teaching and learning.

Knowledge Domains	Description
Content Knowledge (CK)	Knowledge about the subject matter to be learned or taught.
Technological Pedagogical Knowledge (TPK)	An understanding of how teaching and learning change, for a given content area, when particular technologies are used.
Technological Content Knowledge (TCK)	An understanding of the manner in which technology and content influence and constrain one another.
Pedagogical Content Knowledge (PCK)	The blending of content and pedagogy into an understanding of how particular aspects of subject matter are organized, adapted, and represented for instruction.
Technological Pedagogical Content Knowledge (TPACK)	Represents the complex interplay between the interactions among technological, pedagogical, and content knowledge.

TPACK's strengths and limitations. Since the publication of Mishra and Koehler’s (2005b) seminal TPACK paper, over 1,000 research articles had been published based on TPACK, and over one hundred forty instruments had been developed to measure its constructs (Koehler, Mishra, Kereluik, Shin, & Graham, 2014). The TPACK framework has received considerable attention from scholars and practitioners due to the fact it provides a framework to analyze and measure teachers’ technology integration abilities. As a result, this model has been used extensively in both K-12 and higher education settings (Chai et al., 2013).

For the past 12 years, the TPACK framework has gained traction among educational technology scholars because it illustrates the complex act of teaching with technology in an organized and visually attractive manner (Lubke, 2013). However, some scholars have argued that the simplicity of the TPACK framework makes it too nebulous (Angeli & Valanides, 2009), and that its constructs are too “broad and ill-defined” (Graham, 2011, p. 1955). Due to the model’s ambiguity, scholars such as Angeli and Valanides (2009) have argued that this “may lead to possible erroneous, simplistic, and naïve perceptions about the nature of integrating technology in teaching and learning” (p. 157). Additionally, Graham (2011) has suggested that the TPACK’s ambiguity is a direct by-product of not having well defined and articulated domains and constructs and that this ambiguity and nebulousness are significant factors in a critique of TPACK. Kimmons (2015) also noted that the vague and ambiguous “descriptions of teacher technology integration have been the result of poor understandings of how different domains of technological, pedagogical, and content knowledge interact with one another… and little work has been done to interrogate TPACK’s theoretical value or to identify limitations of the model in practice or contexts for its appropriate use” (pp. 53-54). Scholars such as Cox (2008), Chai, Koh, and Tsai (2013), Graham (2011), Angeli and Valanides (2009), and Chai, Hwee, Koh, and Tsai (2011) have all suggested that the limitations described above could be mitigated by better defining each construct within the TPACK framework.

In addition to concerns with the model's simplicity and ambiguity, some scholars have also questioned whether the TPACK framework is an appropriate approach to facilitate learning. For instance, researchers have suggested that the model is to *teacher-centered*, instead of *learner-centered* (Gómez, 2015; Kimmons, 2015). This issue of being too teacher-centered was exhibited in Maeng, Mulvey, Smetana, and Bell's study (2013) where they examined whether instructional technology, using the TPACK conceptual framework, could be used to support student-centered instruction. Their study discovered that there is a pressing need to reexamine the TPACK framework "to develop a better understanding of how beginning and experienced teachers navigate the complex decision-making process of when and how to appropriately use technology to support inquiry teaching and learning" (Maeng et al. 2013, p. 855).

Is TPACK a theory or a framework. Kimmons (2015) has argued that scholars should be apprehensive of viewing TPACK as a theory. To support his argument, Kimmons (2015) has used Thomas Kuhn's (1977; 2013) five characteristics of a *good* scientific theory: accuracy, consistency, scope, simplicity, fruitfulness, as the criteria to critique the validity of using TPACK as a theory. Based on his analysis, Kimmons' (2015) lamented that TPACK, in its current state, might be described more as a framework rather than a formal theory, because "like many such constructs in education, it tends to be adopted or ignored based upon its perceived usefulness for specific purposes" (p. 54). Due to the fact that the field of education "enjoys a high level of theoretical pluralism that permeates practice and research…where contradictory frameworks and theories can coexist and even complement one another" (Kimmons, 2015, p. 54).

Although some scholars have reservations concerning the TPACK framework, Mishra and Koehler (2006) were the first to acknowledge TPACK's shortcomings. Mishra and Koehler (2006) noted they are "sensitive to the fact that in a complex, multifaceted, and ill-structured domain such as integration of technology in education, no single framework tells the 'complete story'; no single framework can provide all the answers" (p. 1047). However, even with its limitations, Mishra and Koehler (2006) have contended that the TPACK framework is "better than no framework at all" (p. 1047). Due to the absence of a universally agreed-upon educational technology integration framework, scholars have embraced the TPACK framework for its lucidity (Lubke, 2013). Niess (2011) has argued that Shulman's (1986) pedagogical content knowledge (PCK) model evolved through use, and so too will a better understanding of the TPACK framework emerge through an "evolution of multiple representations", and through continuing examination, discussion, and research in future studies using the TPACK framework (p. 303).

Improving Teachers' Technology Integration Skills through Self-Reflection

While the term *reflective practitioner* is commonly used in the field of education today, many scholars have different definitions for this term. For example, Dewey (1933) defined the term as an "active, persistent, and careful consideration of belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it ends" (p. 9). While other scholars have defined the term as something teachers do to problem solve (Bigge & Shermis, 1992), better understand their teaching (Brubacher, Case & Reagan, 1994), critically assess their instructional practices (Norton, 1994), rationalize and describe their instructional practices (Ross, 1989), examine and investigate their teaching experiences (Ross & Hannay, 1986), frame and analyze instruction to enhance future instruction (Schön, 1983). Although a single definition for the term *reflective practitioner* does not exist, this research refers to the term as "a self-critical, investigative process wherein teachers consider the effect of their pedagogical decisions on their situated practice with the aim of improving those practices" (Tripp & Rich, 2012b, p. 678).

To help facilitate the teachers' reflection process, Schön (1983) broke down the process into two distinct categories: *reflection in action* and *reflection on action*. He described *reflection in action* as "a process in which an individual makes immediate decisions based on observations in the actions", and *reflection on action* as "a process in which an individual reflects back on the actions and refines upon the actions" (Kong et al. 2009, p. 545). Studies have shown the use of digital visual mediums, such as videos, are beneficial in helping teachers engender both *in action* and *on action* reflections (Fadde et al., 2009; Kong et al., 2009; Sewall, 2009). Studies have also shown that having teachers watch, analyze, and reflect on recordings of their teaching samples can lead to robust personal reflections (Zhang, M., Lundeberg, & Koehler, 2015; Kong et al. 2009), which in turned has been shown to help teachers improve their teaching efficacy (Black, 2015; Blomberg, Sherin, Renkl, Glogger, & Seidel, 2014; Ball & Cohen, 1999).

Reflection is often used in teacher education as an instructional strategy to help teachers improve their teaching skills and abilities (Black, 2015; Sherin et al., 2014; Fadde et al., 2009). However, for reflections to be meaningful and helpful, they are often guided by reflective frameworks with theoretical foundations (Vong, 2017). For example, Borton's developmental framework (1970) is a reflective framework often used by novice teachers. The simplicity of this model is due to its three descriptive reflective prompts delivered to reflectors. The first reflective prompt asks the reflector, *what happened*; the second prompt asks the question, *so what*; and finally, the third reflective prompt asks the reflector, *now what* (Borton, 1970). Forty years later, Rolfe, Jasper, and Freshwater (2010) have further enhanced Borton's developmental framework to provide reflectors with richer descriptions and more contexts for each prompt. For example, Rolfe et al. (2010) have categorized the prompts into three different constructs (*what happened?* – descriptive; *so what?* – theory and knowledge; *now what?* – action-oriented). Additionally, Rolfe et al. (2010) have included additional probing prompts for each construct to help facilitate deeper reflections.

Another reflection framework is Kolb's (2014) experiential learning cycle. This framework is an iterative process that prompts teachers to become reflective practitioners by facilitating their reflective process through four specific reflective phases. In phase one, teachers are asked to describe an incident or experience from a specific teaching episode - *concrete experience*. In phase two, teachers are asked to describe why their experience was positive or negative - *observations*. In phase three, teachers are asked to describe what went well or did not go well in their teaching - the *formation of abstract concepts*. In phase four, teachers describe what they would change or do differently in their future instruction - *testing concepts in new situations*. While Kolb's experiential learning cycle (2014) has often been the most cited and used by researchers to frame reflections in their research, there are many other reflection frameworks used by scholars.

Gibbs Reflective Cycle

The reflective framework commonly used to facilitate professional development for teachers is called the Gibbs' reflective cycle (1988). This reflective framework includes six phases instead of four (Table 5). The six phases are: description (what happened?), feelings (what were you thinking and feeling), evaluation (lessons strengths and limitations), analysis (based on the evidence, what happened?), conclusion (what could I have done better?), and action plan (if I were to do this again, what would I do differently?) (Gibbs, 1988). Unlike Kolb's (2014) experiential learning cycle, Gibbs' (1988) framework considers a teacher's emotional experience to be an important factor within their reflective process. This assumption led Gibbs to include a phase that prompts teachers to identify their emotions and feelings during their teaching experience. Additionally, the Gibbs reflective cycle (1988) includes a conclusion and action plan reflective prompts to help teachers take action after their reflective essays.

Table 5

Gibbs reflective cycle framework (1988)

Gibbs Reflective Cycle *(Prompts)*	**Description**
P1: *Description: what happened*	What, where and when? Who did/said what, what did you do/read/see hear? In what order did things happen? What were the circumstances? What were you responsible for?

Gibbs Reflective Cycle ***(Prompts)***	**Description**
P2: *Feelings: what were you thinking about?*	What was your initial gut reaction, and what does this tell you? Did your feelings change? What were you thinking?
P3: *Evaluation: what was good or bad about the experience?*	What pleased, interested or was important to you? What made you unhappy? What difficulties were there? Who/what was unhelpful? Why? What needs improvement?
P4: *Analysis: what sense can you make of the situation?*	Compare theory and practice. What similarities or differences are there between this experience and other experiences? Think about what actually happened. What choices did you make and what effect did they have?
P5: *Conclusion: what else could you have done?*	What have you learned for the future? What else could you have done?
P6: *Action Plan: what will you do next time?*	If a similar situation arose again, what would you do?

For this study, Gibbs' reflective cycle framework was used to guide participants' reflective essays. This framework also informed the design of this study during the participants' *interpreting evidence phase* within the ERDS model. This reflective framework was selected because it prompts participants to critique and reflect on their videotaped instruction through the six distinct phases.

Video Self-Analysis: A Promising Instructional Approach

A promising instructional approach that may help teacher educators facilitate their students' TPACK is through the use of video self-analysis. Video self-analysis has been considered as an effective instructional strategy, because it forces teachers to see their teaching in an "objective light" (Sewall, 2009, p. 14), "provides actual records rather than uncertain recollections" (Kong, Shroff, & Hung, 2009, p. 546), enables teachers to examine their instruction and develop strategies to improve future instruction (Sherin & van Es, 2005; Snoeyink, 2010), and helps teachers become reflective practitioners (Fadde, Aud, & Gilbert, 2009; Pellegrino & Gerber, 2012). As Schön has pointed out in his seminal book, *The reflective practitioner: How professionals think in action*, engendering teachers to become reflective practitioners is a critical component in developing exemplary educators (1983).

Teachers are often faced with a "blooming, buzzing, confusion of sensory data", and there is often too much information for teachers to process at once (Sherin & Star, 2011, p. 69). Video self-analysis is considered to be an effective teacher development instructional approach because it provides teachers with a medium to analyze accurate and real depictions of their instructional practices (Wang & Hartley, 2003). Studies have shown that providing teachers with a digital video recording of their teaching is beneficial in helping them analyze, critique, and reflect on their own teaching episodes, by building “a stronger depth of knowledge and understanding about their own teaching” (Chase Martin & Sadera, 2011, p. 4300). Furthermore, through iterative self-analysis of their videotaped teaching samples, teachers are able to facilitate their own professional development by designing personalized instructional strategies that help address their pedagogical limitations (Jang & Lei, 2015; Goldman, Pea, Barron, & Derry, 2014; Snoeyink, 2010; Sherin & van Es, 2005).

Due to the positive influence of video self-analysis in helping enhance human performance, this instructional approach has been pervasively used in business (Hershey, Jung, Mummareddy, & Sharma, 2011), athletics (Knudson, 2013), and medicine (Guerlain, Turrentine, Adams, & Calland, 2004; von der Heyden & Meissner, 2015). Additionally, Yousef, Chatti, and Schroeder (2014) examined 67 peer-reviewed papers that investigated the influence of video analysis on facilitating learning and improving human performance and found that this instructional approach is a “rich and powerful model, that improves learning outcomes as well as learner satisfaction” (p. 116). Video self-analysis has gained popularity in diverse sectors because it helps stakeholders improve their performance by critically “observing, assessing, and confronting their own actions” (Rich & Hannafin, 2008, p. 66). In addition, the use of video self-analysis has been shown to help people facilitate their own professional development (Yousef et al. 2014; Snoeyink, 2010; Fadde et al. 2009; Sherin & van Es, 2005). For instance, Dyer (2013) investigated the impact of video analysis on improving math teachers’ instructional efficacy. Her study found that the use of video analysis empowered her participants to facilitate their own professional development by helping them “notice interesting moments of student thinking… and probe students’ underlying understandings with different frequencies in their classrooms” (Dyer, 2013, p. 988).

The idea of using video self-analysis to facilitate teachers' professional development is not a novel idea. During the 1960s, when video-recording technologies first became available, some teacher preparation programs began video recording their teachers during their field practicums to help support their pre-service teachers' development process (Wang & Hartley, 2003). The video self-analysis instructional approach is seen as an effective teacher development strategy because it provides teacher educators with "permanent and manipulable records of their students' teaching activity" (Fadde et al. 2009, p. 76), and helps teachers "emotionally distance themselves regarding their own teaching" during their reflective process (Sewall, 2009, p. 13). By helping teachers emotionally detach themselves from their teaching experiences, they are able to focus their attention on essential actions, such as their instructional practices and students' learning, instead of inconsequential actions such as body language, the sound of their voice, clothing (Fadde et al. 2009).

Through the use of video self-analysis, studies have shown that teachers are able to engender robust personal critiques and reflections on their teaching episodes (Sherin & van Es, 2005; Tripp & Rich, 2012a). Due to the importance of reflecting on one's teaching practices, many teacher preparation programs in the United States require their pre-service teachers to go through a reflective process after each teaching experience (Acquah & Commins, 2015; Amobi, 2005; Black, 2015; Posner, 2005). During this process, teachers are instructed to actively "engage in reflective thinking in relation to their teaching", so that they can improve their future instruction (Fadde et al. 2009, p. 76). These self-reflections play a critical role in a teacher's development process because they help teachers critically analyze and continuously improve their teaching practices (Dewey, 1933; Pultorak, 2014; Schön, 1984; Shulman, 1987).

Historically, teacher preparation programs have dedicated lessons, activities, and even entire courses aimed at facilitating their pre-service teachers to become better reflective practitioners (Fadde et al. 2009). However, for the past decade, educational scholars have started to show more interest in experimenting with video technologies to help teachers facilitate their professional development (Schoenfeld, 2017; Zhang et al. 2015; Jang & Lei, 2015; Pultorak, 2014; Rich & Hannafin, 2008). According to Yost, Sentner, and Forlenza-Bailey (2000), helping teachers become reflective practitioners takes two specific conditions: 1) “practical experiences that will serve as a foundation for their reflections” and 2) “a personally meaningful knowledge base in pedagogy…in which they can connect their experiences” (p. 41). By video recording teachers’ teaching episodes, they are now able to improve their future instruction by “critically analyzing their teaching episodes” (Sewall, 2009, p. 13). Furthermore, studies have found that teachers who self-analyzed recordings of their teaching episodes produced “much deeper reflections” when compared to teachers who did not have access to their digitally recorded teaching samples (Schoenfeld, 2017; Kong et al. 2009, p. 548).

What is video self-analysis, and how is it done. Although there is no standard definition for the term *video self-analysis*, scholars who use the term in educational research describe it as: a method for collecting, analyzing, interpreting instructional practices using digital videos to systematically help teachers capture, identify, and analyze their own instruction (Snoeyink, 2010; Recesso et al. 2009; Rich & Hannafin, 2009b; Copeland & Decker, 1996). For the purpose of this research, video self-analysis is defined as an instructional approach in which teachers self-analyze and critique their videotaped teaching samples, using guiding frameworks or protocols (Snoeyink, 2010; Recesso et al., 2009; Rich & Hannafin, 2009b).

In addition to the absence of a clear standard definition of the term *video self-analysis*, a clear standardized video length for self-analysis also does not exist. For example, Fadde and Sullivan (2013) examined how the use of video self-analysis influences pre-service teachers' classroom awareness by having them analyze short video clips of their teaching (p. 161). While Sherin and van Es, (2005) examined how using video self-analysis influences teachers' ability to notice classroom interactions by having them analyze five to seven-minute video clips of their teaching (p. 479). Although a standardized length for conducting video self-analysis does not exist, the literature recommends choosing a video length that will: provide teachers with enough video data that will facilitate their ability to self-analyze their teaching (Knoblauch et al. 2006), and keep teachers focused and engaged on their self-analysis (Rich & Hannafin, 2009b).

Due to the benefits of this instructional approach, it is currently being used by teacher preparation programs to help advance their teachers' instructional scaffolding (Rich & Hannafin, 2009a), content knowledge (Stürmer, Könings, & Seidel, 2013), classroom management (Pianta, Burchinal, Jamil, Sabol, Grimm, Hamre, & Howes, 2014), and instructional technology integration (Jang & Lei, 2015). However, it is not clear how the use of video self-analysis helped teachers to better reflect on their teaching (Major & Watson, 2018; Bowers, Laster, Gurvitz, Ryan, Cobb, & Vazzano, 2017). As a result, this research seeks to fill existing gaps in the literature by examining how the use of an ERDS based video self-analysis instructional component influences pre-service teachers' technological pedagogical content knowledge (TPACK).

Evidential Reasoning and Decision Support (ERDS)

While conducting video self-analysis may seem like a straight forward procedure (e.g., have teachers watch and analyze their videotaped teaching samples), Recesso et al. (2009) have pointed out that it is actually an iterative, multi-step process. To help teachers navigate through this process, Recesso et al. (2009) developed the Evidential Reasoning and Decision Support (ERDS) model to help educators improve their teaching efficacy through video self-analysis (Table 6).

Table 6

Evidential reasoning and decision-making (ERDS) model

ERDS Phases	Description
Phase 1: Identify a focus	First, a teacher chooses a specific focus, which might range from micro or macro-level issues (how to enhance students' learning through meaningful adoption of instructional technologies).
Phase 2: Collect evidence	The teacher then identifies and collects evidence directly or indirectly associated with his or her focus (videotaped lessons)
Phase 3: Look through a "lens"	Teachers then select a *lens* to filter, analyze, and interpret collected evidence (TPACK observational rubrics). Lenses help teachers amplify fine-grained attributes of their instructional practices by helping them suppress unrelated ''noise,'' thereby helping teachers improve their analyses of their videotaped instructional samples.

ERDS Phases	Description
Phase 4: Enact a course of action	Following a lens-aided analysis, the teacher synthesizes their findings into an action plan, which outlines a specific course of action they will undertake in order to improve their instruction (action plan to improve their ability to teach with instructional technologies).

The ERDS model consists of four distinct phases. The first phase of the ERDS model requires participants to identify triggers or a specific focus area they want to improve upon. During phase two, participants' teaching samples are digitally recorded as a means to collect and capture evidence. In this study, participants' reflective essays and action plans were collected as supplementary evidence. In phase three, participants use a guiding protocol or instrument, such as Hofer et al. (2011) TPACK observational rubric, to facilitate their ability to filter, analyze, and interpret their technology integration skills. Lastly, during phase four, participants apply the lessons learned from phase three to develop a specific action plan that they will undertake to improve their future instruction. Action items include enhancing current practices and addressing the specific instructional limitations they observed during their video self-analysis. For example, if a teacher observes via their videotaped lesson that they need to model their technology use more during their lesson, the participant would self-prescribe specific action steps to incorporate more technology modeling into their ensuing technology-enhanced lessons.

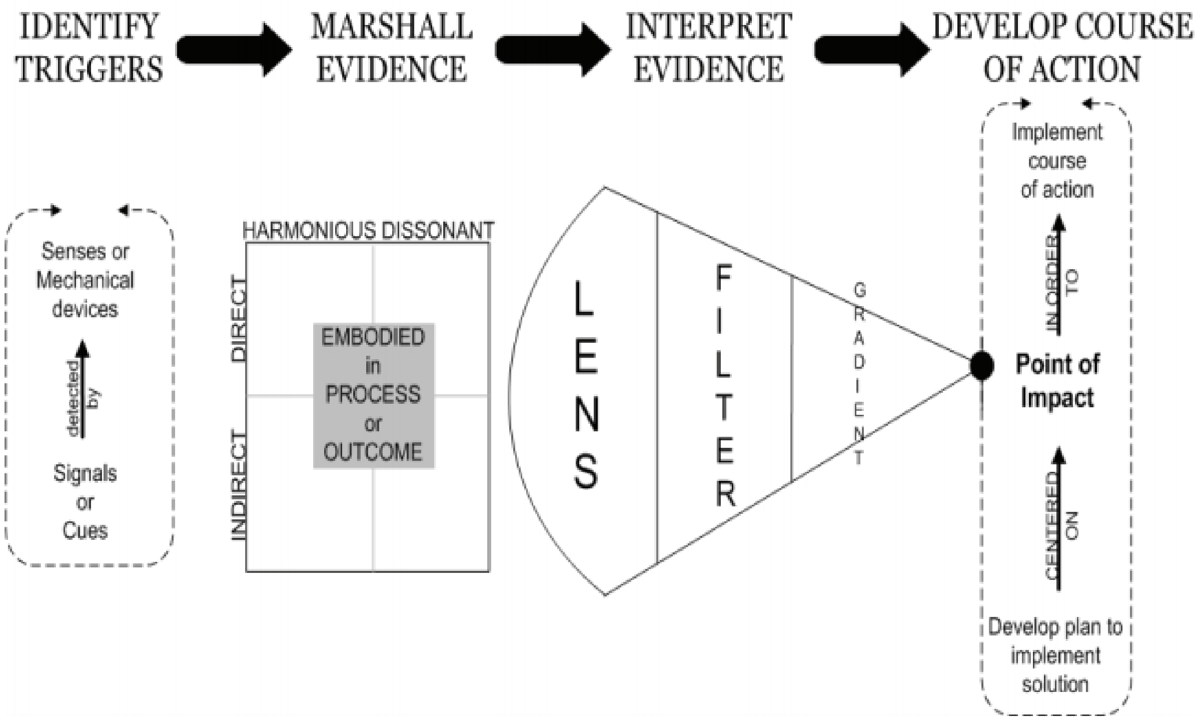

Figure 2

Evidential reasoning and decision support (ERDS) model (Recesso et al., 2009)

Although there are some scholars who have argued that pre-service teachers are not discerning enough to identify or critique the important aspects of their teaching practices (Freese, 1999; Parsons & Stephenson, 2005), there is, nevertheless, a long history of research that contends that teachers, even novice or pre-service teachers, are able to improve their teaching efficacy by self-analyzing their own teaching practices, if given structured guidance (Angeli & Valanides, 2008; Chula, 2001; Collins et al., 2004; Sharpe et al., 2003; Sherin & van Es, 2005).

Providing pre-service teachers with a guiding framework or protocol as they self-analyze their teaching is critical (Parsons & Stephenson, 2005). Pre-service teachers often need some type of guiding framework as they self-assess their instruction because most pre-service teachers are “not yet discerning enough to identify the important aspects of teaching practices” (Freese, 1999; Parsons & Stephenson, 2005; as cited in Kong et al., 2009, p. 545). However, by providing teachers with a guiding framework while they conduct their video self-analysis, studies have shown that teachers are able to accurately filter, analyze, and interpret specific areas of their instruction (Blomberg, Sherin, Renkl, Glogger, & Seidel, 2014; Rich & Hannafin, 2009b). Through this focused, guided, and structured approach, research has shown that pre-service and in-service teachers are able to improve their teaching practices by self-analyzing their instructional strengths and limitations to create specific course of action to improve their future instruction (Jang & Lei, 2015; Sherin et al. 2014; Kong et al. 2009; Sharpe et al. 2003).

Social Cognitive Theory

Social cognitive theory (SCT) defines learning as an internal mental process that may or may not be reflected in immediate behavioral change (Bandura, 1986). Furthermore, social cognitive theorists also believe people can learn through observation without needing direct reinforcement (Bandura, 1986). As a result, the primary characteristic of social cognitive theory is the concept of human agency and the concept of “triadic reciprocal causation” (Bandura, 1986, p.22). This means “human beings have the capacity to direct themselves through control over the thinking process, motivation, and self-action” (Abdullah, 2019, p.1). Social cognitive theorist believes learning involves the interaction of several factors, such as *behavio*r (e.g., skills, practice, self-efficacy), *environment* (e.g., social norms, people in your community), and *personal factors* (e.g., knowledge, expectations, attitudes) (Martin, 2004). A visual representation of the social cognitive theory is shown in the subsequent figure (Fig. 3).

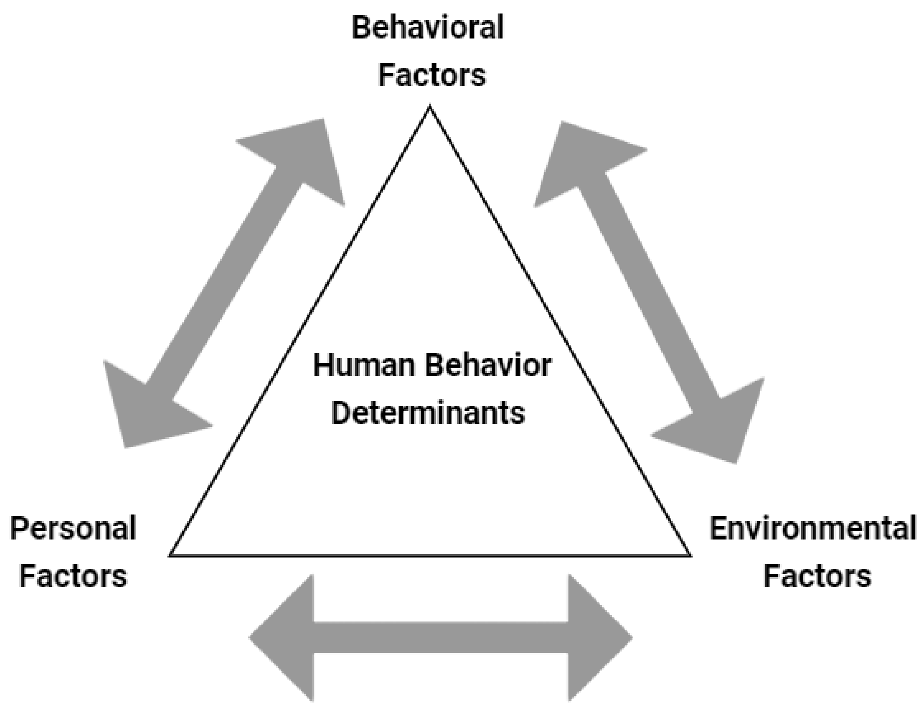

Figure 3

Social Cognitive Theory (Bandura, 1986)

Through his seminal research, Bandura (1988) expressed that three components of his social cognitive theory are especially relevant to facilitate learning. The three components are “developing competencies through mastery modeling, strengthening people's beliefs in their capabilities so they make better use of their talents, and enhancing self-motivation through goal systems” (Bandura, 1988, p.276). As expressed by Bandura (1986), modeling is effective when three major elements are in place. The three elements are as follows. “First, the appropriate skills are modeled to convey the basic competencies. Second, the people receive guided practice under simulated conditions so they can perfect the skills. Third, they are helped to apply their newly learned skills in work situations in ways that will bring them success” (Bandura, 1988, p.276). Due to its importance, Bandura (1988) cited modeling is the first step towards developing and learning new skills and competencies. For example, Bandura (1988) recommends teachers to break down complex skills into smaller subskills so that the learner does not get overwhelmed during the learning process. To help facilitate this process, Bandura (1988) recommended instructors to model each subskill in an easy to follow videotaped tutorial. Once the learner learns the new subskills, they then can combine those subskills and apply them to complex skills. As a result, once new skills are developed via modeling, learners need ample opportunities to apply and practice these new skills (Bandura, 1988). To promote a non-threatening learning environment, Bandura (1988) recommends the learners to engage in role-playing simulations. As people begin to learn and develop new skills, research suggests people need informative feedback on how they are doing (Schoenfeld, 2017; Zhang et al. 2015; Jang & Lei, 2015). To help solicit and collect this information, Bandura (1988) recommends using video technology to facilitate this process.

Bandura (1986) defined self-efficacy as a construct through which knowledge is gained through experience and social interaction. For example, if a person believes in "one's capability to perform certain actions is based on cognitive processes such as perception, attention, and memory. The cognitive construal of past performances, situational factors, and one's knowledge and skills all influence how much one will perceive to be capable of attaining a certain performance level" (Eun, 2019, p.76). Research suggests that people with high levels of self-efficacy persist in the face of numerous obstacles, and are more apt to accept innovative ideas (Bandura, 1997). As a result, teachers with high levels of self-efficacy tend to be more receptive to embrace changes if it's related to their professional teacher development (Eun, 2019). While Bandura (1988) cited modeling was critical in the learning process, he pointed out "there is a difference between possessing skills and being able to use them well and consistently under difficult circumstances. Success requires not only skills but also strong self-belief in one's capabilities to exercise control over events to accomplish desired goals" (p.279). Recent research appears to affirm Bandura's (1988) findings because the more recent literature suggests there is a strong correlation between educators with high levels of self-efficacy towards their teaching with student learning outcomes (Zee & Koomen, 2016; Prior, Mazanov, Meacheam, Heaslip, & Hanson, 2016). As a result, teacher self-efficacy generally has been related to teachers' confidence in their ability to deliver quality instruction or content (Abello, 2018).

Social cognitive theory also emphasizes human capacities for self-direction and self-motivation (Bandura, 1988). As a result, self-regulated behavior is essential to the learning process (Zimmerman, 1990). The concept of self-regulation is important for understanding this theory because human behaviors occur without immediate reinforcement or punishment (Bandura, 1988). Zimmerman (1990) further elaborated by stating that "self-regulation is not a mental ability or an academic performance skill; rather it is the self- directive process by which learners transform their mental abilities into academic performance skill; rather it is the self-directive process by which learners transform their mental abilities into academic skills" (p.65). According to Bandura (1988), self-regulated learning is driven by three main components. These components are a person's goals, self-efficacy, and interests (Bandura, 1988). For example, setting and establishing goals "can improve psychological well-being and accomplishments" (Bandura, 1988, p.290). Research suggests goal setting in important in self-regulating one's own learning because it acts as a motivator (Zimmerman, 1990; Bandura, 1988).

At its core, social cognitive theory (SCT) is based on imitative and observational learning (Watson, 2017). Bandura (1977) argues that most humans learn through this approach and that people can't construct behaviors based only on their own lived experiences. Bandura (1977) further elaborated this concept by stating people learn through observations because it helps people code information in their minds, which in turn can help them enhance their own personal development by forming new ideas. This theory is often used in research "to guide the development of extensive research programs and to design instructional–learning materials, systems, and environments" (Martin, 2004, p. 135).

Limitations of Prior Research

Despite the fact that educational scholars are continuously experimenting and researching new instructional strategies to facilitate teachers' technology integration skills and TPACK (Habowski & Mouza, 2014); there is a limited amount of research exploring how the use of video analyses influences teachers' TPACK development (e.g., Jang & Lei, 2015; Chase Martin & Sadera, 2011; Polly, 2011). In addition to the limited literature on video analysis, as it relates to facilitating teachers TPACK, scholars who research this topic have predominately studied pre-service teachers, who have no or very limited classroom teaching experience, as their research participants (Chang, Jang, & Chen, 2015; Holland & Piper, 2014; Pierson, 2008). Focusing solely on inexperienced participants can be problematic because the TPACK framework is centered on the concept that teachers can become exemplary 21^{st}-century educators by effectively combining their TK, PK, and CK together (Mishra & Koehler, 2006). However, since most TPACK research has examined pre-service teachers who are in their freshman or sophomore year, the findings from their studies may not be applicable or accurately depict pre-service teachers' TPACK development process.

Another limitation in the existing body of literature is the disconnection between the intended research outcomes, such as improving teachers' actual instructional technology integration skills; and how scholars have been actually measuring the intended outcome. Historically, educational scholars have relied heavily on participants' self-perception data such as surveys and interviews to measure their participants' TPACK (Angeli & Valanides, 2009; Chase Martin & Sadera, 2011; Koh & Chai, 2014). However, recent research suggests that participants' perceptions may not accurately represent their actual abilities (Hendricks, 2016; Pretz & McCollum, 2014; Krumpal, 2013; Furnham, 1986). By investigating how teachers change their actual instructional behaviors through their observable actions, instead of solely relying on participants' self-perceptions of their TPACK development, this research aims to build upon the existing body of literature to help scholars and teacher educators better understand how the use of an ERDS guided video self-analysis instructional approach, facilitates pre-service teachers' TPACK.

Summary. Although instructional technologies have become more accessible in K-12 schools across the United States, teachers are still not adopting or effectively teaching with technology. A major reason why teachers are not utilizing technology in their classroom instruction is due to inadequate training and preparation. Currently, teacher educators across the country have embraced the collaborative learning instructional paradigm as a method to enhance their teachers' technology integration skills. However, recent studies suggest that teachers are still unprepared to effectively teach with technology.

A major reason why teachers are unprepared to effectively teach with technology is due to a disconnect between how teachers are currently being trained and the realities of the teaching profession. The teaching profession has been well documented as being an isolated and solitary profession, and not a collaborative working environment. The reality is that teachers regularly prepare and teach lessons independently, and have to rely on themselves to improve their teaching practices. Although there is no magical instructional approach that can transform teachers to become better integrators of technology, research suggests that preparing teachers in ways that are mindful of the realities of the teaching profession may help teachers improve their ability to teach with technology. A promising strategy that may help enhance teachers' technology integration skills is through the use of video self-analysis. This instructional approach is seen as a promising instructional strategy because it provides teachers with opportunities to continuously observe, analyze, and critique samples of their own teaching practices. By providing teachers with video recordings of their actual technology integration abilities, the research suggests that teachers are able to facilitate their own professional development and improve their teaching practices.

Preparing teachers to effectively teach with technology is a complex process, and it is critical to continue researching alternative instructional strategies that can help teacher educators accelerate their pre-service teachers' ability to effectively teach with technology. Building upon the work of previous scholars, this research explored how the use of an ERDS guided video self-analysis instructional approach influenced pre-service teachers' TPACK development in an undergraduate technology integration course. In the subsequent chapter, an outline of the study's background information, research setting, research participants, research design, data sources, and data analysis is presented.

Chapter 3: Methodology

The purpose of this study was to examine how the use of a video self-analysis instructional component, guided by the ERDS model, influenced pre-service teacher technological, pedagogical, and content knowledge (TPACK). Specifically, this study investigated how this instructional approach influenced pre-service teachers' perceptions of their technology integration skills, and their actual technology integration abilities through the following three research questions:

1. How do pre-service teachers perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses?
2. How does the use of video self-analysis, guided by the ERDS model, inform pre-service teachers' technology integration planning?
3. Do pre-service teachers change their instructional behaviors after their ERDS guided video self-analyses?

These research questions were investigated through the explanatory sequential mixed methods design (Creswell, 2014). In this design, quantitative data was first collected, followed by the collection of qualitative data. This two-step process is important because it helps explain and elaborate on the quantitative results (Creswell, 2014). The benefits of using the explanatory sequential mixed methods design are that it helps researchers refine, extend, or explain the complex phenomenon (Creswell, 2014). The participants in this study completed a pre- and post-TPACK survey and their responses were analyzed during the first step (quantitative phase). The findings from the quantitative data then helped inform step two of this study (qualitative phase); where the participants were individually interviewed and probed using a semi-structured interview protocol that was informed by the findings from the survey results.

Research Context

The context of the study was selected for three primary reasons. First, the video self-analysis instructional approach has been shown to improve and facilitate teachers' learning and development. Second, the researcher was able to design the course using the ERDS model. Third, the researcher had access to the participants. This study was implemented in a mandatory technology integration course at a large private university, located in the northeastern United States. The course used for this study was the third and final sequence in a three-part technology integration course series offered within the university's School of Education. To help advance pre-service teachers' technology integration skills, three one-credit courses were developed by the university faculty and graduate teaching assistants to provide pre-service teachers, who are majoring in early childhood and elementary education, with the knowledge, skills, and experiences needed to effectively teach with instructional technologies.

Each course consisted of six, two hours and fifteen minutes sessions, which took place throughout one academic semester. However, due to mandatory field practicum placements, pre-service teachers who were enrolled in the second and third technology courses had their class sessions spread out intermittently throughout the semester. For example, pre-service teachers with field placements attended classes for the first three weeks of the semester, then attended one class during the middle of the semester, and completed their final two classes at the end of the semester. During the periods that they were not attending classes, the pre-service teachers were concurrently gaining classroom teaching experience in their field placements.

In this course, each pre-service teacher taught two 10-minute sample lessons to their peers. During each lesson, the course instructor video recorded and uploaded the videos onto the course Blackboard learning management system. Pre-service teachers then self-analyzed their videotaped teaching samples using Hofer et al.'s (2011) TPACK observation rubric to facilitate and guide their self-analysis. Based on the findings from their video self-analysis, the pre-service teachers wrote reflective essays where they designed action plans that outlined how they planned to improve their teaching and technology integration in their future lessons. This ERDS guided video self-analysis process was repeated twice throughout the semester: once at the beginning of the semester, and again at the end of the semester.

Participants. The participants in this study were a convenience sample of 21 female pre-service teachers of senior academic standing, enrolled in one of two, six-week, one-credit, undergraduate, technology integration courses, that were run simultaneously during the spring 2016 academic semester. In all, 90.5% (n=19/21) of the participants were White and 9.5% of the participants were Asian (n=2/21). These participants had completed the prerequisite first and second technology integration courses and had prior experiences of teaching in real classroom settings. During their first six-week, one-credit technology integration course, in which they took it during their freshman year; the participants learned about basic instructional technologies with an emphasis on connecting technology experience with instruction through hands-on activities. For example, the participants explored and interacted with assistive instructional technologies and learned about leveraging widely available software (e.g., Microsoft Office) to help facilitate their teaching through technology. During this initial course, the participants were also introduced to the concepts, history, and purpose behind the TPACK framework. During their second six-week, one-credit technology integration course, which they typically took during the fall semester of their junior year; the participants were introduced to more advanced and emerging instructional technologies that could be used to help enhance their teaching. For example, the participants began learning how to leverage and integrate open online digital resources such as Google Forms, Google Docs, and Google Spreadsheets into their teaching. In this course, the participants once again learned about integrating technology into their instruction using the TPACK framework to guide and assess their technology integration abilities. During this time period, the participants were also simultaneously engaged in their field practicums and were beginning to practice teaching with technology in an authentic teaching environment. The participants in this study were all early childhood and elementary education majors with a focus on special education. Furthermore, all participants were in their final semester of academic course work and were finalizing their technological, pedagogical, and content coursework.

Research Design

This study was conducted in an instructional technology course that was informed by the four phases of the ERDS framework (Table 7). The ERDS framework was selected to guide the design of this study because it "is an iterative methodological process centered on using video evidence to plan and monitor a trajectory of continuous professional growth" for pre-service teachers (Bryan et al. 2008, p. 158); and it also helps pre-service teachers to improve their teaching skills by providing a platform to "interpret evidence for the purposes of refining their teaching practices” (Bryan et al. 2008, p. 158). The following section describes the seven steps of this research design and describes how each step connects to the ERDS framework.

Table 7

ERDS informed course design

Session (#)	Key Activities	ERDS Phase(s)
1	• Review course syllabus and objectives • Explore and practice using four new educational technologies • Develop a 10-min. lesson plan where technology is used to enhance content or instruction	1: Identify Triggers
2	• Participants teach a 10-min. lesson • Participants write an in-class reflection on their experiences teaching with technology • Participants conduct their first video self-analysis on their teaching • Participants reflect on their experiences teaching with technology after conducting their video self-analysis.	2: Marshalling Evidence 3: Interpreting Evidence 4: Develop Course of Action

Session (#)	Key Activities	ERDS Phase(s)
3	• Participants learn how to edit their individual teaching videos via iMovie video-editing software • Review EdTPA video-editing requirements	-
4	• Explore and practice using four new educational technologies • Based on the lessons learned from their first video self-analysis, participants develop a 10-min. lesson plan where technology is used to enhance content or instruction	1: Identify Triggers
5	• Participants teach a 10-min. lesson • Participants write an in-class reflection on their experiences teaching with technology • Participants conduct their second video self-analysis on their teaching • Participants reflect on their experiences teaching with technology after conducting their video self-analysis.	2: Marshalling Evidence 3: Interpreting Evidence 4: Develop Course of Action
6	• Participants present their final edited video • Participants discuss and share their lessons learned	-

In session one, the participants were tasked to design and develop a 10-minute technology-enhanced lesson. During the second session, each participant taught a 10-minute technology-enhanced lesson to their classmates, based on a lesson plan they developed in the first session. The participants were given full autonomy on the instructional topic and their instructional pedagogy. The only requirement was that they try to enhance their lesson by thoughtfully integrating technology into their instruction. This step is important because it provided the participants with an opportunity to practice planning a lesson where technology is meaningfully integrated into their instruction (*ERDS Phase 1 – identifying triggers*). In addition, the video recorded teaching samples provided the participants with evidence (*ERDS Phase 2 – marshalling evidence*) to later analyze and critique their TPACK (*ERDS Phase 3 – interpret evidence*).

At the completion of session two, the video recorded lessons were uploaded onto the course Blackboard site by the course instructor, where the participants were able to view and self-analyze their teaching videos. During their video self-analysis, the participants used a validated TPACK observation rubric (appendix B) to facilitate their self-assessment of their technology integration. This observation rubric was reviewed by scholars and educational technology experts for both construct and face validity (Hofer et al. 2011). Additionally, this instrument's inter-rater reliability for all six categories ranged from 86-94%, and the Cronbach's alpha for the instrument was .91 (Harris, Hofer, & Grandgenett, 2010). The TPACK observation rubric is a six by five matrix that outlines the six core technology integration areas. The core areas include *curriculum goals and technologies, instructional strategies and technologies, technology selection(s), fit, instructional use,* and *technology logistics*. Based on their self-assessments, the participants rated their level for each of the core areas. Possible scores ranged from one through four, where four was the highest possible rating, and one was the lowest. Prior to using the TPACK observation rubric, each participant was trained by the course instructor on how to correctly use the observation rubric during their video self-analysis. To ensure the participants used the TPACK observation rubric correctly, the course instructor modeled how to use the TPACK observation rubric using a sample videotaped teaching sample.

After completing each video self-analysis, the participant wrote a personal reflective essay. The participants' personal reflective essays were guided using Gibbs' reflective cycle framework (1988). Through the six guiding reflective prompts found within this framework, participants iteratively analyzed their lesson's strengths and limitations through the prism of their technology integration skills and abilities. Based on the findings from their video self-analysis and reflections, the participants developed an action plan that detailed how they would specifically address and improve their lesson's instructional technology integration limitations (*ERDS Phase 4 – develop course of action*). Each participant then developed a second technology-enhanced lesson adopting the lessons learned from their first ERDS guided video self-analysis.

During the fifth session, each participant taught their revised 10-minute lesson. The participants' second lesson plans were revised based on the lessons learned from their first video self-analysis. Through this iterative learning process, the participants were able to modify and revise their second technology-enhanced lesson. As a result, the second video recorded teaching sample once again provided the participants with evidence (*ERDS Phase 2 – marshalling evidence*) to analyze their TPACK (*ERDS Phase 3 – interpret evidence*), which enabled them to create an action plan to improve their future technology-enhanced lessons (*ERDS Phase 4 – develop course of action*). Based on the findings from their second video self-analysis, each participant wrote a second reflective essay. This reflective process was once again guided using Gibbs' reflective cycle framework (1988). Centered on the findings from their video self-analysis, the participants developed a subsequent action plan that outlined how they would improve their TPACK limitations (*ERDS Phase 4 – develop course of action*).

During the final session, each participant wrote a reflective essay that summarized their experiences using video self-analysis to facilitate their TPACK development and described their lessons learned throughout the course. In addition, the participants shared their successes and the challenges while teaching with technology, and described how their video self-analysis influenced their TPACK. It is important to note that this final reflective essay did not use the Gibbs' reflective cycle (1988) as a guiding framework. Instead, they were given specific reflective prompts to address the points highlighted above. The rationale as to why the Gibbs' reflection framework was not used for the final reflective essay was because the researcher wanted to capture how the participants felt about using the ERDS guided video self-analysis instructional approach to facilitate and develop their TPACK as a whole; and not in a context of a specific instance within the study (e.g., right after a teaching episode) where the Gibbs reflective framework would have been more appropriate to use.

Facilitating learning: from theory to practice. While the design of this research was informed by the following three frameworks: Recesso et al., (2009) evidential reasoning and decision support framework (ERDS), Koehler and Mishra (2009) technological pedagogical content knowledge framework (TPACK), and Gibbs (1988) reflective cycle framework; the underlying theory used to contextualize this study was based on Bandura's (1986) social cognitive learning theory. Social cognitive learning theory was used to contextualize this research because it theorizes that personal growth can occur through three distinct stages *(1) self-development, (2) adaption, and (3) change* (Bandura, 2001). As a result, the three frameworks were used in this study because each framework either facilitated participants to self-develop *(ERDS and TPACK)*, adapt *(ERDS and Gibbs reflective cycle)*, or change the way they teach and integrate technology into their instruction *(TPACK, ERDS, and Gibbs reflective cycle framework)*. For example, when participants critiqued and self-analyzed their videotaped teaching samples following the four phases within the ERDS framework (i.e., Identify Triggers, Marshall Evidence, Interpret Evidence, and Develop Course of Action), they participated in the social cognitive learning theories *self-development* phase via self-analyzing their videotaped teaching samples, while using the TPACK observation framework to guide their self-assessment. In phase two of the social cognitive learning theory, participants planned how they would *adapt* their future technology-enhanced lessons (*ERDS Phase 4 – develop course of action*) while simultaneously using the Gibbs reflective cycle as a framework to guide their reflective process. Finally, the researcher was able to assess whether the participants *changed* their actual behaviors by analyzing the participants' videotaped teaching samples.

Data Sources

For this study, four data sources were used. The data sources were reflection essays, videotaped lessons, pre- and post- TPACK surveys, and semi-structured interviews. The section below describes and outlines each data source, its purpose, and the data collection method.

Reflection essays. The primary purpose of collecting participants’ reflective essays was to describe changes in their perceived TPACK throughout the study. For example, participants were tasked to write reflective essays immediately following their experience of teaching with technology. This immediate in-class reflection was important because it captured the participants’ immediate state of mind. In addition, the participants’ reflective essays they wrote after viewing and analyzing their videotaped teaching sample were also collected. Through these reflective essays, the researcher was able to compare and contrast the changes in participants’ perceived TPACK before and after their video self-analysis. In all, 147 reflections were collected and analyzed for this study. The length of each reflection varied from one to two pages.

Videotaped lessons. Each participant taught two 10-minute, technology-enhanced lessons that were videotaped. The participants’ first videotaped lesson occurred during session two, and their second videotaped lesson occurred during session five. The lessons were videotaped using a tripod and digital camera, which were stationed in the back of the classroom. Once all participants had been videotaped, the lessons were securely uploaded onto the participants’ course Blackboard site. There, the participants were given access to view and self-analyze their videotaped lessons. In all, 42 videotaped lessons, containing 420 minutes of video data, was used for this study. It is important to note that while this study collected a large amount of video data, the only purpose for collecting and analyzing the video data was to investigate whether participants changed their instructional behaviors. For example, if a participant cited on their reflective essays that they would take a specific course of action (e.g., modeling technology use in front of their students), the video data was used to confirm or reject whether this instructional action took place in the participants' actual lesson.

Surveys. Pre- and post- surveys were used to collect and measure changes in participants' perceived TPACK from the beginning (i.e., before conducting video self-analysis), and at the end of the study (i.e., after conducting video self-analysis). For this research, a validated 47 self-report item survey instrument was used to measure the participants' TPACK. This survey instrument was developed by Schmidt et al. (2009) and is called the *survey of teachers' knowledge of teaching and technology*. This instrument uses a 5-point Likert scale to measure pre-service teachers' self-perceptions of their knowledge of the six domains that comprise the TPACK framework (appendix A). This instrument was developed by educational technology scholars and has been analyzed and critiqued by instructional technology experts (Schmidt et al., 2009). The survey was validated with 124 pre-service teachers with Cronbach's alpha values ranging from .75 to .92 (Schmidt et al. 2009). In all, 21 pre- and post- surveys were administered in paper form and were distributed and collected at the end of the participants' first technology integration course class, and at the end of the last class.

Semi-structured interviews. The primary purpose of conducting semi-structured interviews was to better understand how an ERDS guided video self-analysis instructional approach, informed participants' technology integration planning. Specifically, the semi-structured interviews were used to probe the participants about specific examples of how self-analyzing their videotaped lessons, informed their future technology integration planning. Interview participants were recruited using the research consent form. Prior to conducting this study, the researcher received approval to pursue this study by the universities' Institutional Review Board (IRB). As a result, each participant signed consent forms agreeing to participate in this study and allowing the researcher to use their recorded teaching samples. To ensure no participant felt pressured to participate in this study, the consent form had specific language in it where it stated that regardless of their participation in this study, their final course grades would not be influenced and that they would receive the same training and curriculum regardless of their participation in this study. In all, all 21 pre-service teachers signed the consent form and agreed to participate in this study.

In addition, the consent form also had a section that asked the participants if they were interested in participating in an interview. Only participants who checked "yes" were followed up with an email sent by the researcher. Of the 21 participants, 10 participants (47.6%) agreed to be interviewed for this study. Participants who agreed to be interviewed were emailed a link to an online calendar where they scheduled a date and time that was most convenient for them. All interviews took place during April 18-22, 2016. At the request of the participants, the interviews were conducted in the same technology lab classroom where the participants had attended their technology integration course.

The interviews were digitally recorded using a voice recorder, and each interview lasted approximately 20 minutes. Upon completion of all interviews, the recorded interview data was uploaded onto a secure and encrypted hard drive. The hard drive was then safeguarded in a locked drawer located in the researcher's private office. In all, approximately 220 minutes of interview data were collected. To better understand the role of each data source, the table below (Table 8) outlines which data sources were used to answer the following research questions.

Table 8

Research question and data sources

Research Question(s)	Data Sources
How do pre-service teachers perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses?	• TPACK survey • Reflective essays
How does the use of video self-analysis, guided by the ERDS model, inform pre-service teachers' technology integration planning?	• Semi-structured interviews • Reflective essays
Do pre-service teachers change their instructional behaviors after their ERDS guided video self-analyses?	• Videotaped lessons • Semi-structured interviews

Data Analysis

Qualitative Analysis. This research investigated how the use of video self-analysis, guided by the ERDS model, influenced pre-service teachers' TPACK. To better examine this phenomenon, this study triangulated data across various sources and analyzed them for emerging patterns, trends, and themes using constant comparative analysis (Glaser, 1965). This analysis is beneficial in helping researchers create meaningful connections within the data (Boyatzis, 1998; Taylor & Bogdan, 1984). Prior to analyzing the interview data, the researcher first had to collect and record the participants' interview data. This was accomplished by using a pre-loaded voice recording application on the researcher's LG V20 smartphone. The researcher chose to use this medium record and collect his participants' interview data because of its audio quality, affordability, and accessibility. To expedite the transcription process, the researcher hired a transcriptionist. The audio files were shared with the transcriptionist via an email that contained the password encrypted audio files. The transcriptionist then transcribed the interviewed participants' audio data and emailed them back to the researcher over. To verify the accuracy of the transcriptions, the researcher listened to the audio while simultaneously reading the interview transcripts. During this process, the researcher read and re-read each transcript and made the appropriate edits when necessary. The researcher then used the qualitative research software NVivo to analyze and organize the participants' reflective essays and the transcribed interview data into emergent themes (Creswell, 2002; Stake, 2010).

The recognition of themes subsequently led to the creation of a data codebook (Table 9). For example, when participants described instances where technology was arbitrarily used in their teaching, the researcher coded this phenomenon as *using technology for the sake of using technology*. The definition developed to describe this code was as follows: *the arbitrary use of technology when teaching* (i.e., no purpose, not used to enhance instruction or content). In addition to creating specific definitions for each code, the researcher also created specific characteristics for each applicable code. Creating specific codes in this study was an important step because codes can be "a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (Saldaña, 2016, p. 4). Furthermore, "coding connects the qualitative data collection phase with the data analysis phase of a study… and it can increase the trustworthiness (or validity) of the data" in research studies (Rogers, 2018, p. 889).

In the before-mentioned example, the characteristic for the arbitrary use of technology when teaching was described as: *using technology just for the sake of using technology, technology not being used to enhance content or instruction, false perceptions of technology integration in classroom instruction, technology is used to present material (e.g., PowerPoint), using any form of technology in their teaching and calling it technology integration*. In this instance, the proposition for this code was that participants believed they were effectively integrating technology into their instruction through the mere integration of any technology. To better illustrate this point, this code was applied when participants described instances such as using PowerPoint to display class objectives, as an example they provided as evidence of effective technology integration.

In addition to creating codes and a codebook, the researcher also wrote analytic memos containing specific definitions, characteristics, conditions, propositions, negative cases, and illustrations that were also developed for each code (Bogdan & Biklen, 1997). These memos were useful in helping the researcher elaborate key concepts and summarize his findings. The researcher wrote his analytic and reflective memos in journals and on his laptop computer throughout the duration of the study. A significant benefit of writing the memos was that it enabled the researcher to critical think about the data and challenged his preexisting biases, subjectivities, and assumptions regarding all aspects of this study. Furthermore, the memos helped the researcher better make sense of his data and provided insightful connections throughout the duration of the study. This systematic process of writing and recording the researcher's thought process was extremely beneficial in this research, because it allowed him to make meaningful connections with his data, and align his findings with his specific research questions.

It is important to note that the coding process used for this research was not a one-time event. As described by Rogers (2018), the qualitative research process is not linear; rather it is an iterative and cyclical process. Due to the iterative nature of qualitative research, the researcher constantly reviewed his memos, notes, and various data sources throughout the research process to make meaning from the data and make meaningful connections with the data. For example, the researcher coded each of his ten interview transcripts individually. He then went through the process of re-coding the interviews again, to compare the results from this first coding process. All codes used for this study were developed via this ongoing and iterative process.

To ensure inter-rater reliability, two raters independently analyzed and coded the data using the researcher's designated codes (Armstrong, Gosling, Weinman, & Marteau, 1997). Prior to the start of the coding process, the two raters met, reviewed, and practiced coding sample data using a codebook. After the completion of the coding rehearsal, the two raters met and discussed their results and experiences. Any questions or concerns between the two raters regarding the coding process were addressed and resolved during this meeting. After the completion of the practice and coding rehearsal, the two raters independently coded the real data. Upon completing the coding process, the two raters once again met and debriefed each other on their findings. During this meeting, the two raters discerned they had reached an agreement of .71 on the codes. Based on the inter-rater reliability benchmark scale Landis and Koch (1977) proposed, the score of .71 indicates a *substantial strength of agreement*. Through this debriefing process, the raters discussed and negotiated agreements and disagreements regarding their coding process. At the end of this process, the two raters reached a 100% consensus on the coding used for this study.

Table 9

Data Codebook Excerpt

Code	Definition	Characteristic	Specific Condition Under Which the Code Works	Proposition	Illustration
Self-Awareness of Teaching Strengths (+)	Using video self-analysis to help self-identify their teaching strengths (+) in their videotaped teaching samples.	When preservice teachers analyze their personal videotaped micro-teaching simulation and self-identify their instructional strengths (i.e., what they believed they did well) as a teacher (e.g., I used technology to help promote meaningful learning).	Preservice teachers self-identify their strengths (+) through self-analyzing their videotaped teaching sample (e.g., effectively integrating technology into instruction, showing/exhibiting command of the classroom, applying effective instructional strategies).	When preservice teachers self-identify their teaching (e.g., classroom management, instruction, technology integration) strengths using video self-analysis.	*"I liked how engaged the students were with the technology and how they listened to the directions well."*
Self-Awareness of Teaching Limitations (-)	Using video self-analysis to help self-identify their teaching limitations (-) in their videotaped teaching samples.	When preservice teachers analyze their personal videotaped micro-teaching simulation and self-identify their teaching limitations as a teacher (e.g., I should have done a better job modeling the instruction, I could have done a better job managing the classroom).	When preservice teachers self-identify their teaching limitations (-) through analyzing their videotaped teaching samples.	When preservice teachers self-identify their teaching limitations (e.g., not integrating technology, lack of classroom management, not modeling instruction, not being aware of classroom climate) using video self-analysis.	*"I should have walked around the room in order to make sure students were on task and had the correct programs open on their computer."*
Engendering Reflective Practitioners	When preservice teachers develop alternative teaching and/or instructional strategies to improve/enhance future classroom instruction (e.g., using different forms of technology, developing strategies to increase student engagement) based on their analysis of their videotaped teaching sample.	When preservice teachers identify their lessons limitations (-)and develop ideas and strategies to improve future instruction (e.g., I did not model the classroom instruction and my *students* were confused. Next time, I will make sure to systematically show my students the specific steps to complete the assignment).	Whenever preservice teachers develop strategies and/or ideas to improve or enhance their future classroom instruction through video self-analysis.	When preservice teachers develop ideas and alternative instructional strategies based on their personal analysis of their videotaped teaching sample. The preservice teacher must self-identify their personal pedagogical limitations, and then reflect and think of ideas and/or strategies to fix and improve their current instructional practices.	*"Another idea I have is if students are having group discussions and I am unable to observe I can have students have their group discussion in front of a camera and listen to it later so I can see what students discussed about and if they understand"*

Quantitative Analysis. To better understand how an ERDS guided video self-analysis instructional component influenced pre-service teachers' TPACK through a quantitative lens; a paired-samples t-test was conducted on the participants' pre and post TPACK surveys. This statistical test was conducted to investigate whether the video self-analysis instructional approach influenced participants' TPACK, by determining whether the mean of the differences between the results from the pre and post-TPACK surveys differed from zero (Mee & Chua, 1991). Prior to conducting the statistical analysis, the researcher first entered the participants' paper TPACK survey results into a password-protected Microsoft Excel file. Next, the researcher analyzed the data using SPSS software and calculated the results from the paired sample t-test. The TPACK survey data was then analyzed in terms of frequencies, means, and standard deviations.

Study Limitations

Limitations for this study include its small sample size, and its specific participant parameters (e.g., preservice teachers who are in their final year of their teacher preparation program). By having a small sample size, and explicit participant parameters, the researcher recognizes that the study's findings may not be generalizable to all preservice teachers (e.g., preservice teachers who are freshman, sophomores, and/or juniors), let alone experienced in-service teachers. For example, this study only investigated the influence of an ERDS guided video self-analysis instructional component on predominately white female pre-service teachers who were of senior academic standing. Furthermore, the participants in this study already participated in two mandatory technology integration courses that provided them with more knowledge and context of teaching with technology and TPACK. As a result, securing a more diverse group of participants would also help shed more light on the strengths, limitations, and impact that this instructional approach on pre-service teachers' TPACK and actual technology integration skills. To improve the validity and generalizability of this study, this study's findings also warrants additional research using larger sample sizes with the before mentioned diversified participant populations (e.g., age, gender, race, socio-economic status, teaching experience) to better understand the impact of this alternative instructional approach has on teachers TPACK and technology integration skills. While this study underlines the complexities of preparing teachers to effectively teach with technology, it also examined the influence of an ERDS guided video self-analysis instructional component on pre-service teachers' TPACK in a controlled non-authentic teaching setting. As a result, it may be beneficial for researchers to examine the influence of this instructional approach on both pre-service and in-service teachers in actual authentic classroom settings.

Due to the qualitative component within this study, the researcher made it a point of emphases to be aware of his own biases and subjectivities throughout this study. For example, the researcher also served as the course instructor for this study and understood that he was in a position to influence outcomes. However, the researcher put in place numerous mechanisms (e.g., two raters, self-assessments) to mitigate any biases that could be interpreted as advocacy. Instead, the researcher relied on the collected data and evidence to guide his study's results and conclusions. Another limitation within this study may be due to the researcher's personal bias and preference towards believing in the potential benefits of teaching with technology via the TPACK framework. For instance, this study sought to examine the potential benefits of using an ERDS guided video self-analysis instructional component because of the researchers' past history examining this line of inquiry (e.g., previously published research examining this topic).

As such, even the research questions in this study were specifically crafted to further examine how the use of the ERDS guided video self-analysis instructional component influenced pre-service teachers TPACK via a qualitative lens. While the research recognizes that he could have picked a framework other than TPACK to measure his participant's technology integration skills in this study; the researcher recognizes that he has a personal preference for this framework due to the fact he's used it in the past and is comfortable using this framework. However, it is also important to note that the TPACK framework is overwhelmingly accepted by scholars and instructional technologists who seek to research new and existing approaches to improving teachers' technology integration knowledge and skills. While researcher bias and subjectivity are commonly understood as inevitable and important by most qualitative researchers, it is important to point out that researchers and experts in the field of qualitative research see this type of self-discovery and self-awareness as essential components to learning and conducting qualitative research (Brown, 1996).

Summary. This chapter has described the explanatory, sequential, mixed-methods design used in this study to examine how an ERDS guided video self-analysis instructional component influenced pre-service teachers' TPACK. In this chapter, the researcher outlined how he investigated this instructional approaches influence on pre-service teachers' perceptions towards their technology integration skills, and their actual technology integration abilities by examining the following three research questions:

1. How do pre-service teachers perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses?

2. How does the use of video self-analysis, guided by the ERDS model, inform pre-service teachers' technology integration planning?
3. Do pre-service teachers change their instructional behaviors after their ERDS guided video self-analyses?

Furthermore, chapter three introduced and described the research context, program participants, research design (e.g., the seven procedural steps used for this study), data sources, and the analysis used to analyze both quantitative and qualitative data. In chapter four, the results from the quantitative and qualitative analysis of the first research question, *How do pre-service teachers perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses* – is presented. The results and findings in chapter four were based on the analysis of the following data sources: reflective essays, participants' interviews, surveys, and videotaped lessons. Tables summarizing participants' before and after perceptions of their TPACK, after conducting their video self-analysis, are also presented. In addition, snapshots and summaries are provided to describe how participants in this study perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analysis.

Chapter 4: RQ_1 Results - How do pre-service teachers perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses?

This research was conducted to examine the following three research questions: (1) how do pre-service teachers perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses?; (2) how does the use of video self-analysis, guided by the ERDS model, inform pre-service teachers' technology integration planning?; and (3) do pre-service teachers change their instructional behaviors after their ERDS guided video self-analyses? Results and findings from the first research question are presented in this chapter. Tables summarizing participants' before and after perceptions of their TPACK, after conducting their video self-analyses, are also presented. In addition, snapshots and summaries are provided to describe how the pre-service teacher participants perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses.

To determine how participants perceived their TPACK before and after conducting their video self-analyses, pre- and post- TPACK surveys were administered. Through the participants' TPACK survey data, a paired sample t-test was conducted to compare and measure their perceived TPACK. The findings from this analysis suggest there was a statistically significant increase in how participants perceived their CK, PK, PCK, TCK, TPK, and overall TPACK, after conducting their video self-analysis (Figure 4). However, there was no statistically significant change in participants' perceived technological knowledge (TK). To help elucidate these findings, the participants' reflective essays were analyzed to further investigate this phenomenon.

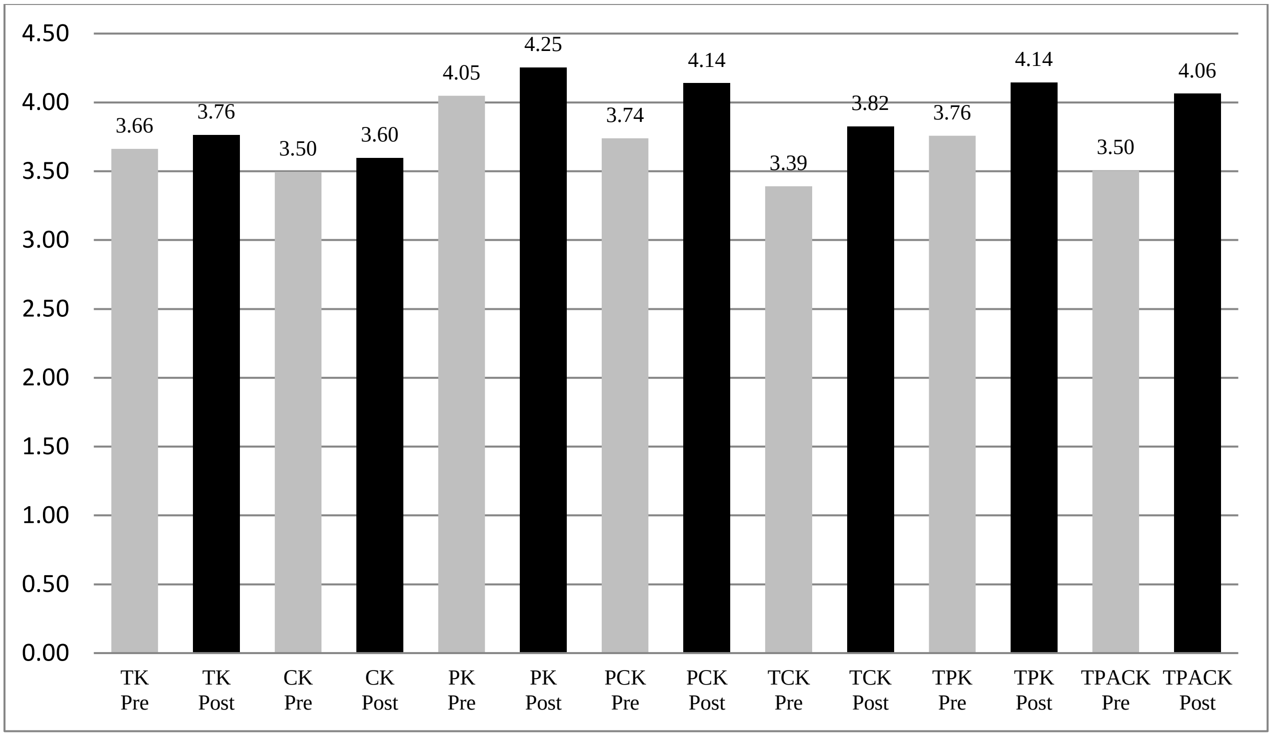

Figure 4

Changes in pre-service teachers' perceived TPACK

The results from the paired sample t-test, as shown in Table 10, indicated that there was a statistically significant increase in participants' content knowledge (M_{pre}=3.5, M_{post}=3.6, $p<.05$), pedagogical knowledge (M_{pre}=4.05, M_{post}=4.25, $p<.05$), pedagogical content knowledge (M_{pre}=3.74, M_{post}=4.14, $p<.001$), technological content knowledge (M_{pre}=3.39, M_{post}=3.82, $p<.01$), technological pedagogical knowledge (M_{pre}=3.76, M_{post}=4.14, $p<.01$), and technological pedagogical content knowledge (M_{pre}=3.5, M_{post}=4.06, $p<.001$).

Table 10

Changes in participants' technological pedagogical content knowledge

	Mean Difference	Standard Deviation	Standard Error Mean	t	Df	Sig. (2-tailed)	Effect Size *(Cohen's d)*
TK	.1	.634	.138	1.463	20	.158	.157
CK	.1	.367	.080	2.35	20	.029*	.272
PK	.205	.372	.081	2.703	20	.013*	.551
PCK	.4	.357	.078	3.864	20	.000***	1.12
TCK	.433	.540	.118	3.724	20	.001**	.801
TPK	.385	.474	.103	3.28	20	.003**	.812
TPACK	.557	.450	.098	6.959	20	.000***	1.23

Note: *p<.05, **p<.01, ***p<.001

These results indicate that participants' TPACK increased significantly during the course, but this may or may not due to the use of video self-analysis. Furthermore, a closer examination of the data indicated that not all six knowledge domains that comprise the TPACK framework increased significantly. For example, the evidence demonstrated that the use of video self-analysis did not have a statistically significant effect on participants' perceived technological knowledge (TK) development (p=.158). This phenomenon is further investigated and discussed in the sections below.

Changing perceptions towards TPACK. Participants' perceptions of their TPACK were compared before and after their video self-analysis. The results from participants' responses were broken down into the seven domains. The findings are presented in the table below (Table 11), and the changes in participants' perceptions are displayed in Figure 4.

Table 11

Participants perceived TPACK: before and after video self-analysis

Before	After
High Confidence in Pedagogical Knowledge (PK)	**Moderate Confidence in Pedagogical Knowledge (PK)**
86% of participants (n=18/21) cited they are very knowledgeable in the practice of teaching and learning.	After their first video self-analysis, 71% of participants (n=15/21) cited they believe they are very knowledgeable in the practice of teaching and learning.
High Confidence in Technological Pedagogical Knowledge (TPK)	**Moderate Confidence in Technological Pedagogical Knowledge (TPK)**
86% of participants (n=18/21) cited they know how to effectively use technology to enhance their teaching.	After their first video self-analysis, only 67% of participants (n=14/21) cited they felt they could effectively use technology to enhance their teaching.
High Confidence in Technological Knowledge (TK)	**Moderate Confidence in Technological Knowledge (TK)**
81% of participants (n=17/21) believe they are able to integrate particular technologies into their instruction effectively.	After their first video self-analysis, 71% of participants (n=15/21) cited they believe they can integrate particular technologies into their instruction effectively.

Before	After
High Confidence in Pedagogical Content Knowledge (PCK)	**High Confidence in Pedagogical Content Knowledge (PCK)**
81% of participants (n=17/21) cited they understood how certain instructional strategies are better suited for enhancing specific content areas.	After their first video self-analysis, 76% of participants (n=16/21) cited they felt they understood how certain instructional strategies are better suited for enhancing specific content areas.
Moderate Confidence in Technological Pedagogical Content Knowledge (TPACK)	**Moderate Confidence in Technological Pedagogical Content Knowledge (TPACK)**
71% of participants (n=15/21) cited they understood the complex interplay between the three major knowledge domains (i.e., TK, PK, CK).	After their first video self-analysis, 62% of participants (n=13/21) cited they felt they understood the complex interplay between the three major knowledge domains (i.e., TK, PK, CK).
Moderate Confidence in Content Knowledge (CK)	**Moderate Confidence in Content Knowledge (CK)**
67% of participants (n=14/21) cited they are very knowledgeable in their core content areas.	After their first video self-analysis, 67% of participants (n=14/21) cited they felt very knowledgeable in their core content areas.

Before	After
Low Confidence in Technological Content Knowledge (TCK)	**Low Confidence in Technological Content Knowledge (TCK)**
48% of participants (n=10/21) cited they understand how technology and content influence one another.	After their first video self-analysis, 48% of participants (n=10/21) cited they understand how technology and content influence one another.

Of the six knowledge domains that make up the TPACK framework, the participants in this study expressed the highest levels of confidence, prior to conducting their video self-analyses, in the following two knowledge domains: PK (86%) and TPK (86%). Their confidence levels in the subsequent domains decreased: TK (81%), PCK (81%), CK (67%), and TCK (48%). Upon completing their ERDS guided video self-analysis, the participants' confidence levels towards their TPACK either dropped (e.g., PK, TPK, TK, PCK, and CK) or stayed constant (e.g., CK and TCK). The next sections provide more contexts to the drop in participants' TPACK confidence levels after they analyzed their videotaped teaching samples, using the guidance of the ERDS framework.

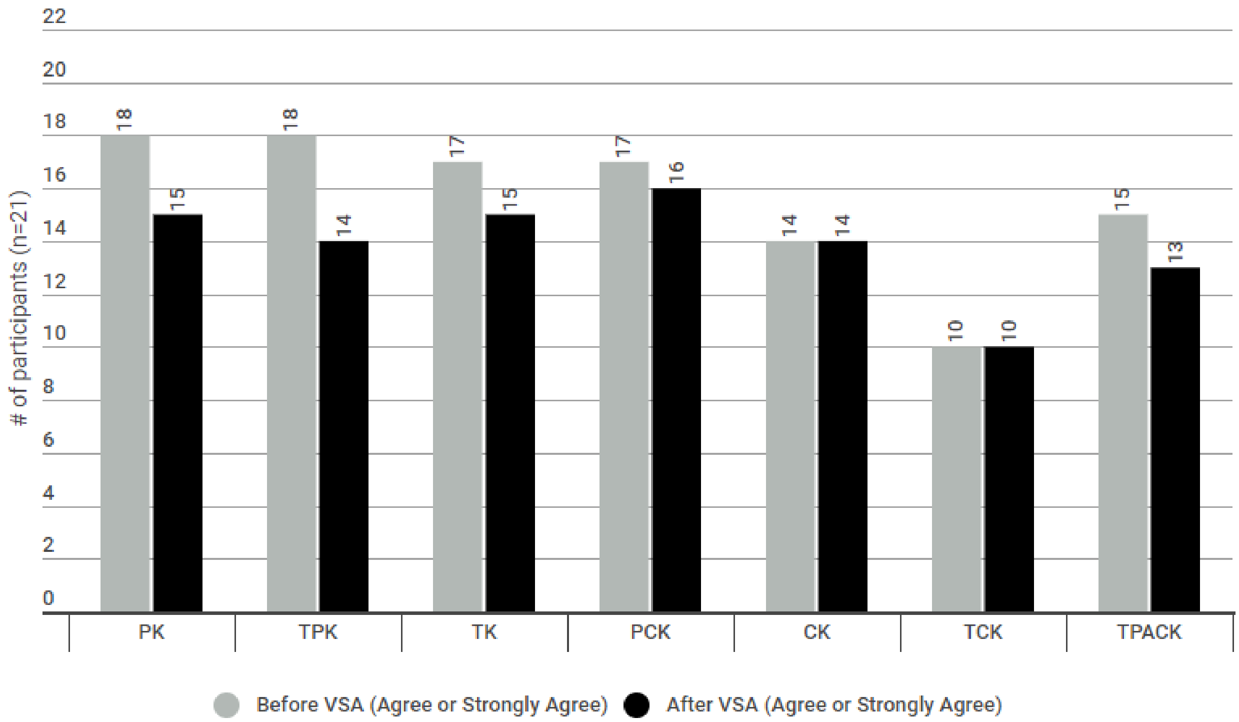

Figure 5

Change in participants' confidence towards their TPACK by domain

Decreased confidence level in most TPACK domains. As presented in Figure 5, the participants' confidence levels towards their TPACK dropped in five of the six knowledge domains (e.g., PK, TPK, TK, PCK, and CK) after they conducted their ERDS guided video self-analysis. For example, approximately 10% of the participants (n=2/21) expressed that their confidence level towards their overall TPACK decreased after conducting their video self-analysis. After analyzing their videotaped teaching samples, the participants cited they began to realize the complexities of teaching with technology, and that their video self-analysis was beneficial in helping them confront the realities of their actual technology integration abilities. This finding corroborates with findings from previous studies that pre-service teachers often overestimate their ability to teach with technology (e.g., Abbitt, 2011; Ertmer & Ottenbreit-

Leftwich, 2010; Whetstone & Carr-Chellman, 2001). When the data from the participants who cited a decrease in their TPACK was further investigated, a common theme emerged. Participants expressed that by watching their videotaped teaching sample, along with the guidance of their TPACK observation rubric, helped them to better understand and critique their TPACK strengths and limitations. Furthermore, the participants expressed that watching videotaped sessions of their teaching samples enabled them to enhance their recollections of their teaching, which in turn helped them provide more honest and accurate depictions of their ability to effectively integrate technology into their teaching. This finding that participants are more apt to improve their ability to self-assess their teaching ability via watching videotaped samples of their teaching, corroborate with findings from past research that examined and investigated this subject (e.g., Fadde & Sullivan, 2013; Snoeyink, 2010; Recesso et al. 2009). The subsequent sections below breakdown the results from each individual TPACK domain.

Decreased confidence in PK. Prior to self-analyzing their videotaped sample lessons, the participants reported high levels of confidence in their PK (86%; n=18/21). Participants' high confidence levels were primarily driven by their belief that they have the necessary knowledge and skills to facilitate students' learning by differentiating their instructional approach to diverse learners. Based on participants' interviews, they also expressed their prior practicum experiences, along with their pedagogy training received in their teacher preparation program, reflected their high PK confidence levels.

Interestingly, after the participants conducted their video self-analysis, their confidence levels towards their PK decreased. For example, only 71% of the participants (n=15/21) reported they still felt confident with their PK after analyzing their videotaped instruction. This represents a 15% decline in the number of participants who still felt confident with their PK after their video self-analysis. The three participants who changed their perceptions towards their PK cited that watching themselves teach with technology was an eye-opening experience for them. For example, these participants all reported that the video evidence contradicted their prior presumptions and recollections of how their sample lesson went. Prior to their video self-analysis, these participants expressed high levels of confidence towards their PK due to the fact that they believed their lessons were well planned, and that their teaching sample went relatively well. However, after analyzing their videotaped lesson using the TPACK observation rubric, these participants began to realize that their PK was not as strong as they once believed. The following excerpt is representative of why these participants reported lower levels of confidence in their PK after self-analyzing their videotaped lessons:

> *As I watched myself teach, I noticed that my lesson did not go as planned. If I were to teach this lesson again, I would go back and be more structured in the way I went about things. I should have had questions ready ahead of time to ask my students, and I should make sure that my students have the background knowledge to be able to understand the content I'm bringing forth.*

This participant taught a geography lesson on urban, suburban, and rural communities and the purpose of the lesson was to teach students about the differences between the three communities. Prior to self-analyzing her videotaped instruction, this particular participant reported in her reflective essay that she believed her pedagogical approach in her sample lesson helped facilitate students learning. However, after analyzing her videotaped lesson, she noticed that her instructional approach did not work as well as she had previously thought. Through her ERDS guided video self-analysis, the participant realized her PK was not as strong as she once believed, because she noticed her lesson lacked structure and did not use instructional strategies that promoted or facilitated her students' knowledge around rural, urban, and suburban communities (*ERDS phase 3 – interpret evidence*).

Furthermore, the participants in this study who reported decreased levels of confidence towards their PK after conducting their ERDS guided video self-analysis expressed that having an opportunity to watch videotaped samples of their teaching, enabled them to improve the accuracy of their assessment of their PK and TPACK. For example, the participant quoted above-cited she "*noticed that my lesson did not go as planned"*. The findings from this study suggest that the participants may not have been able to *"notice"* their PK limitations, had they not watched samples of their actual teaching practices. Time and again, the participants in this study cited they were *surprised, shocked,* and/or *stunned* that their planned lesson did not go as well as they had planned. Furthermore, some participants described instances in their reflective essays and cited in their interviews that they were often not aware of some of the PK issues they encountered during their lesson.

The participants in this study often used the expression that *during the heat of the moment* (i.e., while they were delivering instruction), they were so focused on getting through and covering the content, that they would sometime omit certain aspects within their teaching - such as implementing the appropriate instructional strategies that would enhance the content of their lesson (PK). Some additional illustrations of this instance are as follow:

> *During my lesson* (science)*, I realized that I just displayed bullet points of the concepts I wanted my students to learn during the lesson* (food cycle)*. I couldn't believe I didn't even share an actual image of the food cycle into my presentation. If I were to actually teach this lesson to a classroom of third graders, I'm pretty sure my students would have been confused.*

> *I should have walked around the room in order to make sure students were on task and had the correct programs open on their computer… and looking back I should have not given so many verbal instructions because when I was kind of confused myself… which made my instructions confusing to my students.*

When participants were asked why they decided to change their PK confidence levels after conducting their ERDS guided video self-analysis, they mentioned that the video self-analysis process provided them with a medium and opportunity to critically assess their teaching sample by keying in onto specific instances of their teaching, where they were able to identify their PK and TPACK limitations. As a result, when the participants in this study self-analyzed their videotaped teaching samples and focused on specific TPACK constructs such as their PK, they re-adjusted their initial perceptions to more accurately reflect the realities of their actual PK. As a result, the findings from this study strongly corroborate with earlier findings that the use of video self-analysis has gained popularity in the field of human development because it has been shown to help people improve their work performance by critically "observing, assessing, and confronting their own actions" (Rich & Hannafin, 2008, p. 66); and that the use of video self-analysis can help teachers facilitate their own professional development through this self-reflective process (e.g., Yousef et al. 2014; Snoeyink, 2010; Fadde et al. 2009; Sherin & van Es, 2005). The most frequent comment made by the three participants, or 15% of them who cited lower levels of confidence in their PK after analyzing their videotaped teaching samples was that the videos of their teaching sample were beneficial in helping them bridge their PK into actual practice. As illustrated from the excerpt above, "*looking back I should have not given so many verbal instructions because when I was kind of confused myself",* this participant was able to identify the root cause of their PK limitation in their teaching sample (e.g., too many verbal instructions), and provide analysis as to why having too many verbal instructions can be detrimental to their teaching (e.g., confusing to her students, and even to herself). Through this ERDS guided video self-analysis process, participants in this study expressed their perceptions of their PK changed because they were able to *see* their actual PK in action.

Decreased confidence in TPK. Prior to analyzing their videotaped teaching samples, the participants reported high levels of confidence in their TPK (86%; n=18/21). Participants' high confidence levels toward their TPK were primarily driven by their belief that they knew how to modify and adapt their instruction based on the technology they chose to integrate into their lesson. Based on participants' interviews, they also stated that their prior technology integration training they received in their teacher preparation program contributed to their high confidence levels towards their TPK. For example, the participants expressed that their experience in the mandatory technology integration courses for their teacher preparation program helped them improve their TPK, which they later described as a contributing factor for their high confidence levels towards their TPK, prior to their video self-analysis. The following excerpt is illustrative of why participants, prior to their ERDS guided video self-analysis, reported higher levels of confidence in their technological pedagogical knowledge (TPK):

> *I feel that the technology I used did enhance my content. My lesson was about organizing thoughts from a brainstorm to be used for an outline. To organize students' thoughts, I used Kidspiration* [i.e., an online concept mapping tool for children]. *In the Kidspiration file I created, students could drag and drop detail ideas into groups, categorized by topic ideas. Some students might find it hard to organize their thoughts, so if they have a program that gives them a visual so they could rearrange their thoughts and ideas, it might help them when developing a detailed outline. When the Kidspiration file is organized how the student prefers, he or she can then create a brainstorming mind map.*

This participant described how she leveraged an online concept mapping tool into her instruction so that it could facilitate her students' ability to organize their thoughts. Participants in this study reported higher confidence levels towards their TPK, pre-video self-analysis, because they believed they understood the concept that teaching and learning changes with the integration of instructional technologies. For example, when participants were asked where they learned this concept (i.e., TPK); they cited their prior technology integration coursework as their reference point. It is important to note that participants in this study exhibited higher levels of confidence towards their TPK prior to conducting their ERDS guided video self-analysis. Based on the findings from the participant interviews and reflective essays, they mentioned that they had high levels of confidence towards their TPK because *they could explain and or recite what TPK is.* Throughout this study, the concept of the participants understanding something versus being able to implement theory into practice was a common occurrence.

The selected excerpt above is a classic example of how participants' in this study were able to articulate and describe the concept of TPK in their lesson. For example, this participant said, "*my lesson was about organizing thoughts from a brainstorm to be used for an outline. To organize students' thoughts, I used Kidspiration* [i.e., an online concept mapping tool for children]. *In the Kidspiration file I created, students could drag and drop detail ideas into groups, categorized by topic ideas".* On face value, this participant was able to demonstrate through her thought process, as to why she expressed high levels of confidence with her TPK. Based on her response, she was also able to articulate how the integration of instructional technologies, such as the Kidspiration concept mapping tool, can be used to enhance her pedagogy for this lesson. For example, she cited that the use of the online concept mapping tool would enable her students to quickly drag and drop concepts and ideas into different categories and then make meaning of the visual representation they created via the Kidspiration program. This participant then went on and gave more context as to why using this instructional technology would help enhance her teaching and students learning by saying, *"some students might find it hard to organize their thoughts, so if they have a program that gives them a visual so they could rearrange their thoughts and ideas, it might help them when developing a detailed outline".* By just examining her response, it is easy to understand why she would report a high level of confidence towards her TPK. She artfully articulated that the instructional technology she selected wasn't arbitrary, but was purposefully selected for her lesson so it would help enhance her ability to teach her lessons concepts (i.e., TPK). However, after this participant went back and analyzed her videotaped teaching sample using the ERDS framework to guide her self-analysis, she realized that her TPK in the lesson was not as strong as she had originally believed. For example, in her post video self-analysis reflective essay, this participant noted that she observed some of her students were not following the procedures she outlined and that the use of the Kidspiration concept mapping program may have actually taken away from her lesson due to the technical glitches some of her students experienced. For instance, this participant did not upload a hyperlink to the Kidspiration concept mapping tool onto her teacher portfolio in her Blackboard account. This omission, however small it may seem, adversely influenced the quality of her lesson because she had to allocate approximately 15% of her instructional time to helping her students find the appropriate link to the Kidspiration concept mapping tool on their desktop computers. This participant went on to say that it may have been more beneficial for her students to have created concept maps using non-digital technologies such as paper and pencil because there would not have been the technical glitches that interrupted portions of her lesson.

This type of reflective self-awareness awareness was a constant theme throughout the course of this study. For example, this study developed a code called *developing into a reflective practitioner*. For the purpose of this study, this code was defined as when pre-service teachers develop alternative teaching and/or instructional strategies to improve/enhance future classroom instruction. For example, when they express changing their lesson in terms of using different forms of technology, developing strategies to increase student engagement, and/or better aligning their instructional technologies to enhance their ability to effectively teach and convey information to their students (TPK). Characteristics of when this code was used for the study are when the pre-service teacher participants' self-identified their lessons limitations, and then later develop ideas and strategies to improve future instruction. For example, if a participant identified that their lesson could be improved, due to the fact their students were confused due to the lack of instructional modeling during the lesson; it would be representative of a participant showing signs of *developing into a reflective practitioner.* For this research, the participants have to also have to outline specific strategies they would undertake in their future lessons in order to improve the outcome of the lesson, to be considered a reflective practitioner.

As the participants concluded their first iteration of their ERDS guided video self-analysis, their confidence levels towards their TPK also decreased. For example, only 67% of the participants (n=14/21) reported that they still felt confident with their TPK, after analyzing their videotaped lesson. This represents a 19% decline in the number of participants who still felt confident with their TPK after their video self-analysis. The four participants who changed their confidence level towards their TPK cited that analyzing their videotaped teaching samples changed their perceptions towards their TPK. The participants cited that they observed evidence of their TPK limitations throughout their lesson (*ERDS phase 3 – interpret evidence*). The following excerpt is an example of why four participants' in this study changed their perceptions towards their TPK after analyzing their videotaped teaching sample.

> *In the future, I can improve integrating technology into my instruction by first, making sure that my own source of technology is working (the smartboard) so that students have a visual to reference. Also, I would make sure to give my students an opportunity to explore the website and figure things out on their*

> *own so that it would encourage them to add their own personality and creativity into the project they were tasked with.*

Through her ERDS guided video self-analysis, this particular participant noticed her TPK limitations, because she was able to see that her lesson did not provide students with meaningful opportunities for them to engage with instructional technologies (*ERDS phase 3 – interpret evidence*). This finding corroborates with earlier findings that the use of video analysis can help teachers develop a more accurate and realistic assessment of their technology integration abilities, and can also help them better prepare for their teaching (Osmanoglu, 2016; Tripp & Rich, 2012a; Snoeyink, 2010).

A deeper examination of the sample excerpt above also sheds light on how the ERDS guided video self-analysis influenced the participants' perception of their TPACK. For example, the cited participant said, "*In the future, I can improve integrating technology into my instruction by first, making sure that my own source of technology is working".* This participant, who originally cited high levels of confidence towards her TPK, revealed that her original perceptions towards her TPK, prior to conducting her video self-analysis, may have been overestimated. Through her ERDS guided video self-analysis, she described how she noticed her TPK limitations, and then outlined specific steps she would undertake to improve her future technology-enhanced lesson (e.g., by first taking the time to make sure the technology she was planning on using for her lesson actually worked). As a result, the 19% of the participants (n=4/21) who changed their perceptions towards their TPK, after conducting their ERDS guided video self-analysis, is an example of how the use of a guided video self-analysis instructional component can be beneficial in helping pre-service teachers more accurately self-assess their TPACK.

Decreased confidence in TK. Prior to analyzing their videotaped sample lessons, the participants reported high levels of confidence in their TK (81%; n=17/21). Participants' high confidence levels toward their TK were primarily driven by their *lived experiences* using digital technologies in their daily lives. For example, the participants stated that they regularly used technologies such as YouTube, Facebook, cellphones, tablets, computers, and the internet; and are comfortable using these types of technologies. The following excerpt is an example of a participant's thought process as to why she reported higher confidence levels towards her technological knowledge (TK) prior to her ERDS guided video self-analysis.

> *I definitely believed that the technology I used for my micro lesson enhanced my lesson because the technology* [i.e., YouTube video] *I picked was particularly helpful in my lesson because it allowed my students to review the content that they have learned in the past.*

The participant in this example described how she used YouTube as an instructional technology to enhance her students' learning. For her lesson, this participant created a PowerPoint presentation and embedded a YouTube link onto a slide. After providing a short presentation on how a bill becomes a law in the U.S. government, she clicked on the embedded YouTube link that directed her to the School House Rock video: *How a Bill becomes a Law*.

When asked during her interview why she felt so confident towards her TK prior to her ERDS guided video self-analysis, she expressed the same sentiment the overwhelming majority of her colleagues stated in which she said her high levels of confidence towards their TK stemmed from her regular interaction and use of digital technologies in her daily life. As an example, this participant shared how she had high levels of TK because she understands and uses digital technologies such as YouTube, Facebook, Snapchat, and Instagram to create, view, and upload content. Thus, this participant cited high levels of confidence towards her TK, prior to conducting her ERDS guided video self-analysis, because she understood how to operate the YouTube application she used during her lessons (i.e., show the School House Rock video).

Interestingly, the participants in this study often did not describe their TK in the context of teaching and learning; rather they framed their TK confidence in the context of their experience using certain technologies in their personal lives. This disconnect between what the participants thought was TK (e.g., being able to use their smartphones, mobile applications, tablets) to the actual realities of TK in the context of teaching and learning (e.g., smartboards, educational programs and software, projectors, audio, visual, etc.) were very apparent while they conducted their ERDS guided video self-analysis. For example, 10% of the participants cited lower confidence levels towards their TK after their video self-analysis. As a result, only 71% of the participants (n=15/21) reported they were had confidence in their TK. The following excerpt is from a participant's reflective essay where she described why she reported lower confidence levels towards her TK after conducting her ERDS guided video self-analysis.

> *After watching myself teach, I noticed that I was too focused on using technology for my lesson that I forgot to still make it fun and*

> *interesting for my students. I was also surprised at how quietly I spoke and was surprised that the Wordle* [online cloud word generator] *activity did not work. I have tried using Wordle before and it always worked, but I think I may have clicked the wrong thing during my lesson.*

Prior to analyzing her videotaped instruction, this particular participant reported that she was very comfortable and knowledgeable in using digital technologies. For example, she highlighted the fact that she incorporated an online word cloud generator (i.e., Wordle) into her lesson. However, after self-analyzing her videotaped lesson, she stated she was surprised that word cloud application did not actually work (*ERDS phase 3 – interpret evidence*). It is important to point out that this participant would not have known her word cloud application did not actually work, had she not reviewed and analyzed a videotaped sample of her lesson. As she cited herself, "*I was too focused on using technology for my lesson that I forgot to still make it fun and interesting for my students".* A by-product of *being too focused on using technology* can result in a lack of awareness from the teacher. As expressed by this participant, she was too focused on integrating and using her instructional technology (i.e., Wordle) in her lesson that she did not notice that the Wordle application was actually not functioning properly. In her case, the Wordle application creates word clouds where words with higher frequencies appear in a larger font, compared to words that are used less frequently. As a result, the Wordle application can mold the words into an image that resembles the intended theme. For her lesson, this participant tried to teach students how to create a word cloud that uses the actual outline of their face profile, and have their classmates go around the room and type in words onto their computer station that described each student. Examples of words used were: kind, funny, athletic, hilarious, nice, humble, outgoing, and smart.

However, this participant was not able to correctly create a word cloud image using a profile picture of her, as originally intended in her lesson plan. Hence, this participant said she used "*...Wordle before and it always worked, but I think I may have clicked the wrong thing during my lesson".* As a result, this participant lowered her TK confidence level to low, based on her ERDS guided video self-analysis findings. The findings from this study corroborate earlier findings that teachers often overestimate their technology integration skills (Abbitt, 2011; Ertmer & Ottenbreit-Leftwich, 2010; Whetstone & Carr-Chellman, 2001); and that teachers who are considered digital natives may express more confidence towards their TK due to the fact they grew up using these types of technologies in their daily lives (Clarke & Zagarell, 2012; Lei, 2009).

Marginal decrease in PCK confidence. Prior to analyzing their videotaped teaching samples, the participants reported high levels of confidence towards their PCK (81%; n=17/21). Participants' high confidence levels were primarily driven by their belief that they knew how to adjust their pedagogy (PK) to facilitate their students' learning for a given content area (CK). The following excerpt is a sample of why participants reported high levels of confidence towards their pedagogical content knowledge (PCK) prior to conducting their ERDS guided video self-analysis:

> *I think the instructional strategy I chose for my lesson enhanced my lesson's content. The students were able to make a prediction*

> *on what sunflowers need in order to grow, and then I had them test their theories with the sunflower growing website* [e.g., an online plant growth simulator]. *I did this because I would not have enough time to plant a real sunflower plant and wait for it to grow up in order to teach my students about plant growth. So, to overcome this, I used the website so my students could test their hypothesis quickly*. *By having my students actually test their theories, I think the strategy I used for this lesson was appropriate in improving my lesson's content.*

The participant in this example taught a science lesson focused on plant growth. In her lesson, she taught her students about plant biology using a website that contained an online plant simulator. Through the online simulation, her students were able to test their theories regarding what variables would produce the most robust tomato plant by having them input different variables, such as soil, lighting, and water, into the online simulator.

For her lesson, this participant adopted the scientific methodological instructional approach (PK) into her lesson to help her students gain a deeper understanding of plant growth. For example, she had her students make an educated guess to what combination of soil and water levels would produce the most healthy and big tomato plants (*hypothesis*). The participant then directed her students to test their hypotheses via the online plant growth simulator she had screened and selected for her students (*experiment*). For their experiments, her students tested three specific variables that influence the growth of a tomato plant in three separate trials (Fig. 6). The three variables she had her students' test were: soil types, water levels, and amount of light. After the students had completed their three test trial experiments, the participant had her students record the outcomes of their experiments and observations onto an excel spreadsheet she created and projected on the classroom smartboard (*collect data*).

Figure 6

Online plant growth simulator dashboard

After all the students had reported their data onto the participant's excel spreadsheet, she had each student analyze the results of their experiments and the results of their peers (*analyze*). After each of her students had completed their individual analysis, the participant had her students orally report out to their peers whether their hypothesis was correct or not (*report*). As a result, this participant expressed high levels of confidence towards her PCK, because of how she was able to articulate what instructional approach she would take (PK), in order to best enhance her science lesson (CK). The PCK this participant displayed and articulated is representative of how other participants' in this study described their PCK.

However, after the participants conducted their ERDS guided video self-analysis, their confidence levels towards their PCK diminished marginally. For example, prior to their video self-analysis, 81% of the participants (n=17/21) reported high confidence levels towards their PCK. Even after their ERDS, guided video self-analysis, the participants'' confidence levels towards their PCK stayed constant. When the participants' were further probed to understand why they continued to have high levels of confidence towards their PCK, they stated it was due to three primary factors. Those factors are their academic standing (i.e., senior-level), field practicum experience, and their extensive coursework in pedagogy and content-specific subjects such as math, science, and English language arts. As a result, only 4.7% of the participants (n=1/21) changed their perceptions towards their PCK after their ERDS guided video self-analysis. The findings from this study align with previous research that pre-service teachers, especially those of senior academic standing, have high levels of confidence towards their PCK, due to their field practicum experiences and their prior teacher preparation training (Berry, Depaepe, & van Driel, 2016; Nilsson & Loughran, 2012; Jenkins & Veal, 2002).

One of the factors, why participants in this study expressed high levels of confidence towards their PCK, was due to their extensive coursework in pedagogy and content-specific training they receive during their teacher preparation program. Based on this finding, it may be plausible for pre-service teachers to be able to improve their TPACK if teacher preparation programs mandated extensive and rigorous technology education coursework into their curriculum as well. For example, research indicates that the technology education courses provided by teacher preparation programs are often focused on teaching pre-service teachers computer literacy skills (Zhao, Pugh, Sheldon, & Byers, 2002), and basic technological skills (Admiraal et al., 2016; AACTE, 2013; Belland, 2009). However, some literature suggests that if we want to help develop pre-service teachers to have the same confidence levels towards their TPACK as they do with their PCK, then teacher preparation program may want to consider having teacher preparation programs intentionally embed more technology in their teacher preparation courses and assignments, because it is critical in developing pre-service teachers TPACK (e.g., Estes, 2016; AACTE, 2013).

No change in participants CK and TCK. Prior to analyzing their videotaped teaching samples, the participants stated that they felt knowledgeable in their core content areas, and reported moderate levels of confidence towards their CK (67%; n=14/21). However, a third of the participants originally expressed that they were not confident with their CK, in the following two subject areas: math and science. Specifically, participants reported that they had anxiety when preparing and teaching these two subject areas because they sometimes were unsure or confused with certain math and science concepts. For example, the participants described how they were often flustered when teaching math and science lessons due to the fact that they sometimes did not know, or were not confident with the subject matter they were trying to teach. These participants said that they cringed while analyzing their videotaped teaching samples because they were embarrassed by the content-related mistakes in their lessons. Examples of content-related errors included incorrectly teaching students how to measure volume in irregular shapes, and concepts around multiplying and dividing fractions.

Participants in this study did express a small amount of anxiety while they were being video recorded and while watching their videotaped teaching samples. For example, based on the researchers' observational field notes, it was quite clear that half of the participants in this study were nervous being in front of the video camera. Based on their physical demeanor (e.g., hunched shoulders, talking into the smartboard, standing static, unnatural body movements, etc.) it was apparent that these participants were in a state of anxiety while teaching their first lesson. During the interviews with one of these participants who exhibited anxiety, she revealed that she was nervous about being video recorded. She felt it was almost like *big brother* looking over her and used the book written by George Orwell, 1984, to make her point. Although this participant expressed that she was curious to watch how she did; at the same time she shared that she didn't want to watch herself teaching because she was scared to see "*how bad I was*". When the interview participants were posed with the same probing question, many of her fellow research participants felt the same way. They all liked the idea of being videotaped to help them with their future teaching and technology integration, but they were all slightly anxious to watch themselves teach on tape. During the in-class peer micro-teaching video reviews (i.e., where the participants watched everyone's videotaped teaching sample), the researcher frequently observed the participant whose video was being displayed on the screen projection screen looking down at the ground, not wanting to see themselves teaching on the screen. Only after their teaching video sample has ended, did the researcher observe the participant who was being showcased on the projection screen raise their heads up – often followed with a big sigh of relief and a small smile.

However, during their second iteration of being videotaped and analyzing their videotaped lesson, the participants' anxiety levels diminished. For example, during the participants' second iteration of being video recorded, the researcher noticed an observable increase in confidence from the pre-service teacher participants. Examples of confidence the researcher observed include shoulders back, walking around the classroom with more authority, better command of their lessons, louder voice, head up during their lesson, and actually watching their lesson on the projection screen. When the participants were asked why they demonstrated more confidence during their second videotaped teaching sample, they cited that they got used to being in front of the camera and that it was no longer an issue (or less of an issue) compared to their first videotaped teaching experience.

In addition to exhibiting no change in their CK, the participants in this study expressed that their TCK also did not change after completing their ERDS guided video self-analysis. For example, 48% of participants (n=10/21) initially reported they understood how to align the content of their lesson with appropriate instructional technologies (TCK); and 48% of the participants' felt the same way after completing their video self-analysis. The following excerpt is representative of why over half (n=11/21) of the participants cited low levels of confidence towards their TCK.

> *I had my World Holidays [lesson focus] PowerPoint projected on the SMART Board at the beginning of class. By integrating the SMART Board technology into my lesson, my students were able to read along as I read aloud. The large digital SMART Board also made it easy for my students to visualize the story. However, after watching my lesson a few times, I noticed that my technology didn't really help enhance my content… I just used it to project pictures and words.*

The participant in this example delivered a third-grade lesson on world holidays. The objective of the lesson was to teach her students about the different types of holidays people celebrate all over the world. After analyzing her videotaped teaching sample, via the ERDS guided framework, this participant noticed that her selection of technology did not enhance the content of her lesson *(ERDS phase 3 – interpret evidence*). Rather the participant noticed that the technology she selected just *digitized* her content, instead of enhancing her content or instruction. For example, this participant said, "*by integrating the SMART Board technology into my lesson, my students were able to read along as I read aloud. The large digital SMART Board also made it easy for my students to visualize the story".* Based on this statement alone, the participant tried to express that the SMARTboard technology (TK) she selected was meaningful and purposeful because it would enable her students to read along with her and help them visualize the pictures from the story she created. However, after she conducted her ERDS guided video self-analysis, this participant said she "*noticed that my technology didn't really help enhance my content… I just used it to project pictures and words".* As demonstrated by this participant, the participants in this study also exhibited greater awareness of their TPACK strength and limitations after they analyzed their videotaped teaching samples. For example, she stated, "*after watching my lesson a few times, I noticed that my technology didn't really help enhance my content… I just used it to project pictures and words".* Based on her video self-analysis, this participant was able to recognize that she was merely digitizing her instruction instead of meaningfully using technology to enhance the content of her lesson (TCK).

The concern of teachers merely *digitizing* their instruction, instead of meaningfully integrating technology to enhance their content of instruction, has been a persistent issue for teacher educators. For example, scholars such as Lim and Tschopp-Harris (2018) examined whether teachers are innovating their teaching with technology, or just merely digitizing their teaching. The results from their study indicate that teachers are overwhelmingly using technology to digitize instructional materials (e.g., turning paper worksheets into electronic documents), and not sufficiently modifying their pedagogy to effectively teach with technology (Lim & Tschopp-Harris, 2018). Scholars such as Jochems, Koper, and Van Merrienboer (2004) also expressed that effectively teaching with technology "is not simply a matter of digitizing traditional materials, but involves a new approach, which must take into account pedagogical, technological, and organizational features" (p. i).

Decreased confidence in TPACK. Prior to analyzing their videotaped teaching samples, 71% (n=15/21) of the participants reported moderate levels of confidence towards their TPACK. Participants' moderate confidence level towards their TPACK can be attributed to their belief that they can effectively integrate technology into their instruction. For example, they cited their personal experiences using various digital technologies (e.g., smartphones, tablets, laptops) and the training they received during their teacher preparation programs as the primary factors as to why they expressed moderate levels of confidence towards their TPACK. As a result, 71% of the participants indicated that they believed they had the necessary TK, PK, CK, PCK, TCK, and TPK to effectively teach their students with technology.

However, upon completing their ERDS guided video self-analysis, only 62% of the participants (n=13/21) believed they had the necessary TK, PK, CK, PCK, TCK, and TPK to effectively teach their students with technology (*ERDS phase 3 – interpret evidence*). The participants conveyed the decrease in their TPACK confidence levels stemmed from watching and analyzing their videotaped lessons, which led them to observe first hand their struggles and difficulties they faced while teaching with technology. For example, the following excerpt is illustrative of why participants in this study expressed lower confidence levels towards their overall TPACK after conducting their ERDS guided video self-analysis.

> *Prior to watching my teaching video, I really believed I knew how to effectively teach with technology…What surprised me the most after watching my teaching video was the fact I'm actually not using the technology to improve my teaching. It was really awkward for me to watch myself just instructing my students to go log onto their computers and click on the website links I provided them. I watched myself just stand in the corner quietly while I had my students read the online text I gave them…When it was time to use the rubric to assess my TPACK* [i.e., Hofer et al. 2011]*, I realized that I wasn't really using the computers to improve my pedagogy or content…and I wasn't as knowledgeable about my TPACK as I previously thought.*

As with the overwhelming majority of the participants in this study, they all expressed to an extent that they believed they know how to teach with instructional technologies. However, the excerpt above highlights the contradiction between the participants' *perception* towards their TPACK compared to the *realities* of their actual TPACK. For example, this participant said, "*prior to watching my teaching video, I really believed I knew how to effectively teach with technology…what surprised me the most after watching my teaching video was the fact I'm actually not using the technology to improve my teaching".* This statement was very telling of the psyche of the pre-service teacher participants in this study. As noted earlier, these participants held strong self-perception of themselves in regards to their ability to effectively teach with technology because of their daily exposure and interactions with technology in their daily lives, and their cumulative experiences in their teacher preparation program (e.g., content-specific coursework, technology integration courses, field practicum experiences where they actually taught and led classroom lessons). This finding suggests that without their ERDS guided video self-analysis, participants in this study may have continued to hold inaccurate assessments of their TPACK. Furthermore, the ramifications of the participants holding erroneous and overestimated confidence levels towards their TPACK may have caused the pre-service teacher participants to not address or change their instructional behaviors when teaching with technology; because they would not have been aware of the disconnect between their perceived TPACK abilities versus their actual TPACK abilities.

However, after this participant conducted her ERDS guided video self-analysis, she said, "*I realized that I wasn't really using the computers to improve my pedagogy or content…and I wasn't as knowledgeable about my TPACK as I previously thought*". It is important to note *how* this participant realized she wasn't integrating technology into her instruction effectively. As described in Chapter 3, the participants in this study used a validated observation rubric to self-assess their videotaped lessons TPACK as part of their ERDS guided video self-analysis. By providing the pre-service teacher participants with a guiding observational framework for them to self-assess their TPACK; they were able to realize and come to the conclusion that their TPACK may not be as strong as they originally believed. When the interviewed participants' were asked how the ERDS framework, along with the guiding TPACK observation rubric helped inform their self-analysis, they expressed their videotaped teaching data in combination with the TPACK observation rubric allowed them to meaningfully reflect on their teaching and TPACK. Specifically, the participants shared that they needed the videotaped teaching sample data so they would have an accurate example of their actual ability to teach with technology. In addition, the pre-service teacher participants expressed that the TPACK observation rubric was critical because it informed them of what to look for and what they needed to work on in order to improve their TPACK as they analyzed their videotaped teaching samples.

As a result, participants in this study remarked that their ERDS guided video self-analysis was beneficial in helping them develop a more accurate assessment of their own TPACK. For example, over 70% of the participants originally cited they thought they knew how to effectively teach with technology. However, after their ERDS guided video self-analysis, they determined that they did not fully understand how to effectively teach with technology (*ERDS phase 1 – identify triggers*). As a result, 80% of the interviewed participants (n=8/10) expressed that teaching with technology was much more difficult than they had previously realized. When further probed, 60% of the interviewed participants (n=6/10) admitted that they previously believed that just using any form of technology, such as integrating a YouTube clip into their lesson, meant they were effectively integrating technology into their instruction (*ERDS phase 3 – interpret evidence*). The contrasting views held by the participants in this study supported prior research findings that teachers often have misconceptions towards their teaching (Terry & Head, 2013; Wheatley, 2005; Grant, 2002) and technology integration skills (Abbitt, 2011; Ertmer & Ottenbreit-Leftwich, 2010; Whetstone & Carr-Chellman, 2001).

Summary. While the participants cited, through their survey responses, that this study had no effect on their TK development, an examination of their course reflection data contradicted these findings. Based on the document analysis performed on the participants' reflective essays, the evidence indicates that the participants actually believed they enhanced their TK during this study. For instance, all the participants (n=21/21) stated that they acquired new technological knowledge (TK) during this study by learning how to edit videos, learning how to develop quick response codes for smartphones, and learning how to use online student learning and assessment platforms. A possible explanation as to why participants reported contradictions in their TK development may be due to the fact that the TPACK survey instrument does not measure the acquisition of new technological skills acquired in this course, such as video editing.

The findings from the TPACK survey data suggest the ERDS guided video self-analysis instructional approach had a varied effect on participants TK, PK, CK, TPK, TCK, and PCK development. For example, the findings from this study suggest the video self-analysis instructional approach had a large effect on facilitating participants' TCK, PCK, and TCK (d= ≥.08). However, participants cited this instructional approach only had a moderate effect on their PK (d=.557), and a small effect on their CK (d=.272). While the results from the TPACK survey analysis generally paralleled findings from previous studies that have explored pre-service teachers' TPACK development in a six-week technology integration course (Jang & Lei, 2015; Lu & Lei, 2012), there was one curious outlier. For instance, research conducted by Jang and Lei (2015) and Lu and Lei (2012) both reported their participants' content knowledge (CK) developed marginally during their studies. However, the findings from this study revealed the exact opposite (i.e., participants' CK improved significantly, p=.029). A viable and alternative explanation as to why this study registered significant increases in participants' CK may be due to the fact this study used older participants (senior academic standing) compared to the previous studies. In addition, the participants' in this study were also simultaneously attending content courses throughout the duration of this study.

This chapter presented the findings from the following research question: *how do pre-service teachers perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses?* In the next chapter, the findings from the second research question will be presented.

Chapter 5: RQ_2 Results - How does the use of video self-analysis, guided by the ERDS model, inform pre-service teachers' technology integration planning?

This research examined the following three research questions: (1) how do pre-service teachers perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses?; (2) how does the use of video self-analysis, guided by the ERDS model, inform pre-service teachers' technology integration planning?; and (3) do pre-service teachers change their instructional behaviors after their ERDS guided video self-analyses? In the previous chapter, the results from the first research question were presented. As such, results from the second research question are presented in this chapter. Snapshots and summaries from interviews and relevant data sources were used to provide context and describe how the use of an ERDS guided video self-analysis instructional component informs pre-service teachers' technology integration planning.

Based on the researcher's analysis of the participants' interview data and reflective essays, two major themes emerged. The two major themes as to how the use of an ERDS guided video self-analysis instructional component informed preservice technology integration planning are: (1) participants were able to improve their technology integration planning by recognizing their TPACK strengths and limitations, and (2) participants were able to improve their technology integration planning process by self-assessing and reflecting on their TPACK strengths and limitations. The section below provides descriptions and examples of each theme.

Theme 1: participants were able to improve their technology integration planning by recognizing their TPACK strengths and limitations. When participants were asked how the use of video self-analysis informed their technology integration planning process, 100% of the participants (n=21/21) said it helped them by facilitating their ability to *see* their TPACK strengths and limitations in their lesson (*ERDS phase 1 – identify triggers; ERDS phase 3 – interpret evidence*). For example, the interviewed participants shared how they were able to improve their second technology-enhanced lesson by analyzing their teaching video (*ERDS phase 3 – interpret evidence*) and then strategically planning their second lesson around their observed TPACK strengths and limitations (*ERDS phase 4 – develop a course of action*). The following excerpt is an example of how participants in this study were able to recognize their TPACK *strengths* through their video self-analysis and used that information to influence their future technology integration planning process.

> *After my video self-analysis, I noticed that I actually did a good job explaining my lesson* [lesson was on the three branches of the US government] *to my students. Before I watched my lesson, I felt like I might have said some things that were wrong; but after watching my video, I noticed I actually did a nice job demonstrating my content knowledge* (CK) *in this subject. An example of where I thought I made a mistake was when I was explaining why each US State has a different number of voting representatives in Congress. However, after watching myself teach, I noticed I actually got it right, and that I did a really good*

> *job explaining the differences in US congressional votes and the differences between the three branches of the US government using the website I found online* (TPK) [this participant used an online and interactive map of the US, where students were able to hover their mouse over each state to learn about the number of congressional representatives from each state].

This participant described how she was able to inform her future technology integration planning process, by *noticing* specific TPACK strengths in her lesson. For example, she cited that she felt like she "messed up" explaining the three branches of government during her lesson (CK). However, after watching her videotaped lesson, she noticed that she actually got it right (*ERDS phase 3 – interpret evidence)*. This participant and other participants in this study expressed their video self-analysis was beneficial to their technology planning process because it allowed them to parse out specific instances in their videotaped teaching samples where they observed themselves effectively teaching with technology. This was a noteworthy discovery because prior research suggests that having pre-service teachers observe and experience positive instances of them effectively teaching with technology is critical for their future technology lesson planning and actual adoption of technology (Lehtinen, Nieminen, & Viiri, 2016). Furthermore, research conducted by Chen (2010) also suggests that preservice teachers' beliefs have a significant influence on their choice to integrate technology in their teaching.

Based on her findings from her ERDS guided video self-analysis, this particular participant noted that she believed she *"did a really good job explaining the differences in US congressional votes and the differences between the three branches of the US government using* *the website I found online*". This participant expressed she had strong convictions towards her lessons TPK because she was able to see first-hand how effective her online interactive US congressional map was to help her students learn about the different branches of the US government and the variance between US congressional representatives by state. As a result, the evidence suggests that the use of an ERDS guided video self-analysis instructional component helped inform pre-service teachers' technology integration planning process by helping them see the positive results of effectively integrating technology into their teaching.

In addition to helping participants recognize their TPACK strengths, 100% of the research participants (n=21/21) also expressed that their ERDS guided video self-analysis helped inform their technology planning process by helping them recognize their TPACK *limitations*. When the participants were further probed as to how their ERDS guided video self-analysis helped them recognize their TPACK limitations, they cited that watching themselves teach with technology allowed them to pinpoint specific areas within their teaching sample that they needed to address in their future technology-enhanced lessons (*ERDS phase 3 – interpret evidence*). The following excerpt is an example of how a participant in this study was able to improve their technology integration planning process, by recognizing their TPACK limitations, through their ERDS guided video self-analysis (*ERDS phase 4 – develop a course of action*).

> *When I watched my videotaped lesson for the first time, I didn't realize how much confusion there was with the technology I picked for my lesson. I saw students were whispering to each other, and saying things like… I don't know what's going on, and how are we supposed to do this? Also by the looks on their faces, I could see*

> *that they were totally confused. So that's when I realized that the technology that I chose for this lesson just wasn't helpful, it didn't even align with my lesson's standard at all* [TCK]. *After watching myself a couple of times, I made edits to my second technology lesson… I made sure to switch up the technology I picked, so that it would be easy for the students, while also enhancing my lesson* [e.g., Math-teaching multiples of ten].

After conducting her ERDS guided video self-analysis, this participant expressed that she was surprised by how much confusion there was during her lesson (*ERDS phase 3 – interpret evidence*). For example, she initially reported that she thought her lesson "was ok" because she was able to check off all the action items she had planned for her lesson. However, after analyzing her videotaped teaching sample, she quickly realized that she was too focused on delivering the instruction, and was totally unaware of her students' confusion when she was explaining and directing them on how to use technology she selected (TPK). For example, the confusion in her lesson was further clarified when she said, "w*hen I watched my videotaped lesson for the first time, I didn't realize how much confusion there was with the technology I picked for my lesson... I realized that the technology that I chose for this lesson just wasn't helpful, it didn't even align with my lesson's standard at all*". This participant described this instance in her teaching sample as her "autopilot moment", where she expressed she was so focused on infusing technology into her lesson, that she lacked the classroom awareness to recognize her students' confusion.

However, through her ERDS guided video self-analysis, this participant used the guiding TPACK observation instrument to help her detect that her lesson was lacking in the following TPACK observation rubric criterion: *Instructional Strategies & Technologies*. Of the four possible ratings given in this criterion, this participant rated herself at the lowest level (i.e., level one). For example, the lowest rating in the Instructional Strategies & Technologies criterion is described as when teachers use instructional technologies, and it does not align or support their instructional goals (Hofer et al., 2011). At the opposite end of the spectrum, the highest possible rating on the TPACK observation rubric (i.e., level four) is described as when technology is used in the lesson to optimally support the teachers' instructional strategies (Hofer et al., 2011). Based on the findings from her video self-analysis, this participant realized that she had to improve her TPK because she did appropriately leverage technology to support her lesson. Through this self-reflective and self-analysis process, the participants in this study demonstrated that they actually applied their lessons learned from their ERDS guided video self-analysis to inform their subsequent technology-enhanced lesson plan.

The findings from the interviewed participants also aligned with the findings from the participants' reflective essays. For example, the participants in this study shared how analyzing their videotaped teaching samples was extremely beneficial in informing their technology integration planning process (*ERDS phase 4 – develop a course of action*). The following excerpt from a participant's reflective essay is illustrative of why participants in this study believed their ERDS guided video self-analysis was beneficial in informing their technology integration planning process.

> *After watching my video, I was surprised by how confusing my directions were in my lesson. I told my students to log onto Storybird* [Online storybook creation tool] *and create a short story using this program. But because I didn't provide them with any rules like how long it had to be, I noticed a lot of my students just looking at each other and whispering what they should do. In the moment of teaching, I didn't pick up on how confusing my directions were. I also noticed that some students were inserting YouTube videos into their online storybook to make it more exciting and interesting. I didn't even know you could even do that, and it turned out to be a big hit with everyone. The next time I teach this lesson, I'll definitely make sure to incorporate the YouTube videos as a prerequisite into this lesson because I think it helped improve my lesson.*

This particular participant noticed limitations within her TPACK (*ERDS phase 3 – interpret evidence*). For example, she acknowledged her TPK limitations when she observed how her lesson was confusing to her students. For example, she expressed, "*after watching my video, I was surprised by how confusing my directions were in my lesson. I told my students to log onto Storybird and create a short story using this program. But because I didn't provide them with any rules like how long it had to be, I noticed a lot of my students just looking at each other and whispering what they should do".* A deeper examination of this statement suggests that this participant would not have known her technology-enhanced lesson was confusing if it was not for her ERDS guided video self-analysis. For example, this participant conveyed she was surprised by how confusing her directions were in her lesson because she observed and heard her students whispering that they didn’t know what to do. This suggests that without providing this participant a medium to analyze her videotaped lesson that she would have continued to prepare her lesson the exact same way. However, through her video self-analysis, she was able to design and develop an enhanced technology-enhanced lesson plan that addresses her lesson limitations. As a result, in her subsequent technology-enhanced lesson plan, she did, in fact, make modifications to her lesson. For example, this participant outlined a systematic step by step process, based on the findings from her video self-analysis, in how she could improve her technology integration in her future lesson.

In addition to informing her future technology integration planning process (e.g., modeling how to use the instructional technology in front of her students), this participant was also able to enhance to TK when she noticed that she could also incorporate YouTube videos into her students' digital story books. For example, she noticed her TK limitations when she described that she had no idea that it was even possible to add YouTube clips into the online Storybird program. However, based on her self-analysis, she expressed that she plans on incorporating her new technological knowledge (TK) she learned in the course, and use it to enhance her future instruction (*ERDS phase 4 – develop a course of action*). These findings support the findings from prior research that the use of a video analysis is an effective instructional approach that can help teachers inform their future teaching practices (Tripp & Rich, 2012a; Tripp & Rich, 2012b; Alsawaie & Alghazo, 2010; Star & Strickland, 2008) by helping them recognize their teaching strengths and limitations (Barnhart & van Es, 2015; Seidel & Shavelson, 2007; Daniel, 2006).

Theme 2: participants were able to improve their technology integration planning process by self-assessing and reflecting on their TPACK strengths and limitations. In this study, the participants described how the use of guiding frameworks, such as the TPACK observation rubric, helped them self-assess their TPACK strengths and limitations during their video self-analysis. The following table (Table 12) provides excerpts that illustrate how participants in this study used the ERDS guided video self-analysis, to inform their technology integration planning processes by self-assessing their TPACK strengths and limitations.

Table 12

Examples of participants TPACK strengths and limitations

Strengths	**Limitations**
"I thought I explained the directions clearly to the students which allowed the lesson to flow from activity to activity" [PK]	*"I could have had the students turn and talk to a partner when discussing some of the questions and ideas I mentioned during the lesson"* [PK]
"I liked how engaged the students were with the technology and how they listened to the directions well" [TPK]	*"I should have walked around the room in order to make sure students were on task and had the correct programs open on their computer"* [TPK]
"I explained the concept of rural, urban, and suburban well, and used the appropriate instructional strategies to deliver my message" [PCK]	*"I could have used a better teaching strategy to teach my lesson* [food cycle] *because when I watched myself on tape it didn't work as well as I thought it could"* [PCK]

Strengths	Limitations
"I thought the technology I selected for the lesson was appropriate for the content of the lesson" [TCK]	*"After watching my video I noticed that the technology I chose* [SMART Board] *didn't really help me at all because I could have done that same thing on a regular whiteboard using colored markers"* [TCK]

Participants in this study described how using guiding frameworks, such as the TPACK observation rubric, helped guide their self-assessments during their ERDS guided video self-analysis. For example, one participant cited her TCK limitations when she observed that her first technology-enhanced lesson was not effective because she arbitrarily integrated an instructional technology into her lesson plan. This participant stated, "*after watching my video I noticed that the technology I chose* [SMART Board] *didn't really help me at all because I could have done that same thing on a regular whiteboard using colored markers".* Through her ERDS guided video self-analysis this participant was able to recognize her lessons TCK limitation due to the fact she was just using technology to digitize information instead of integrating the technology to help enhance the content of her lesson. Through this self-reflective process, this participant and participants in this study were able to use their findings to inform their future technology integration planning process.

It is important to reemphasize the importance of providing pre-service teachers with guiding frameworks to help them self-assess their teaching and TPACK. For example, after analyzing their videotaped teaching samples with the TPACK observation rubric, participants in this study demonstrated the ability to assess their lessons TPACK strengths and limitations.

Based on their self-analysis findings, the participants in this study went on to make adjustments to their subsequent technology-enhanced lesson plans. The following excerpt below provides insight into participants' thought process of how they used the TPACK observation rubric, during their ERDS guided video self-analysis, to inform their subsequent technology integration planning process.

> *One of the categories in the rubric was something like how well you used the technology to enhance your instruction… and had a score range of like one through four and it provided these descriptions of what each number meant (e.g. a score of 4 is very good, a score of 1 is a poor use of technology). While I was watching myself teach I just used the rubric to score myself, and based on the score I gave myself, I tried to work on the areas where I gave myself anything less than a three… the rubric was helpful in helping me find my weaknesses and improve my technology integration skills because it provided me with benchmarks of what I needed to do in order to better teach with technology.*

This particular participant expressed that her ERDS guided video self-analysis was helpful in informing her technology integration planning process because it provided a mechanism for her to rate her lesson TPACK skills. This was a common response from the participants in this study. For example, when participants were asked whether they believed they could have critiqued their TPACK strengths and limitations without the guidance of a TPACK observation rubric, 100% of the participants (n=21/21) responded no. When further probed, the participants expressed that without the assistance of a guiding framework, such as the TPACK observation rubric, they would not know where to even begin with regards to critiquing and analyzing their lessons' TPACK strengths and limitations. This finding aligns with the findings from previous scholarship that novice and experienced teachers both need some form of guidance when self-analyzing their own teaching (Santagata & Angelici, 2010; Welsch & Devlin, 2007; Wineburg, 2006; Reiman, 1999).

Summary. This chapter presented the findings from the second research question: *how does the use of video self-analysis, guided by the ERDS model, inform pre-service teachers' technology integration planning?* The findings from this study suggest that the use of the ERDS guided video self-analysis instructional component can be beneficial in informing pre-service teachers' technology integration planning process. As a result, every participant in this study (n=21/21) reported that the findings from their video self-analysis helped inform their technology integration planning process. The strong consensus from the participants was mainly driven by two major factors. First, the participants reported they were able to improve their technology integration planning process because they were able to see first-hand which parts of their lesson went well and didn't go well. Based on the information gleaned from their ERDS based video self-analysis, the participants reported that they were able to use this information to brainstorm alternative instructional strategies that could further improve their lesson. Second, participants reported that they were able to greatly improve their ability to teach with technology by watching and self-analyzing their videotaped teaching samples and learning from their mistakes. For example, the participants expressed that they were able to focus on specific instances within their lessons, such as technology misalignment, being unprepared to teach with technology or lack of technological knowledge. By clearly identifying the areas they needed to improve upon, the participants were able to develop specific action plans to address each instructional limitation (*ERDS phase 4 – develop a course of action*). The participants in this study also cited that their ERDS guided video self-analysis was beneficial in helping them inform their technology integration planning process by helping them *recognize* their lessons TPACK strengths and limitations. Furthermore, the participants said their ERDS guided video self-analysis was beneficial in helping them inform their technology integration planning process because it provided them with evidence (i.e., videotaped teaching samples) and a framework (i.e., TPACK observation rubric) to *self-assess* their lessons TPACK strengths and limitations. The findings from this study align to social cognitive theories prediction that learners would be able to self-regulate their own development if they are given the opportunity to practice and critique their own actions (Bandura, 1988). In the next chapter, the findings from the third and final research question will be presented.

Chapter 6: RQ_3 Results - Do pre-service teachers change their instructional behaviors after their ERDS guided video self-analyses?

This research examined the following three research questions: (1) how do pre-service teachers perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses?; (2) how does the use of video self-analysis, guided by the ERDS model, inform pre-service teachers' technology integration planning?; and (3) do pre-service teachers change their instructional behaviors after their ERDS guided video self-analyses? In the previous chapter, the results from the second research question were presented. As such, results from the third and final research question are presented in this chapter. Snapshots and summaries from relevant data sources were used to provide context and describe how the use of an ERDS guided video self-analysis instructional component influenced pre-service teachers' instructional behaviors while teaching with technology.

To better understand whether participants actually changed their instructional behaviors while teaching with technology, bases on their ERDS guided video self-analysis findings, participants' reflective essays, and their lesson improvement action plans were compared to their second videotaped teaching sample. It is important to note that the videotaped teaching data were specifically used to check whether the participants implemented their proposed changes. During this comparative analysis, the researcher recorded what the participants actually said they were going to do in their reflective essays and lesson plans; and then compared that to what actually occurred during the participants' lessons by analyzing the observable changes in the participants' instructional behaviors via the videotaped lessons. For example, if a participant stated that they planned to enhance their future technology-enhanced lessons through instructional modeling

(PK), by explicitly showing students how to use the technology (TPK); the researcher then used the videotaped teaching sample data to check to see if the proposed instructional changes occurred in the participants lesson (Figure 7).

	Participant ID: 1	Participant ID: 2	Participant ID: 3	Participant ID: 4
TPACK Focus Area	TPK	TCK	PK	TK
Observable Changes in Instructional Behavior	**Strategy**	**Strategy**	**Strategy**	**Strategy**
	Incorporate the online Venn diagram program to help students compare and contrast urban, rural, and suburban	Incorporate Google Earth application into lesson to enhance my geography lesson	Incorporate the think, pair, and share instructional strategy	Review and practice using the online plant simulation game before teaching my lesson
Yes	x	x	x	
No				x
Research Notes	Used the Kidspiration online tool for students to create Venn diagrams to compare and contrast.	Google Earth was used to enhance her lessons content.	The think, pair, and share instructional strategy was used in her lesson.	Observably flustered and unprepared to teach with online plant simulation. Observation later verified via interview.

Figure 7

Checking for changes in instructional behavior

As underlined in the figure above, the researcher systematically outlined which TPACK domain each participant was trying to enhance (e.g., TK, PK, CK, TPK, TCK, PCK); and then recorded the participants' specific instructional strategy they planned to employ in order to improve the specific TPACK domain. For instance, one participant indicated that she would be adopting the *think, pair, and share* instructional strategy in order to help enhance her future lesson. Armed with this information, the researcher then reviewed this specific participant's videotaped teaching sample and recorded whether the proposed instructional changes were observed. To quantify this analysis, the researcher used a binary yes or no method to indicate if the proposed instructional changes were actually implemented and observed in the participants' videotaped lessons. To better understand which pre-service teacher participant changed their instructional behaviors, after conducting their ERDS guided video self-analysis; the figure below (Figure 8) summarizes the findings via the participants' targeted TPACK domain focus area and outlines whether or not they actually implemented their proposed instructional changes in their lesson.

	TPACK Domains						
Participants	**TK**	**PK**	**CK**	**TPK**	**TCK**	**PCK**	**Did the participant implement proposed instructional changes?**
1	x			x			Yes
2					x		Yes
3	x			x			No
4					x		Yes
5		x		x			Yes
6			x		x		Yes
7				x		x	Yes
8				x			Yes
9		x		x			Yes
10				x		x	Yes
11				x			Yes
12	x				x		No
13			x	x			Yes
14				x	x		Yes
15	x			x			Yes
16			x		x		Yes
17					x	x	Yes
18	x			x			Yes
19		x			x		No
20			x	x			Yes
21				x	x		Yes
Total	**5 (23.8%)**	**3 (14.3%)**	**4 (19%)**	**14 (66.7%)**	**9 (42.9%)**	**3 (14.3%)**	**18 (85.7%)**

Figure 8

Targeted TPACK focus area and changes in behavior

The findings from this study indicated that 85.7% of the participants in this study (n=18/21) changed their actual instructional behaviors. The participants who changed their instructional behaviors expressed that the findings from their ERDS guided video self-analysis were instrumental in helping them change their actual teaching behaviors. For example, the participants expressed that analyzing their videotaped teaching samples using the ERDS model motivated them to change their instructional behaviors because it helped them increase their awareness of their TPACK limitations and their teaching deficiencies. Specifically, they shared that using the TPACK observation instrument during their ERDS guided video self-analysis really helped them level set where they were as a technology integrator, and helped them zero in on which TPACK area they needed to improve upon in order to improve their ability to effectively teach with technology. Furthermore, the participants cited that by watching themselves teach with technology also helped them accept the realities and challenges of effectively planning and teaching with technology.

The 14.3% of the participants (n=3/21) who did not follow their self-prescribed lesson improvement action plan, which in turn meant that they did not change their instructional behaviors cited the following factor as to why they did not adopt or change their instructional behaviors: *they did not adequately prepare for the lesson*. When further probed as to why they were not prepared to teach the lesson, one participant admitted that it was primarily due to being "lazy" (33%), and the remaining two participants (67%) cited they just forgot they were supposed to teach their technology-enhanced lesson that day. Interestingly, the three pre-service teacher participants who did not change their behaviors still cited that they believe teaching with technology could help enhance their students' learn outcomes. The findings from this study align with prior research that investigated the disconnect between what teachers said what they do versus what actually happens (e.g., Bell, 2016; Dicke, Elling, Schmeck, & Leutner, 2015; Banilower, Heck, & Weiss, 2007). This finding was important in this study because it underlines the divide between what teachers say is either important or what they're going to do; versus the realities of what they actually do.

What TPACK domains did the participants focus on? As expressed in Figure 7, participants in this study focused on all six domains that make up the TPACK framework. However, through their ERDS guided video self-analysis, participants were given the freedom to identify the specific TPACK domains they needed to further enhance in order to improve their ability to teach with technology. To help guide each participant in this process, and to ensure that the participant prioritized the most pressing areas of need, the researcher directed each participant to select two TPACK domains that they believed needed to be improved upon in order to improve their ability to effectively teach with technology.

The following figure below (Figure 9) outlines which TPACK domain areas the participants in this study cited they needed to immediately address in order to improve their ability to teach with technology. Based on their ERDS guided video self-analysis findings, two-thirds of the participants cited that they needed to focus and work on improving their TPK (*ERDS phase 3 – interpret evidence*). This suggests that participants recognized their limitations in understanding how technology (TK) and pedagogy (PK) influence each other during their self-analyses. When the 66.7% of participants (n=14/21) were asked why they zeroed in on improving their TPK, the overwhelming theme of their response was that they *observed* that their regular teaching strategies (PK) in combination with instructional technologies (TK) did not necessarily translate into enhanced content or instruction. Through their own analysis and guided observations (e.g., TPACK observation rubric), the participants expressed that they were regularly just digitizing information instead of meaningfully integrating the technology into their teaching to either enhance their content or instruction.

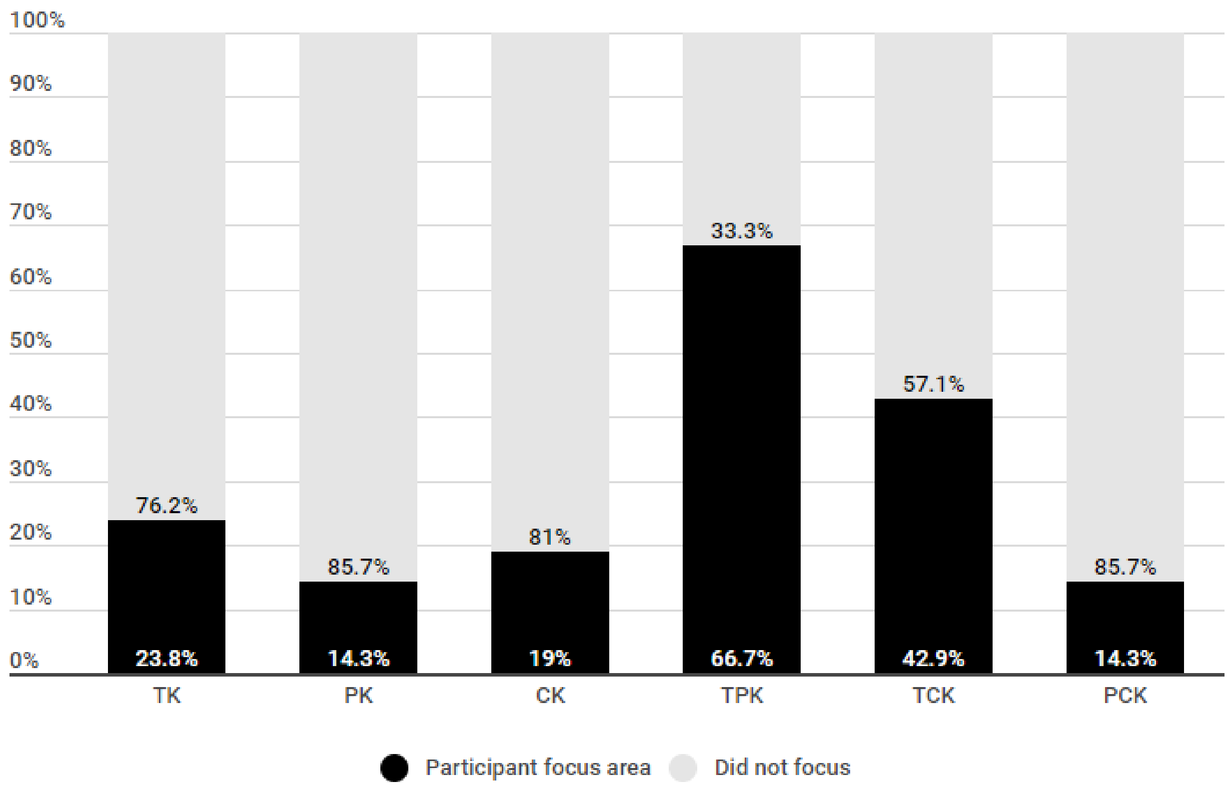

Figure 9

Participants TPACK focus areas

During the interviews, the participants shared that they recognized the challenges and difficulties of planning and teaching with technology, but also saw the benefits of teaching with technology. With that said, the top three TPACK domains selected by the participants all revolved around some form of technology. For example, 66.7% of the participants (n=14/21) identified they needed to further work on enhancing their TPK, while 42.9% (n=9/21) and 23.8%

(n=5/21) of the participants also indicated that they needed to work on their TCK and TK. A deeper examination of the data sources suggests that the participants predominately focused on the TPACK domains that contained technology because it was still relatively a new concept to them.

To further elaborate on this concept, participants who were interviewed expressed that the findings from their ERDS guided video self-analysis really "*opened their eyes*" to the challenges and realities of teaching with technology. For example, they noticed on videotaped teaching samples that they sometimes didn't actually know how to use certain technologies they selected for their lesson (TK). For instance, a participant in this study selected to use the Google Earth application as a component of her geography lesson. Her lesson objective was to have her students use the application to measure the distance between two different cities located in different parts of the world. However, when this participant tried to model how to complete this task on the Google Earth application, she became noticeably flustered and frustrated because she did not know how to navigate the measurement application. As a result, she had to scrap her original lesson plan, and asked the students to do their best, and try to figure this out on their own. For the 42.9% of the participants who chose to target and enhance their TCK, and the 23.8% who expressed they needed to focus on their TK, the evidence suggests that participants highlighted these TPACK domains because they observed similar limitations during their ERDS guided video self-analysis. As a result of confronting their perceived TPACK, 85.7% of the participants in this study actually changed their instructional behaviors, based on the findings from their ERDS guided video self-analysis.

How participants' changed their instructional behaviors. Based on the findings from their ERDS guided video self-analysis, participants developed lesson improvement action plans to enhance their teaching and TPACK (*ERDS phase 4 – develop a course of action*). For example, participants in this study noticed specific instances within their teaching samples where they needed to improve certain TPACK elements (e.g., TK, PK, CK, TPK, PCK, or TCK). Based on the evidence they gleaned from their self-analyses, they revised their original lesson plan to reflect the changes they outlined in their lesson improvement action plan. Specifically, each action plan included and described the specific steps each participant would undertake to improve their next technology-enhanced lesson. Example of some actions steps taken by the participants include but are not limited to:

- *Selecting an instructional technology that aligns and enhances their lesson*
- *Practicing teaching with the technology prior to teaching the lesson*
- *Checking ahead of time to make sure the technology works on the classroom's computers*
- *Physically modeling in front of the students on how to use and operate the technology*

During their ERDS guided video self-analysis, the participants reported that they frequently observed a lack of instructional modeling during their lessons (*ERDS phase 3 – interpret evidence*). For example, of the 21 total research participants, two thirds (67%, n=14/21) reported that they needed to do a better job modeling technology use in front of their students during their lessons (TPK). When the researcher later reviewed and analyzed the video data, he was able to confirm that 62% of the participants, in fact, were not physically modeling technology use to their students. The finding suggests that pre-service teachers when provided with video evidence and a guiding observation framework, are able to candidly assess their own TPACK strengths and limitations.

The participants in this study expressed they needed to do a better job modeling technology use in front of their students because they were able to see (i.e., watching themselves teach) first-hand how using only verbal instructions led to confusion and ineffectiveness in regards to delivering their classroom lessons. The participants in this study also indicated that they were able to use their previous videotaped teaching samples to learn from them by analyzing their lesson strengths and limitations via the TPACK framework. Participants also revealed that having a database (i.e., course Blackboard) containing videos of their teaching samples allowed them to actively review and critique how their ability to effectively teach with technology. The participants in this study also shared that the authentic visual evidence provided by the videotaped teaching samples helped them really focus on thinking of ways to improve their lesson (e.g., have students use more technology, providing students with examples, modeling tasks) by helping them confront their actual teaching skills and abilities. As a result, the participants in this study expressed that they now liked being videotaped because it "truly helps them become a better teacher" and they are excited to watch their subsequent teaching videos to see how effective they were in implementing the lesson and instructional changes they outlined in their lesson improvement action plans. For example, one participant said, "*video editing process allowed me to watch and re-watch myself with a purpose … I was able to put myself in the shoes of my student and that allows me to see what could have bettered my lesson from that standpoint."* This participant, in particular, expressed how her video editing and ERDS guided video self-analysis process helped her change her future instructional behaviors because it helped and enabled her to see her teaching from her students' perspective, which allowed her to make the appropriate adjustments to help enhanced her future instruction.

Other participants expressed they decided to change their instructional behaviors because of their innate desire to improve their own teaching efficacy. For instance, another research participant expressed how her ERDS guided video self-analysis spurred her to change her instructional behaviors by giving the following statement:

> *I definitely improved with integrating technology into my second lesson. Last time I had a lot of lecture-based instruction, and never had a visual for the students to look at. I learned from having a story to read on the smart board that it allows the class to look back in the pages and come up with more concrete ideas and words that are adjectives. I also felt as though last time I did not do the best job defining what an adjective was, and this time I used the PowerPoint to do that. This way, students not only said the definition but then we reviewed it when they saw it on the PowerPoint again.*

This sample excerpt describes how this participant originally integrated a lot of verbal lectures in her prior lessons. However, after self-analyzing her videotaped teaching sample, she was able to pinpoint specific instances where she could further enhance her future lessons. As a result of this self-analysis and self-reflective process, this participants' statement provides insight into how the participants in this study began to critically think of new instructional approaches to improve their teaching skills and TPACK.

Challenging participants preconceived perceptions of teaching with technology and their TPACK. Over half of the participants in this study (52%, n=11/21) stated that they were completely *unaware* or did not *notice* their students' confusion during their first lesson (*ERDS phase 3 – interpret evidence*). When this phenomenon was further explored, the participants cited their lack of awareness stemmed from their desire to "just get through the lesson" and to just somehow "integrate technology" into their instruction. These participants also expressed they were often unaware of what was going on during their technology-enhanced lesson because they were on "auto-pilot" and just wanted to finish the lesson without "messing up" or making mistakes. As a result, the participants in this study shared that they really wanted to *believe* that they had the necessary knowledge and skills to effectively teach with technology because they understood the importance of teaching with technology in today's technology-driven society. However, after conducting their ERDS guided video self-analysis, they found that their perceived confidence towards their TPACK was not as strong as they originally perceived. The findings from this study support the findings from previous scholars that novice teachers often have difficulties noticing and interpreting events during their lesson (Barnhart & van Es, 2015), due to their inexperience and instructional anxieties (Santagata & Angelici, 2010; Rich & Hannafin, 2009; Star & Strickland, 2008; van Es & Sherin, 2002).

A key takeaway during the researcher's analysis of the videotaped teaching data was that he noticed some participants were visibly upset and angry at the technology itself (e.g., smartboard, computer, tablets). For example, some participants' observably muttered words of displeasure (e.g., stupid computer, I hate technology, this thing sucks - referring to smartboard) when the instructional technology they chose was not working properly. When the participants were further probed to expand on their feelings, the participants often shared specific reasons why they sometimes do not want to teach with technology, due to the fact they are afraid the technology they select would "crap out" on them. For example, the excerpts below are representative of the statements shared by the participants:

> *Well, to be honest, I feel like using technology is a challenge… because one, I feel like if there's like if technology fails … if your computer or projector or whatever… Ipad… if that fails I don't know what I would do… in that kind of situation. For me, my personal teaching style, watching a video isn't enough.*

> *…Yeah, so I tried to use powerpoint not too long ago and um, it just wouldn't work and I felt frustrated and I didn't have any back up for the slides so at that moment, I just didn't feel like I was um, being a teacher.. you know, it felt like I wasn't teaching anything because I was too caught up being very frustrated…with technology*

As expressed in the excerpts above, the blaming and fearing technology played a major in why the pre-service teacher participants in this study shared why they previously did not choose to integrate technology into their previous instruction. From the researcher's own personal teaching experience, being a novice teacher is incredibly stressful, especially during the first two years where we're just trying to have their heads above water. As a result, the researcher could relate to what his participants were saying when they said, "*this is really cool and I think this* [i.e., integrating technology] *will really help engage and enhance my students in learning…. But I'm just worried something will go wrong and the technology won't work".* However, by providing the participants with videotaped evidence of their actual teaching and technology integration abilities (*ERDS phase 2 – marshall evidence*), participants in this study went on to express they were empowered to confront their teaching weaknesses (*ERDS phase 3 – interpret evidence*), which helped them change their instructional behaviors by creating the action plan to improve their TPACK limitations (*ERDS phase 4 – develop course of action*). Furthermore, the findings from this study suggest the pre-service teacher participants were more inclined to critically think about designing and developing meaningful instructional improvements, due to the fact that it directly impacted their instructional outcomes.

Previous research investigating this topic also supports the idea that empowering pre-service teachers to be actively involved in their own teacher development can increase their self-confidence and motivate them to do better (Wilson, 2004). Furthermore, this study also discovered the participants' ERDS guided video self-analysis was beneficial in engendering robust analysis and meaningful reflections on their technology integration. Based on their self-analyses, the participants were able to self-assess their TPACK strengths and limitations with the guidance of a TPACK observation rubric. The findings from this study support prior research findings that the use of a video self-analysis instructional component and the use of guiding frameworks, such as rubrics, can help educators improve the quality of their lesson and instruction (Sparks-Langer, Simmons, Pasch, Colton, & Starko, 1990; Amobi, 2005; Jang & Lei, 2015).

Summary. The findings from this research suggest that the use of the ERDS guided video self-analysis, helped pre-service teachers improve their actual ability to teach with technology by providing them with a medium where they can watch, analyze, and critique their own teaching and technology integration skills. As a result, 85.7% of the participants (n=18/21) changed their instructional behaviors to align with their self-prescribed lesson improvement action plans. When participants were asked why they changed their instructional behaviors, they credited the findings from their video self-analysis as the catalyst that motivated them to improve their technology integration skills.

The findings from this study suggest an ERDS guided video self-analysis instructional component was beneficial in helping pre-service teachers change their actual instructional behaviors by challenging their preconceived biases and subjectivities about their technology integration skills. Through this self-confrontation process, the participants in this study were able to accept the realities of their technology integration limitations and work towards improving their technology integration skills. Furthermore, the participants in this study expressed that they decided to actually change their instructional behaviors due to the findings from their ERDS guided video self-analysis. For instance, the pre-service teacher participants' cited their video self-analysis were beneficial in helping them change their actual instructional behaviors because it prompted them to confront the realities of their actual teaching skills and TPACK. These findings align to Bandura's (1988) social cognitive theory in that participants in this study were able to improve their TPACK by self-regulating their own teacher development.

The preceding chapters introduced this study by first describing the problem of teachers being unprepared to effectively teach with instructional technologies. Second, a review of recent and relevant literature was presented. Chapter 3, this study then explained the methodological approached employed to investigate the outlined research problems. As a result, the subsequent three chapters presented the findings and results for each individual research question explored in this study. In the final chapter, the study’s key findings are summarized, the implications and recommendations are shared, and the researcher’s closing thoughts are presented.

Chapter 7: Conclusion

Over the past two decades, scholars, researchers, and practitioners have shown considerable interest in designing and developing instructional strategies that can help teachers improve their ability to teach with technology. A teachers' ability to effectively teach with educational technologies is becoming more vital because studies have shown teaching with technology can help enhance students learning outcomes, academic achievement, and academic engagement (U.S. Department of Education, 2017). Due to the importance of preparing teachers to effectively teach with technology, the U.S. Department of Education suggests teacher preparation programs "should focus explicitly on ensuring all educators are capable of selecting, evaluating, and using appropriate technologies and resources to create experiences that advance student engagement and learning" (U.S. Department of Education, 2017, p. 28).

However, even as the focus towards preparing current and future teachers to effectively teach with technology have increased; educational technology researchers suggest there is still a critical need to continue exploring alternative instructional strategies that can further develop both novice and experienced teachers' technology integration skills (U.S. Department of Education, 2017; Bennett, Agostinho, & Lockyer, 2015; Shin, 2015; Sprague & Katradis, 2015). As a result, this research investigated a promising instructional approach that was designed to help pre-service teacher educators improve their TPACK and technology integration skills through the use of an ERDS guided video self-analysis instructional component.

Study Overview. To examine the impact of an ERDS guided video self-analysis instructional component on pre-service teachers TPACK, the undergraduate technology integration courses used in this study were designed and developed using the guiding principles of the ERDS framework. While the design of this research was informed by the following three frameworks: Recesso et al., (2009) evidential reasoning and decision support framework (ERDS), Koehler and Mishra (2009) technological pedagogical content knowledge framework (TPACK), and Gibbs (1988) reflective cycle framework; the underlying theory used to contextualize this study was based on Bandura's (1986) social cognitive learning theory. This learning theory was used to contextualize this research because it theorizes that personal growth can occur through three distinct stages *(1) self-development, (2) adaption, and (3) change* (Bandura, 2001). As a result, this study examined how the use of a video self-analysis instructional component, guided by the ERDS model, influenced pre-service teacher technological, pedagogical, and content knowledge (TPACK). Specifically, this study investigated how this instructional approach influenced pre-service teachers' perceptions of their technology integration skills, their technology integration planning, and their actual instructional behaviors while teaching with technology. To better understand how the use of an ERDS guided video self-analysis instructional component influences pre-service teachers TPACK and technology integration skills, this research investigated the following three research questions:

(1) How do pre-service teachers perceive their technological, pedagogical, and content knowledge (TPACK) before and after their ERDS guided video self-analyses?

(2) How does the use of video self-analysis, guided by the ERDS model, inform pre-service teachers' technology integration planning?

(3) Do pre-service teachers change their instructional behaviors after their ERDS guided video self-analyses?

These three research questions were investigated through the explanatory sequential mixed methods design. As a result, quantitative data from this study was first collected, followed by the collection of qualitative data. This two-step process was important because it helped the researcher explain and elaborate on his results (Creswell, 2014). In addition, the participants in this study completed a pre- and post- TPACK survey and their responses were analyzed during the first step (quantitative phase). The findings from the quantitative data then helped inform step two of this study (qualitative phase); where the participants were individually interviewed and probed using a semi-structured interview protocol that was informed by the findings from the survey results. The key findings from this study are summarized in the sections below.

Key Findings

Change in pre-service teacher participants' instructional behaviors. The most significant finding from this research was that the pre-service teacher participants in this study changed their actual instructional behaviors based on the findings from their ERDS guided video self-analysis. For example, 85.7% of the participants in this study (n=18/21) changed their instructional behaviors to align with their self-prescribed lesson improvement action plans. When participants were asked why they changed their instructional behaviors, they credited the findings from their video self-analysis motivated them to change their teaching behaviors so that they could improve their ability to effectively teach with technology. This study found that the ERDS guided video self-analysis instructional component was instrumental in helping the pre-service teacher participants change their actual instructional behaviors because it challenged their preconceived biases and subjectivities about their technology integration skills. Through this self-confrontation process, the participants acknowledged they were more inclined to accept the realities of their actual technology integration skills and limitations. Furthermore, the participants in this study expressed that by engaging in the ERDS guided video self-analysis process, it actually increased their motivation to improve their TPACK and technology integration skills because they were able to track their progress and growth when they were watching and self-analyzing their individual videotaped teaching samples.

As theorized by Bandura's (1986) social cognitive learning theory, participants in this study were able to improve their ability to integrate and teach with technology because of their self-efficacy towards teaching with technology after conducting their ERDS guided video self-analysis. As expressed by Bandura, self-efficacy "is the foundation of human agency. Unless people believe that they can produce desired effects by their actions, they have little incentive to act or to persevere in the face of difficulties. Whatever other factors serve as motivators, they are rooted in the core belief that one has the power to produce changes by one's actions" (Bandura, 2001, p.28). The findings from this research suggest that the use of the ERDS guided video self-analysis instructional component may be helpful to teacher educators as they seek alternative instructional approaches to improve their students' TPACK and technology integration skills.

The pre-service teacher participants overestimated their TPACK. Based on the results from the TPACK survey, the evidence from this study indicates that the pre-service teacher participants in this study were overconfidence towards their TPACK prior to conducting their ERDS guided video self-analysis. For example, the participants' confidence levels towards their TPACK dropped in five of the six knowledge domains (e.g., PK, TPK, TK, PCK, and CK) after they conducted their ERDS guided video self-analysis. The participants shared that their initial overconfidence towards their TPACK was primarily due to the fact that they've been taking technology integration courses during their teacher preparation program. When further probed, the participants' said they originally expressed higher levels of confidence towards their TPACK because they felt their prior technology integration training (e.g., technology integration courses) prepared them to effectively teach with technology. However, after conducting their ERDS guided video self-analysis, this study found that the participants' confidence levels towards their TPACK dropped in five of the six knowledge domains (e.g., PK, TPK, TK, PCK, and CK).

To better understand why the participants cited lower confidence levels towards their TPACK after conducting their ERDS guided video self-analysis; results from the interview and analysis of the participants' reflective essays shed light on this phenomenon. For example, the participants expressed that by watching their videotaped teaching sample, along with the guidance of their TPACK observation rubric, helped them to better understand their TPACK strengths and limitations. Furthermore, participants in this study shared that the use of the TPACK observation rubric was a critical component that spurred them to re-assess their initial assessment of their TPACK. The pre-service teacher participants shared that the guiding observation rubric was beneficial in helping them change their perceptions towards their TPACK because it provided them with specific guidance and direction as to what they should be looking for during their video self-analysis. As a result, the participants in this study expressed that analyzing videotaped lessons of their teaching, in combination with a guiding observation rubric, prompted them to re-assess their initial TPACK self-assessment.

The ERDS guided video self-analysis instructional approach may be beneficial in helping pre-service teachers develop their TPACK. The participants in this study reported watching and analyzing their videotaped teaching samples was beneficial in helping them improve their ability to meaningfully integrate technology into their instruction. They cited their ERDS guided video self-analysis was invaluable in helping them develop their TPACK because it provided them with an opportunity to analyze and learn from videotaped samples of their own teaching. The findings from this study also corroborate the findings from previous studies that have shown that the use of video analysis is beneficial in helping educators improve their teaching; especially when they are encouraged to analyze and confront their own teaching episodes instead of others (Fadde et al., 2009; Sherin & van Es, 2005). By encouraging pre-service teachers to analyze and reflect on their own teaching samples, the findings from this research support prior research findings that teachers are more inclined to apply their lessons learned into future instruction (i.e., change instructional behaviors), if they practice analyzing and critiquing their own teaching episodes (Tripp & Rich, 2012).

Digital native pre-service teachers sometimes blame and fear technology. During the participants teaching samples, some of their attempts to integrate technology into their instruction did not go as smoothly as they would have liked. As a result, the researcher observed that the participants were sometimes visibly upset and angry at the technology itself (e.g., smartboard, computer, website application). Some of the words muttered by the participants when their selected technology was not working properly were: “stupid computer”, “I hate technology”, “this thing sucks” (referring to the interactive SMART Board). During the participants’ interviews, one of the interviewees explained that the reason why she’s reticent to teach with technology is that she is afraid the computer or technology would "crap out" on her. When asked to further elaborate, she said, *"Well, to be honest, I feel like using technology is a challenge… because one, I feel like if there's like if technology fails … if your computer or projector or whatever… Ipad… if that fails I don't know what I would do… in that kind of situation. For me, my personal teaching style, watching a video isn't enough."* When asked to provide a specific example, she responded by saying, "*yeah, so I tried to use PowerPoint not too long ago and um, it just wouldn't work and I felt frustrated and I didn't have any back up for the slides… so at that moment, I just didn't feel like I was um, being a teacher… you know, it felt like I wasn't teaching anything because I was too caught up being very frustrated…with technology."*

Fear sometimes plays a major in why teachers choose not to integrate technology into their instruction. From my own personal experience, being a teacher is incredibly stressful, especially during the first two years where I was just trying to have my head above water. I can relate to my research participants when they said, "*this is really cool and I think this* [i.e. integrating technology] *will really help engage and enhance my students in learning…. But I'm just worried something will go wrong and the technology won't work"*. While the participants in this study expressed the importance and benefits of teaching with technology, because of its value-added capabilities in helping their students enhance their learning outcomes; their fear of potential technological glitches suggests more technical training and opportunities to actively practice teaching with technology is needed to help pre-service teachers overcome their fears and anxieties of teaching with technology.

Initial nervousness of being videotaped, but the nervousness diminished over time. Based on the researchers' observational notes, it was quite clear that the pre-service teacher participants in this study were initially nervous being in front of the video camera. For example, an analysis of their physical demeanor (e.g., hunched shoulders, staring at the floor while talking, standing static, wringing their fingers, oscillating back and forth due to the weight being shifted from foot to foot) suggests the participants were nervous while teaching their first videotaped lesson. During the participants' interviews, the researchers' assessment was later confirmed. For instance, one participant expressed that she was nervous about being video recorded. She cited she felt it was almost like "big brother" watching her. This participant further elaborated by saying she was curious to watch her videotaped teaching sample to see how she did; but at the same time, she didn't want to watch herself teaching because she was scared to see how bad she may have been.

When the other interviewees were probed with the same question, many of her classmates felt the same way. They all cited they liked the idea of being videotaped because they understood it can help them improve their future teaching, but they were all also anxious and sometimes nervous to watch themselves teach on tape. During the in-class peer reviews, where students watched and analyzed their peers videotaped teaching samples; the researcher observed some of the participants who were being analyzed looking down at the ground during the duration of their video - not wanting to see themselves teaching on the projection screen. Only after their videotaped teaching sample ended, did the participants raise their head, usually followed by a big sigh of relief and less tense facial expressions. However, during the participants' second iteration of being video recorded; there was a significant observable increase in confidence from the preservice teacher participants. For instance, the participants' shoulders were rolled back and they walked around the classroom with their heads held up high, while also exhibiting more command and authority over their lessons. When the participants were asked why they seemed more relaxed and confident during their second videotaped teaching sample, they expressed the increase in confidence was due to be being acclimated being in front of the camera. Participants also gave similar responses to their diminished nervousness during their peer video reviews.

The Gibbs Reflective Cycle, embedded within the ERDS model, helped engender reflective practitioners. The participants in this study reported the guiding reflection prompts, via the Gibbs Reflective Cycle, were beneficial in helping them not only organize their thoughts but also helped them engender robust and meaningful reflections on their teaching and technology integration skills. Based on the analysis of the participants' reflective essays, there was ample evidence where the pre-service teacher participants demonstrated their ability to critically assess their TPACK strengths and limitations. The participants' reflective self-assessments were guided via the TPACK observational rubric. By using the Gibbs Reflective Cycle guiding prompts, the participants in this study demonstrated the ability to write meaningful and robust reflective essays that helped inform their technology-enhanced lesson planning and actual adoption of instructional technologies in their lesson. The findings in this study corroborate with prior research findings that the use of guiding reflection prompts, such as the Gibbs Reflective Cycle, can help stimulate in-depth and robust reflections (e.g., Amobi, 2005; Sparks-Langer, Simmons, Pasch, Colton, & Starko, 1990).

Participants cited lower levels of confidence towards their TPACK after their ERDS guided video self-analysis but actually improved their technology integration skills. A curious phenomenon occurred during this study. Based on the results from the pre and post-TPACK surveys, the evidence indicated that the pre-service teacher participants' confidence levels towards their TPACK decreased in four of the six domains after conducting their ERDS guided video self-analysis. The four TPACK domains that decreased were PK, TPK, TK, and PCK. The participants' confidence levels towards the remaining two domains, CK and TCK, remained the same after their video self-analysis. Interestingly, the participants in this study expressed that they intentionally lowered their TPACK confidence levels after conducting their ERDS guided video self-analysis, because they were able to observe accurate accounts of their TPACK and technology integration skills. As a result of their guided observation analyses (i.e., TPACK observation rubric), the participants were able to assess each TPACK domain individually. Through this self-analysis process, the participants recognized they overestimated their TPACK, and realized that indeed they needed to further develop their technology integration skills and become more knowledgeable regarding their TPACK.

While participants cited lower levels of confidence towards their TPACK after their ERDS guided video self-analysis, the participants actually made observable improvements in their TPACK and technology integration skills. The contradiction between the pre and post-TPACK survey data stems from the participants gaining a deeper understanding of the complexities of teaching with technology. For example, prior to watching and analyzing their videotaped teaching samples, the participants expressed higher levels of confidence towards their TPACK and technology integration skills due to their academic training, practicum experience, and senior academic standing. However, after self-analyzing their videotaped instruction, the participants began to realize that their TPACK may not have been as strong as they had originally believed. As a result, the participants' post-survey results reflected a more accurate representation of how the participants in this study perceived their TPACK. At the same time, the participants in this study were also creating and outlining strategies to improve their TPACK and technology integration skills via their reflective essays and lesson improvement action plans (e.g., more instructional modeling, enhance TK). The participants' revised lessons, informed by the findings of their ERDS guided video self-analysis, were on full display via their videotape teaching data. Based on the researcher's analysis of the video data, he was able to observe that 85.7% of the participants improved their actual technology integration skills by implemented their proposed TPACK improvement action plans into their second lesson. As a result, the participants in this study actually improved their ability to teach with technology; while also expressing lower levels of confidence towards their TPACK after conducting their ERDS guided video self-analysis.

Implications and Recommendations

The findings from this study suggest that an ERDS based video self-analysis instructional component is a promising instructional approach that helps pre-service teachers improve their TPACK and actual technology integration skills. Furthermore, this research found the use of video self-analysis was an effective and viable instructional approach in helping pre-service teachers self-critique and facilitate their own TPACK development. While this is only one study within a specific context, the results from this research suggest it may be worthwhile for scholars and teacher educators to continue examining the effects of using an ERDS guided video self-analysis instructional approach to improve teachers' TPACK and technology integration skills.

As a result, the findings from this study may help inform scholars, researchers, and practitioners in the field of Teacher Education to a viable and beneficial instructional paradigm that can help further prepare pre-service teachers to meet and overcome the challenges they'll face in today's digital learning environment. Key implications and recommendations are highlighted in the section below.

Provide participants with guiding observation frameworks for their video self-analysis. While the pre-service teachers in this study were of senior academic standings and had prior teaching experiences through their field practicums; they are still novices teachers and need guidance to facilitate their own teaching development. As a result, the integration of a guiding observation framework, such as the TPACK observation rubric, was critical in helping pre-service teachers identify and self-assess their TPACK strengths and limitations. Due to the relative inexperience, providing pre-service teachers with guiding frameworks such as checklists and observation rubrics can help strengthen their ability to accurately monitor and self-assess their teaching and technology integration skills. In the future, it may be worthwhile for scholars in the field of Teacher Education to continue researching and developing alternative observation rubrics that can help pre-service teachers identify and assess their teaching strengths and limitations at the various stages of their teacher development.

Provide reflective frameworks. The pre-service teacher participants in this study greatly benefited from using the Gibbs' reflection model (1988) as a framework to facilitate the development of their reflective essays. The participants cited the Gibbs' reflection model was beneficial to them as they were writing their reflective essays because it encouraged them to systematically think about the various stages within their teaching sample. Furthermore, the participants expressed that having a step by step framework helped them become less bias towards their own self-assessment, because it reminded them to not only focus on the things that didn't go well in the lesson but to also reflect and focus on the things that actually went well during their lesson. To help pre-service teachers write meaningful and robust reflective essays, as a mean to improve their teaching and technology integration efficacy; it may be worthwhile for teacher educators to consider adopting guiding reflection frameworks into their own curriculum when trying to help their pre-service teachers become better teachers', technology integrators, and reflective practitioners. Furthermore, as the field of Teacher Education has been shifting towards a practice-based teacher education instructional approach over the past ten years, where self-reflections are a key core tenant of teacher development, it may be beneficial for educational scholars to consider researching how different reflective frameworks, in combination with a video self-analysis instructional component, can help facilitate a teachers ability to elicit deeper and more meaningful insights regarding their teaching.

TPACK survey instrument enhancements. While educational technology scholars have embraced the Schmidt et al. (2009) TPACK survey instrument to measure teachers' perceptions towards their ability to teach with technology; the findings from this study suggest that this survey instrument could be further enhanced if it incorporated a section pertaining to technological skill acquisitions. For instance, while measuring teachers' self-perceptions towards their technology integration abilities is important, it may be worthwhile for educational technology scholars to either enhance the current TPACK survey instrument or develop alternative TPACK measurement instruments that can also capture teachers' actual skill development. As a result, it may be beneficial for scholars in the field of Teacher Education to collaborate with educational technology scholars to develop a comprehensive survey instrument that can adequately measure pre-service teachers perceptions of their ability to not only teach with technology but also their ability to apply learning theories into authentic classroom environments.

Closing thoughts. Bandura (2001) once said theories are often judged by their explanatory and predictive power. He further elaborated this statement by saying “the value of a psychological theory must also be judged by its operative power to improve the quality of people’s lives” (Bandura, 2001, p.37). As a result, this research sought to make a meaningful contribution in the field of Teacher Education and educational technology by investigating how an ERDS guided video self-analysis instructional component, contextualized by Bandura’s (1986) social cognitive theory, impacts pre-service teachers technological pedagogical content knowledge. While teacher preparation programs continue to embrace various learning strategies in an effort to further develop preservice teachers TPACK; the findings from this study suggest adding an ERDS guided video self-analysis instructional component into a technology integration course may be viable and effective options in helping pre-service teachers improve their TPACK and actual technology integration skills. Furthermore, due to the realities and solitary nature of the teaching profession, it may be advantageous for teacher preparation programs to consider creating learning environments where pre-service teachers have opportunities to practice facilitating and self-regulating their own professional development.

As technology becomes more ubiquitous to teachers and students, the ability to effectively teach with technology will become an essential component for all 21st-century teachers. As such, it may be beneficial for teacher educators to consider preparing the next generation of teachers to become self-reliant and reflective technology integrators through the use of a video self-analysis instructional component. By training the next generation of educators to self-critique, self-analyze, and self-direct their technology integration skills, teachers could be empowered to continuously adapt, transform, and improve their instruction using new and emerging instructional technologies.

Appendices

Appendix A: TPACK Survey

Thank you for taking time to complete this questionnaire. Please answer each question to the best of your knowledge. Your thoughtfulness and candid responses will be greatly appreciated. Your individual name or identification number will not at any time be associated with your responses. Your responses will be kept completely <u>*confidential*</u> *and will not influence your course grade.*

DEMOGRAPHIC INFORMATION

1. Your SU e-mail address (username@syr.edu)

Items 2-8 below on pre-questionnaire only

2. Gender
    a. Female
    b. Male

3. Age range
    a. 18-22
    b. 23-26
    c. 27-32
    d. 33+

4. Major
    a. Inclusive Early Childhood Special Education
    b. Inclusive Elementary and Special Education
    c. Other

5. Liberal Arts Major/Concentration
    a. African American Studies
    b. Anthropology
    c. English and Textual Studies
    d. Fine Arts/Art or Music History
    e. French Language, Literature, and Culture
    f. Geography
    g. History
    h. International Relations

i. Mathematics
j. Philosophy
k. Political Science
l. Sociology
m. Spanish Language, Literature, and Culture
n. Women's Studies
o. Other
p. None

6. Year in College
    a. Freshman
    b. Sophomore
    c. Junior
    d. Senior
    e. Other

7. Are you currently enrolled or have you completed a practicum experience in a PreK-6 classroom?
    a. Yes
    b. No

8. What semester and year (e.g.,Spring 2008) have you taken or will take the following?

Pre-Block	
Professional Block I	
Professional Block II	
Professional Block III	
Student teaching	

Items 2 and 3 below on post-questionnaire only

2. In hours, how much time do you spend on a computer every day?

3. Which of the following devices do you own? Select all that apply.
    - ☐ Desktop computer
    - ☐ Laptop computer
    - ☐ Tablet computer (ex. iPad)
    - ☐ Smartphone (ex. iPhone, Blackberry)
    - ☐ MP3 player (ex. iPod)
    - ☐ None of the above

Technology is a broad concept that can mean a lot of different things. For the purpose of this questionnaire, technology is referring to digital technology/technologies. That is, the *digital tools we use such as computers, laptops, iPods, handhelds, interactive whiteboards, software programs, etc. Please answer all of the questions and if you are uncertain of or neutral about your response you may always select "Neither Agree or Disagree"*

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
TK (Technology Knowledge)					
1. I know how to solve my own technical problems.					
2. I can learn technology easily.					
3. I keep up with important new technologies.					
4. I frequently play around the technology.					
5. I know about a lot of different technologies.					
6. I have the technical skills I need to use technology.					
CK (Content Knowledge)					
Mathematics					
7. I have sufficient knowledge about mathematics.					
8. I can use a mathematical way of thinking.					
9. I have various ways and strategies of developing my understanding of mathematics.					
Social Studies					
10. I have sufficient knowledge about social studies.					
11. I can use a historical way of thinking.					
12. I have various ways and strategies of developing my understanding of social studies.					
Science					
13. I have sufficient knowledge about science.					

14. I can use a scientific way of thinking.					
15. I have various ways and strategies of developing my understanding of science.					
Literacy					
16. I have sufficient knowledge about literacy.					
17. I can use a literary way of thinking.					
18. I have various ways and strategies of developing my understanding of literacy.					

PK (Pedagogical Knowledge)					
19. I know how to assess student performance in a classroom.					
20. I can adapt my teaching based upon what students currently understand or do not understand.					
21. I can adapt my teaching style to different learners.					
22. I can assess student learning in multiple ways.					
23. I can use a wide range of teaching approaches in a classroom setting.					
24. I am familiar with common student understandings and misconceptions.					
25. I know how to organize and maintain classroom management.					

PCK (Pedagogical Content Knowledge)					
26. I can select effective teaching approaches to guide student thinking and learning in mathematics.					
27. I can select effective teaching approaches to guide student thinking and learning in literacy.					

28. I can select effective teaching approaches to guide student thinking and learning in science.					
29. I can select effective teaching approaches to guide student thinking and learning in social studies.					
TCK (Technological Content Knowledge)					
30. I know about technologies that I can use for understanding and doing mathematics.					
31. I know about technologies that I can use for understanding and doing literacy.					
32. I know about technologies that I can use for understanding and doing science.					
33. I know about technologies that I can use for understanding and doing social studies.					

TPK (Technological Pedagogical Knowledge)					
34. I can choose technologies that enhance the teaching approaches for a lesson.					
35. I can choose technologies that enhance students' learning for a lesson.					
36. My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.					
37. I am thinking critically about how to use technology in my classroom.					
38. I can adapt the use of the technologies that I am learning about to different teaching activities.					
39. I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.					

40. I can use strategies that combine content, technologies and teaching approaches that I learned about in my coursework in my classroom.					
41. I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.					
42. I can choose technologies that enhance the content for a lesson.					

TPACK (Technology Pedagogy and Content Knowledge)					
43. I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.					
44. I can teach lessons that appropriately combine literacy, technologies and teaching approaches.					
45. I can teach lessons that appropriately combine science, technologies and teaching approaches.					
46. I can teach lessons that appropriately combine social studies, technologies and teaching approaches.					

Models of TPACK (Faculty, PreK-6 teachers)					
47. My mathematics education professors appropriately model combining content, technologies and teaching approaches in their teaching.					
48. My literacy education professors appropriately model combining content, technologies and teaching approaches in their teaching.					
49. My science education professors appropriately model combining content, technologies and teaching approaches in their teaching.					

50. My social studies education professors appropriately model combining content, technologies and teaching approaches in their teaching.					
51. My instructional technology professors appropriately model combining content, technologies and teaching approaches in their teaching.					
52. My educational foundation professors appropriately model combining content, technologies and teaching approaches in their teaching.					
53. My professors outside of education appropriately model combining content, technologies and teaching approaches in their teaching.					
54. My PreK-6 cooperating teachers appropriately model combining content, technologies and teaching approaches in their teaching.					

	25% or less	*26% - 50%*	*51% - 75%*	*76%-100%*
Models of TPCK				
55. In general, approximately what percentage of your teacher education professors have provided an effective model of combining content, technologies and teaching approaches in their teaching?				
56. In general, approximately what percentage of your professors outside of teacher education have provided an effective model of combining content, technologies and teaching approaches in their teaching?				
57. In general, approximately what percentage of the PreK-6 cooperating teachers have provided an effective model of combining content, technologies and teaching approaches in their teaching?				

Appendix B: Technology Integration Observation Rubric

Criteria	4	3	2	1
Curriculum Goals & Technologies (Curriculum-based technology use)	Technologies selected for use in the instructional plan are strongly aligned with one or more curriculum goals.	Technologies selected for use in the instructional plan are aligned with one or more curriculum goals.	Technologies selected for use in the instructional plan are partially aligned with one or more curriculum goals.	Technologies selected for use in the instructional plan are not aligned with any curriculum goals.
Instructional Strategies & Technologies (Using technology in teaching/ learning)	Technology use optimally supports instructional strategies.	Technology use supports instructional strategies.	Technology use minimally supports instructional strategies.	Technology use does not support instructional strategies.
Technology Selection(s) (Compatibility with curriculum goals & instructional	Technology selection(s) are exemplary, given curriculum goal(s) and instructional strategies.	Technology selection(s) are appropriate, but not exemplary, given curriculum goal(s) and instructional strategies.	Technology selection(s) are marginally appropriate, given curriculum goal(s) and instructional strategies.	Technology selection(s) are inappropriate, given curriculum goal(s) and instructional strategies.
"Fit" (Content, pedagogy and technology together)	Content, instructional strategies and technology fit together strongly within the instructional plan.	Content, instructional strategies and technology fit together within the instructional plan.	Content, instructional strategies and technology fit together somewhat within the instructional plan.	Content, instructional strategies and technology do not fit together within the instructional plan.

Appendix C: Interview Protocol

Hi ___________. My name is Jimmy Jang, and I am a doctoral student in the department of Instructional Design, Development, and Evaluation (IDD&E) at Syracuse University.

The purpose of this interview is to better understand your experiences, beliefs, and perceptions of using the ERDS based video self-analyses instructional approach in your technology integration course. Your responses will be an invaluable component in better understanding video self-analyses influence on your technological pedagogical content knowledge (TPACK).

You can rest assured that I will not include your name or any other information that could identify you in any reports I write. Furthermore, I will destroy the notes and audiotapes after I complete my study and publish the results. Before we get started, do you have any questions for me?

****

I have started audio recording, and I am speaking with ____________.

- So that I have confirmation on the audio recording, are you willing to participate in this interview? (Yes/No)
- To confirm your consent, do I have your permission to audio record this interview? (Yes/No)

Thank you again for volunteering to be interviewed. Just to reiterate the purpose of this interview is to better understand your experiences, beliefs, and perceptions of using the ERDS-based video self-analyses instructional approach in your technology integration course.

- To begin, please describe how your video self-analyses influenced your technology lesson planning? Was it positive, negative, or neutral?
    - Probe: Can you describe a specific example of how it informed your lesson planning (e.g., positive, negative, or neutral)?
    - Probe: If video self-analysis ***was beneficial*** in facilitating your technology enhanced lesson planning, please describe how?
    - Probe: If video self-analysis ***was not beneficial*** in facilitating your technology lesson plan, please describe why not?

- While you were conducting your video self-analyses, how did you feel about using the TPACK observation rubric?
    - Probe: Was it helpful? (Yes/No) => please elaborate, and provide an example.

- While writing your reflective essays, how did you feel about using the guiding reflection prompts (Gibbs Reflective Cycle)?
    - Probe: Was it helpful? (Yes/No) => please elaborate, and provide an example.

- Please describe how your video self-analyses influenced your actual instructional technology use and/or instructional behaviors?

  - Probe: Specifically, can you describe how watching and analyzing your teaching videos helped your ability to teach with technology?
  - Probe: If analyzing your videotaped teaching sample was not beneficial, please describe why not?

- Thank you again for taking the time to participate in this interview. Do you have any final thoughts on your experience using the ERDS-based video self-analyses to improve your TPACK?

Thank you very much—that's it for my questions. If you have any further questions or concerns, please don't hesitate to contact me.

Appendix D: IRB Approval

SYRACUSE UNIVERSITY
Institutional Review Board
MEMORANDUM

TO: Jing Lei
DATE: February 26, 2016
SUBJECT: **Expedited Protocol Review - Approval of Human Participants**
IRB #: 16-013
TITLE: *Exploring the Influence of Video Self-Analysis in Facilitation Preservice Teacher Technological Pedagogical Content Knowledge (TPACK)*

The above referenced protocol was reviewed by the Syracuse University Institutional Review Board for the Protection of Human Subjects (IRB) and has been given **expedited approval.** The protocol has been determined to be of no more than minimal risk and has been evaluated for the following:

1. the rights and welfare of the individual(s) under investigation;
2. appropriate methods to secure informed consent; and
3. risks and potential benefits of the investigation.

The approval period is **February 25, 2016** through **February 24, 2017**. A continuing review of this protocol must be conducted before the end of this approval period. Although you will receive a request for a continuing renewal approximately 60 days before that date, it is your responsibility to submit the information in sufficient time to allow for review before the approval period ends.

Enclosed are the IRB approved date stamped consent and/or assent document/s related to this study that expire on **February 24, 2017**. **The IRB approved date stamped copy must be duplicated and used when enrolling new participants during the approval period** (may not be applicable for electronic consent or research projects conducted solely for data analysis). Federal regulations require that each participant indicate their willingness to participate through the informed consent process and be provided with a copy of the consent form. Regulations also require that you keep a copy of this document for a minimum of three years after your study is closed.

Any changes to the protocol during the approval period cannot be initiated **prior** to IRB review and approval, except when such changes are essential to eliminate apparent immediate harm to the participants. In this instance, changes must be reported to the IRB within five days. Protocol changes must be submitted on an amendment request form available on the IRB web site. Any unanticipated problems involving risks to subjects or others must be reported to the IRB within 10 working days of occurrence.

Thank you for your cooperation in our shared efforts to assure that the rights and welfare of people participating in research are protected.

Katherine McDonald
IRB Chair

DEPT: Instructional Design, Development, & Evaluation, 336 Huntington Hall **STUDENT:** James Jang

Office of Research Integrity and Protections
121 Bowne Hall, Syracuse, New York 13244-1200
(Phone) 315.443.3013 ♦ (Fax) 315.443.9889
orip@syr.edu ♦ www.orip.syr.edu

Appendix E: Consent Form

Syracuse University IRB Approved

FEB 2 5 2016 FEB 2 4 2017

SYRACUSE UNIVERSITY

INSTRUCTIONAL DESIGN, DEVELOPMENT, AND EVALUATION

CONSENT FORM

Preservice Teachers' Technology Integration Development through Self Video Analysis

Jimmy Jang, a doctoral student in the Instructional Design, Development and Evaluation department, and Dr. Jing Lei are conducting a research study about video self-analysis influence on preservice teachers' ability to teach with technology.

This research project is titled: *Exploring the influence of video self-analysis in facilitating preservice teachers Technological Pedagogical Content Knowledge (TPACK).* For this study, I am seeking your permission to use ALL your course materials except your grades. The course materials include your weekly reflections, lesson plans, videotaped teaching samples, and your pre and post course survey responses. In addition, I am seeking your permission to conduct one-on-one interviews with you. The interviews will last approximately 40 minutes and they will be audio recorded. Interviews are not mandatory for this study, and you may opt out of the interviews without any repercussions.

From this study's findings, I plan to publish and present my findings to journals and conferences to inform my field of study on the influence of using video self-analysis on facilitating preservice teachers' technology integration development. The results from this study can be used by researchers, scholars, and practitioners to benefit and/or ascend their future research on using video analysis to develop preservice teachers' ability to integrate technology into instruction. Any articles published and/or presentations given will use pseudonyms to protect your identity and your personal information will not be revealed.

All information will be kept confidential. This means that no one will have access to your course materials except the researcher. Your course materials will be securely held in an encrypted external hard drive. The hard drive will be locked in a secure location where only the researcher will have access to the external hard drive. This study will be completed in less than one year; and at the completion of this study, all materials used in this study will be deleted from the external hard drive. If you choose not to participate in this study, your course materials will not be used in this study.

The benefit of this research is that you will receive training that will help you become more mindful about integrating technology in their future instruction. By participating in this research, you will gain a deeper understanding of your own pedagogical practices in teaching with technology. In addition, teacher educators will also have better insight into how the use of video self-analysis can be used to help preservice teachers effectively teach with technology. The risk in participating in this study is minimal. While you may be concerned that your course grades would be affected if you choose not to participate in this study, please rest assure that your grades will in no way be affected by your decision to participate or not participate in this study. Your consent form will be withheld from the student researcher until the final course grades have been submitted to SU's registrar. Once your final course grades have been submitted to the registrar, only then will the student researcher have access to the consent forms.

1

School of Education / 330 Huntington Hall / Syracuse, New York 13244-2340
315-443-3703/315-443-3704 / Fax: 315-443-1218 / http://idde.syr.edu

SYRACUSE UNIVERSITY

INSTRUCTIONAL DESIGN, DEVELOPMENT, AND EVALUATION

Since this study is looking at the influence of video self-analysis on preservice teachers' technology integration development; the researchers are requesting permission to videotape your teaching samples and interview you on your experiences using video self-analysis to facilitate your technology integration abilities. The purpose of videotaping your teaching samples and conducting one-on-one interviews is to explore how video self-analysis influences preservice teachers' technology integration development. If you agree to be interviewed for this study, you may feel uncomfortable during the interview. If this happens, you may stop the interview at any time and withdraw your participation from the interview without any repercussions. Only the researches listed in this study will have access to your videotaped teaching samples, and audio recorded interviews. At the completion of this study, all research participants videotaped teaching samples and audiotaped interviews will be destroyed.

If you have any questions, concerns, or complaints about this study, please feel free to contact the advisor who is supervising this study (Dr. Jing Lei) or the student researcher (Jimmy Jang). Our contact information is listed below. You may also contact the Institutional Review Board (contact information listed below) if you have questions regarding your rights as a participant, or if you have questions, concerns, or complaints that you wish to address to someone other than the investigator or his advisor, or if you cannot reach the investigator.

Dr. Jing Lei
Email: jlei@syr.edu
Phone: 315-443-1362

Jimmy Jang
Email: jejang01@syr.edu
Phone: 315-443-3703

Office of Research Integrity and Protections
Address: 121 Bowne Hall, Syracuse, NY 13244-1200
Email: orip@syr.edu
Phone: 315-443-3013

Syracuse University IRB Approved

FEB 2 5 2016 FEB 2 4 2017

SYRACUSE UNIVERSITY

INSTRUCTIONAL DESIGN, DEVELOPMENT, AND EVALUATION

Please indicate below if you agree or do not agree to be videotaped:

☐ I agree to be videotaped ☐ I do not agree to be videotaped

Please indicate below if you agree to be interviewed, and have the interview audio recorded:

☐ I agree to be interviewed and have my interview audio recorded ☐ I do not agree to be interviewed

I am inviting you to participate in a research study. Involvement in the study is voluntary. If you choose not to participate or to withdraw from the study, you will not be penalized nor will it affect your final course grade. By signing this form, you agree with all the terms listed above, you are 18 years of age or older, you wish to participate in this research study, and that you release all the course material mentioned above for research purposes.

All of my questions have been answered and I wish to participate in this research study.

______________________________ ____________________
Signature of participant Date

____
Printed name of participant

______________________________ ____________________
Signature of researcher Date

____
Printed name of researcher

**A copy of this signed consent form will be provided to you.*

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Vita

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EDUCATION

2012-2019 **Syracuse University,** Syracuse, NY
Doctor of Philosophy (Ph.D.), Instructional Design, Development, and Evaluation

2010-2011 **Johns Hopkins University**, Baltimore, MD
Master of Science (M.S.), Educational Studies (Focus: DDDM Organizational Improvement)
Graduate Certificate: Data Driven Decision Making and Organizational Improvement

2003-2007 **Grand Valley State University,** Allendale, MI
Bachelor of Science (B.S.), Economics

WORK EXPERIENCE

2016-Present **Living Classrooms Foundation,** Baltimore, MD
Chief Research & Analytics Officer

2012- 2016 **Syracuse University**, Syracuse, NY
Teaching Assistant

2015 **Baltimore City Mayor's Office,** Baltimore, MD
Mayoral Fellow

2014- 2015 **Washington Yu Ying Public Charter School,** Washington, D.C
Program Evaluation Consultant & Project Manager

2014 **Education Pioneers Fellowship**, Washington, D.C.
Fellow (D.C. cohort)

2011-2012 **Living Classrooms Foundation,** Baltimore, MD
Sr. Research Analyst

2011 **Center for Research and Reform in Education** (*Johns Hopkins University*), Towson, MD
Graduate Intern

2011 **Maryland Society for Educational Technology,** Baltimore, MD
Graduate Intern

2010 **Seoul Metropolitan Office of Education,** Seoul, South Korea
Instructor/Curriculum Developer

2007-2010 **Gyeonggido Office of Education** (Gyeonggido English Program in Korea – GEPIK)
ESL Teacher

PEER REVIEWED PUBLICATIONS

2015 Jang, J. E., & Lei, J. (2015). The Impact of Video Self-Analysis on the Development of Preservice Teachers' Technological Pedagogical Content Knowledge (TPACK). *International Journal of Digital Literacy and Digital Competence (IJDLDC)*, *6*(4), 13-29.

2014 Jang, J. E. & Lei, J. (2014). Leveraging Technology: Facilitating Preservice Teachers Technology Integration Development through Video Self Analysis. *Proceedings for the Association for Educational Communications and Technology Convention* (Vol. 2014, No 1-2, pp. 133-141).

PRESENTATIONS

2016 Jang, J. E., (2016). *Living Classrooms Performance Management System: LivingClassrooms.Stat.* Presented at the White House Federal Interagency Workshop with the John Hopkins 21st Century Cities Initiative, December 1, 2016, Baltimore, Maryland.

2016 Jang, J. E., (2016). *Technologies for Construction in College Students' Learning*. Paper presented at the annual conference of the Association for Educational Communications & Technology (AECT), Las Vegas, NV.

2016 Jang, J. E., (2016). *Monitoring and Measuring Outcomes*: *LivingClassrooms.Stat.* Presented at the White House Federal Interagency Workshop with the John Hopkins 21st Century Cities Initiative, May 10, 2016, Baltimore, Maryland.

2015 Jang, J. E., (2015) *KidStat: A comprehensive performance management system designed to inform the Outcome Budgeting and CitiStat process for Better Schools*. Report presented to Baltimore's Mayor and her senior cabinet members, August 4, 2015, Baltimore, MD.

2015 Jang, J. E., (2015). *Video self-analysis: Impact on Facilitating Personalized Teacher Development*. Paper presented at the annual Office of the State Superintendent of Education (OSSE), Local Education Agency (LEA) Institute conference, Washington, D.C.

2014 Jang, J. E., (2014). *Leveraging Technology: Facilitating Preservice Teachers Technology Integration Development through Video Self Analysis*. Paper presented at the annual conference of the Association for Educational Communications & Technology (AECT), Jacksonville, Florida.

2014 Jang, J. E., (2014). *Enhancing preservice teachers TPACK via video self-analysis: Results from pilot study*. Syracuse University, IDD&E Brown Bag Series, December 1, 2014, Syracuse, NY

CERTIFICATIONS

2012-Present **Collaborative Institutional Training Initiative** (CITI)

AWARDS & HONORS

2015 **Baltimore City Mayoral Fellowship**
2015 Fellow
The Mayoral Fellowship is a competitive and prestigious program that selects only 5% of its national applicants. Fellows are assigned to projects that focus on a number different urban public policy issues and challenges, and they work under the direction of senior-level city government officials.

2014 **Education Pioneers Graduate School Fellowship**
District of Columbia (D.C.) 2014 Fellow
The Education Pioneers Graduate School Fellowship is a leadership development program that places top-tier professionals in strategic leadership roles within exemplary organizations in the education sector. Fellows engage in critical managerial and leadership roles outside the classroom— to help ensure that all children have access to a high quality education.

PROFESSIONAL ASSOCIATIONS

American Educational Research Association (AERA)
Association for Educational Communications and Technology (AECT)
Maryland Society for Educational Technology (MSET)

PERSONAL

Languages Bilingual (English & Korean)