FACTORS CONTRIBUTING TO EARLY ADOPTION OF TECHNOLOGY

by

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ABSTRACT

FACTORS CONTRIBUTING TO EARLY ADOPTION OF TECHNOLOGY

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The study examined preservice teachers' personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology related to early adoption of technology. Survey, interview, and demographic data were collected from a purposeful sample of instructors of an instructional technology course and a convenience sample of the preservice teachers enrolled in their sections of the class, in a mid-sized suburban university in the Gulf Coast region. The *Students and Information Technology in Higher Education Survey*, *Computer Technologies and Strategies Scale*, *Attitudes toward Computer Technologies Scale*, *Technological Knowledge Survey* component of the *Technological Pedagogical Content Knowledge* (TPACK) surveys were used to determine the beliefs and attitudes reported by the preservice teachers. One-to-one interviews further explored the instructors' beliefs and attitudes associated with the preservice teachers identified as early adopters of technology. Quantitative data was analyzed using structural equation modeling (SEM) and two-tailed independent t-tests, while an inductive coding process analyzed the collected qualitative data. Quantitative analysis demonstrated that there was a significant relationship between perceived usefulness and early adoption of technology. Significant correlations were also found between the independent variables: personal use was correlated with self-efficacy, attitude, perceived usefulness, and knowledge and skills. Statistically significant positive relationships were also observed between self-efficacy and attitude, self-efficacy and perceived usefulness, attitude and perceived usefulness, attitude and knowledge and skills, and perceived usefulness and knowledge and skills. The qualitative analysis provided supporting evidence that the model had correctly identified the early adopters of technology within each section of the course.

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CHAPTER I

INTRODUCTION

Technological innovations have changed the landscape of the 21st Century classroom (Johnson, 2012; Pitler, Hubbell, & Kuhn, 2012). Hence, if teachers are to be able to serve modern students' needs, they need to embrace the use of technological tools. Research has shown that, when properly employed, classroom technology leads to increases in student engagement and improvement in attitudes toward learning, ultimately resulting in much greater positive learning outcomes (Balanskat, Blamire, & Kefala, 2007; OECD, 2006). Akin to the dynamics in any group, when faced with technological advances, some teacher candidates will emerge as early adopters of new tools and resources, while others will need coaching and encouragement in order to begin utilizing the technology effectively (Aldunate & Nussbaum, 2013; Hall & Hord, 2011). If a profile could be developed to identify early adopters, this information could be used to enhance teaching methods, training, and hiring processes. This chapter will explore the background of technology in education and provide evidence supporting the need for the development and utilization of such a profile.

Research Problem

Technology is pervasive in modern life and business. In 2013, expenditure on school technology in the United States (U.S.) exceeded $13 billion, and the funding rate is projected to continue increasing at 8% per year (FutureSource Consulting, 2013). Computer power has been doubling every two years for the past four decades. Presently, it is estimated that 85% of adults in the U.S. use the Internet and over two-thirds of the population owns a smartphone. In addition, 72% of Internet users use social media sites, such as Facebook and Twitter, to connect with others (Pew Research Center, 2015).

Technology usage among high school students is also extensive. According to a report issued by the Pew Research Center (2013), in that year, 78% of teenagers owned a cell phone, and 37% of those had a smartphone, which represented a 60% increase from 2011. In addition, in 2013, 23% of teenagers had a tablet computer, which was comparable to tablet ownership in the general adult population, and 93% of high school students owned a computer or had access to one at home.

Technology has the ability to influence all aspects of education, and the advantages to classroom technology use are numerous. Several researchers have demonstrated benefits to incorporating technology into the curriculum. For example, Machin, McNally, and Silva (2007) found that technology has a positive impact on student outcomes in primary school, particularly in English. Positive correlations have also been found between time spent with technology and mathematics scores (OECD, 2006). Underwood (2005) demonstrated that classroom Internet access had a positive effect on national standardized test achievement at the high school level. Web 2.0 tools allow students to learn collaboratively, as they are able to add to online content, rather than just receiving and utilizing the tools (Morgan, 2014). Given these numerous benefits, it is posited that students who are not immersed in technology during their formative years was less capable of meeting the demands of the 21st Century workforce, which requires mastery of computer skills and adaptation to the complexities of globalization. As philosopher and researcher John Dewey (1944) once pointed out, “If we teach today’s students as we did yesterday’s, we rob them of tomorrow” (p. 167).

However, empirical evidence shows that despite these advantages, there is a disparity in the adoption of classroom technology. Cuban (2003) found that, although teachers regularly use computers in their personal lives, most fail to integrate technology into instructional practices. Similarly, according to Lei (2009), most preservice teachers have limited proficiency in technology related to teaching, despite extensive exposure to mobile devices, communication tools, and social networking in their personal lives. More recently, Aldunate and Nussbaum (2013) asserted that complex technologies have a higher rate of abandonment during implementation than simpler systems, and that the assistance of early adopters is necessary to move groups forward. Given that early adopters play an integral part in the implementation of new technology, the ability to identify them and leverage their strengths during the process is not an entirely new concept.

Extant evidence indicates the presence of individual factors that are positively correlated with early adoption of technology. According to Challoo, Green, and Maxwell (2011), comfort with use of technology is directly related to the stage of adoption. The authors noted that, in their study, participants with a high degree of anxiety tended to be at a low stage of adoption. Interest also has a direct effect on the stage of adoption, as well as an indirect effect on comfort with technology. Mueller, Wood, Willoughby, Ross, and Specht (2008) found that teachers’ experience with computer technology and attitudes towards technology predict classroom computer integration. Akbaba (2013) and Mayo, Kajs, and Tanguma (2005) noted that teachers who use technological tools during their formal instruction would develop a positive attitude and self-efficacy for use of technology. Perceived usefulness is often the strongest determinant of their attitudes, according to Sadaf, Newby, and Ertmer (2012).

Hence, teacher-training programs would greatly benefit from a model that can be applied to identify the human resources within their classrooms that are likely to assist in adoption of new technologies. Failure to do so would likely result in the entire class remaining at a low stage of adoption. Consequently, once teacher candidates enter the workforce, most will abandon the technology, rather than implementing it in their classroom practices. As there is urgent need to increase the number of teachers entering the workforce with high levels of technology skills and self-efficacy, the present study seeks to create such a model to identify potential early adopters of technology. These individuals would be invaluable resources in further technology adoption initiatives, as they may assist with the adoption of instructional technologies during formal training, thereby increasing the total number of technologically savvy teachers entering the teaching field.

Significance of the Study

Previous research has identified traits within the teacher and aspects of the workplace that are predictive of technology adoption. Davis's Technology Acceptance Model (TAM) explored factors which impact in-service teacher technology adoption and found that teacher perceptions about the usefulness of technology were a primary determinant of technology adoption (Davis, 1989). Other researchers have found correlations between self-efficacy and technology adoption (Albion, 2001, Challoo et al., 2011), and prior knowledge and experience (Mueller et al., 2008, Sadaf et al., 2012).

This study will contribute to the field of educational research by using structural equation modeling (SEM) to construct a multifactor model of early adoption of technology in teacher candidates. Given that early adopters can act as change agents to increase the whole group's acceptance of new technologies, this model is applicable to training and instructional processes. In addition, identifying potential early adopters would allow instructors to shift their focus to students who are likely to struggle with technology and allow early adopters to learn more independently. Adult learning theory posits that learning independence enables students who already possess existing knowledge and skills to progress more quickly than if they were taught in a more restrictive group environment (Cox, 2015; Knowles, 2005).

Research Purpose and Questions

The purpose of this study was to examine the factors that lead to early adoption of technology in preservice teachers. The current study addresses the following research questions:

RQ1: To what extent are the factors of personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology related to early adoption of technology in pre-service teachers?

RQ2: Is there a statistically significant mean difference between the pretest and posttest in personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology when preservice teachers complete an instructional technology course?

RQ3: What are instructional technology instructors' perceptions about the behaviors of early adopters of technology in their classes?

Definitions of Key Terms

The following are the definitions of the key terms used throughout this dissertation.

Attitude about technology was defined as the overall levels of comfort and anxiety present in the teacher candidate (Kinzie, Delcourt, & Powers, 1994).

Early adopter: Individuals who are leading the way in the mastery and use of new technology (Gorman, 2010).

Late adopter: Individuals with lagging mastery and use of new technology (Kahn, 2008)

Perceived usefulness of technology was defined as the teacher candidates' beliefs about the advantages to using technology (Kinzie et al., 1994).

Personal use of technology was defined as the ways that teacher candidates utilize technological tools outside of the classroom (Educause, 2008).

Self-efficacy: The extent to which one believes that one is capable of completing a task and reaching a goal (Bandura, 1977).

Self-Efficacy with technology was defined as the extent to which a teacher candidate believes that he or she is capable of completing a technological task and reaching a goal (Wang, Ertmer, &Newby, 2004).

Technology: Computer or digital technologies used to facilitate learning in the classroom (Miranda & Russell, 2011).

Technology adoption: The acceptance and use of new technologies by their intended users (Agarwal & Prasad, 1998).

Conclusion

This chapter identified the need to examine the relationship between personal technology use, self-efficacy with technology, attitudes about technology, perceived usefulness of technology, knowledge and skills regarding technology, and early adoption of technology. The research problem and significance of the study were reviewed and research questions were presented alongside the theoretical framework. In the next chapter, historic and current perspectives on technology trends, levels of use, personal technology use, self-efficacy with technology, attitudes about technology, perceived usefulness of technology, knowledge and skills regarding technology, and early adoption of technology are discussed in further detail.

CHAPTER II

REVIEW OF RELATED LITERATURE

The purpose of this study was to examine the factors that lead to early adoption of technology in teacher candidates. Authors of extant research in this field have identified several factors that individually influence technology adoption. To address these areas, this literature review focused on: (a) technology trends, (b) levels of use, (c) adoption of technology (d) personal technology use, (e) self-efficacy, (f) attitudes about technology, (g) perceptions of usefulness, and (h) knowledge and skills regarding technology.

Technology Trends

The vast majority of students in modern classrooms are digital natives, in the sense that they have been immersed in technology since birth. On the other hand, many of the instructors are digital immigrants, who were gradually exposed to new technologies, as they grew up before the digital age (Prensky, 2001). Thus, it is not surprising that these two groups have drastically different attitudes toward the adoption of new technology.

In the last two decades, daily use of technology has grown at an exponential rate. From 2000 to 2015, overall Internet usage among adults in the U.S. increased from 52% to 85%. However, for young adults aged 18-29, that figure exceeds 96%. More than half of teenagers are online several times a day, and 73% of high school students have access to a smartphone (Pew Research Center, 2015). Today’s students are digital natives, who utilize search engines for research, rather than a set of encyclopedias or a card catalog in a library (Prensky, 2001). Student proficiency with mobile devices, online communication, and the virtual environment is a resource that should not go untapped. It seems prudent that educational strategies incorporate this paradigm shift in order to serve the needs of modern students.

Levels of Use

Hall and Hord (2000) described a Concerns Based Adoption Model (CBAM), in which the adoption of new technology was presented across six levels. At Level 0, the user is taking no action with the new technology, and is neither using it nor learning about it. Level 1, denoted as Orientation, is marked by a quest for additional information by a potential user. At Level 2, referred to as Preparation, a user makes a decision to use the technology but has not yet begun to do so. Level 3, Mechanical Use, features the first rudimentary attempts at implementation of a technology. At Level 4a, known as Routine Use, the user is starting to become more comfortable, but is still only using the basic features of the technology. The user begins to make small changes to get better results in Level 4b, denoted as Refinement. With the onset of Level 5, Integration, the user is starting to seek out other users to coordinate with and share tips and strategies. The final phase, Level 6, denoted as Renewal, is reached when the user has mastered the standard usage of the technology and begins to seek out new ways to innovate with the technology that are not part of established practice.

In order for instructors in teacher training programs to act as change facilitators and move users from the lower levels of adoption to the higher levels, Hall and Hord (2000) recommended several strategies. For example, change agents must help the group develop a shared vision and be able to articulate it. The authors further posit that instructors should help the preservice teachers understand and commit to the importance and value of technology in the classroom. Instructors must also identify the resources that will be needed during the change process, and make arrangements to provide those resources. In addition, change facilitators should recognize the importance of high quality professional development around the proposed change. Instructors should make sure that the lessons taught are consistent with the goal of adoption of valuable classroom technology. Hall and Hord further recommend that agents of change keep the lines of communication open, so that they can check on progress towards the shared goals and provide assistance where it is needed. Finally, one of the most important aspects of encouraging change, according to Hall and Hord, is to create a supportive environment where group members feel comfortable to try new things even if they do not always work in the first attempt.

Adoption of Technology

Although the benefits to learning with the assistance of technology are numerous, some notable factors consistently prevent teachers from fully implementing the tools at their disposal. According to the data reported by the Department of Education (2000), two thirds of teachers do not feel adequately prepared to use technology in the classroom. The report also highlighted that “teachers’ preparation and training to use educational technology is a key factor to consider when examining their use of computers and the Internet in the classroom” (Department of Education, 2000, p. iii). More recently, Fleming and Hynes (2014) conducted a qualitative study of 25 elementary school teachers in the south central region of Texas, who were selected by convenience sampling. In the survey conducted as a part of this investigation, a majority of study participants cited feeling overwhelmed, lack of time, and problems with hardware as the most common barriers to technology usage in the classroom. These studies illustrate the need for teacher-training programs to give preservice teachers experience with technology before they enter the workforce and face additional challenges.

Teo et al. (2014) used quantitative methods to study adoption and use of technology by preservice teachers. Their study sample comprised of preservice teachers (n = 969) from five public universities in Thailand. Structural equation modeling (SEM) was used to analyze survey responses and to describe the relationships between factors predicting technology adoption. Teo et al. reported findings suggesting that these preservice teachers possessed a high level of technology acceptance and adoption. Moreover, the authors posited that the strong emphasis on knowledge and skills with technology throughout the educational system in Thailand was one of the reasons behind increased technology comfort and acceptance exhibited by preservice teachers.

A quantitative study was conducted by Liu (2011) to examine the relationships between perceived usefulness of technology, beliefs about teaching, experience with mentors, and adoption of technology. A random sample of preservice teachers (n = 401) attending a university in Taiwan was invited to complete a survey. SEM findings revealed that experience with mentors had a significant moderate effect on beliefs about teaching, which in turn had a significant positive effect on technology adoption and integration. Recently, Sadaf, Newby, and Ertmer (2016) conducted a mixed methods study aiming to identify factors that have the greatest effect on preservice teachers' planned adoption and integration of technology. The sample employed in the quantitative phase comprised of preservice teachers (n = 189) at a large midwestern university. Subsequently, qualitative interviews were conducted with a subset of 22 of these participants. The reported findings demonstrated that perceived usefulness and self-efficacy were predictive factors for intended technology adoption and integration by preservice teachers.

Personal Technology Use

In a study focusing on incoming freshmen in a teacher training program at a large northeastern university, Lei (2009) found that, although most participants had extensive experience with technology in their personal lives, they were only moderately confident in their abilities to incorporate technology in classroom instruction. However, as participants' technology proficiency increased, so did their interest in learning about additional technologies. Yeung, Tay, Hui, Lin, and Low (2014) also conducted a quantitative study aiming to examine and contrast preservice teachers' personal and professional use of digital technology. The participants in this study were student teachers at a university in Singapore (n = 312). The authors employed SEM to examine the factors affecting motivation to integrate classroom technology. The results yielded demonstrated that preservice teachers' motivation to use digital technology in the classroom increased with personal use and formal training. The effect was more pronounced among female teachers relative to their male peers.

Kumar (2011) conducted a quantitative research study aiming to explore preservice teachers' transfer of technology-related skills in their personal lives to educational environments. All undergraduate students enrolled in the teacher-training program at a large private university were invited to participate. A survey was administered to a convenience sample of preservice teachers that responded to the inquiry (*n* = 54). Findings reported by the authors revealed that, while preservice teachers were very comfortable with informal use of technology, most did not transfer those skills to academic work.

Weatherford (2015) conducted a mixed methods study of preservice teachers' perceptions about purposeful technology use in the classroom. The participants were preservice teachers (*n* = 50) enrolled in undergraduate and graduate level teacher credentialing programs at a midsized university in the United States. Quantitative data were collected using a survey, while focus group interviews yielded qualitative data that was later subjected to a detailed analysis. Findings yielded suggested that the majority of preservice teachers used digital technologies in their personal lives, which promoted feelings of adequate preparation for integration of classroom technology. Hogarty, Lang, and Kromrey (2003) conducted a quantitative study of teachers (*n* = 2,156) in a large southeastern district. Their findings revealed a positive relationship between personal use of technology and comfort, confidence, and attitude about technology.

Self-efficacy with Technology

Willis and Giles (2014) conducted a study of teacher candidates enrolled in an instructional technology class (*n* = 128) aiming to determine if the instruction received during the course resulted in increased self-efficacy with respect to technology use. The authors reported that the knowledge, skills, and confidence with technology increased from the pre-test given at the beginning of the class to the post-test administered at the end of the semester. In an earlier study with a similar aim, Albion (2001) employed a sample of college freshmen (*n* = 114) and found that students' self-efficacy with computers was positively correlated with the amount of time they spent using computers.

Abbitt (2011) employed exploratory quantitative design in a study aiming to elucidate the relationship between self-efficacy and the domains of the Technological Pedagogical Content Knowledge (TPACK) model in preservice teachers. The study sample comprised of preservice teachers (n = 45) enrolled in a technology integration course, which was a prerequisite for the early childhood education program. A multiple regression analysis was conducted on the data yielded by pre- and post-test surveys, which demonstrated significant strong correlations between self-efficacy and technological pedagogical content knowledge (TPACK), technological pedagogical knowledge (TPK), technological content knowledge (TCK), and technological knowledge (TK). In a similar quantitative study, Banas and York (2014) followed preservice teachers (n = 104) enrolled in a professional preparations methods course. The survey data was subjected to a paired samples t-test, which revealed a strong positive correlation between self-efficacy and gains in all TPACK constructs. Nathan (2009) provided evidence of this relationship in an earlier quantitative study by involving preservice teachers (n = 197) that had matriculated into the QUEST teacher education program at the University of Houston. The participants completed a 63-item survey and the resulting data were analyzed using a Pearson's correlation. The reported findings revealed a moderate relationship (r = .42, p < .01) between preservice teachers' self-efficacy with technology and TPACK.

Parchman (2013) employed a quantitative research design to study the attitudes, self-efficacy, and perceived usefulness of technology in a sample (n = 49) of preservice teachers. The study participants were students enrolled in similar instructional technology courses at three universities in West Tennessee. A survey instrument was completed by the participants as both pre- and post-test, allowing their data to be compared and efficacy of an instructional technology course ascertained. Results of the analysis revealed that the students that took part in the course scored higher on the self-efficacy with technology measure at the post-test. Southall (2012) conducted a mixed methods study to explore the self-efficacy of digital native preservice teachers regarding technology. The participants were students (*n* = 21) in the last two semesters of a teacher preparation program at a small mid-Atlantic university. For the quantitative phase of the study, the researchers administered the survey at pre- and post-test, to gauge the effectiveness of the intervention, while they collected qualitative data through interviews with nine of the survey respondents. Their findings indicate that students' self-efficacy improved from the beginning to the end of the semester, potentially due to the instructional technology course. On the other hand, most interviewees cited mentor support and access to technology as the main reasons for the improvement.

Wang, Ertmer, and Newby (2004) conducted quantitative research aiming to assess preservice teachers' self-efficacy in relation to technology integration in practice. The population studied was education students (*n* = 280) at a large midwestern university enrolled in an educational technology course. A 21-item Likert-type survey revealed significant gains in self-efficacy from the pre- to the post-test when preservice teachers were exposed to goal setting vicarious learning experiences within the instructional technology course.

Attitudes about Technology

Teo and Van Schaik (2012) used quantitative research methods to study preservice teachers' intention to use technology. The participants were preservice teachers (*n* = 429) at a teacher-training institute in Singapore. The authors employed SEM to analyze the survey data, reporting that attitude as an independent variable had the greatest influence on technology adoption, which was treated as the dependent variable.

Miranda and Russell (2011) utilized SEM to create a model for student use of technology under the direction of a teacher. They subjected the survey data gathered through the Use, Support, and Effect of Instructional Technology (USEIT) instrument for secondary data analysis. The sample comprised of 104 educators and administrators from all grade levels, working in the Greater Boston area. The researchers found that, when teachers were inexperienced with technology, they tended to report more obstacles to technological implementation. Lack of funding, a culture that did not foster technological innovation, and time constraints also had significant negative correlations with classroom technology use. In an earlier quantitative study, Kinzie et al. (1994) employed an interdisciplinary sample of students that included 111 preservice teachers from three major universities in different regions of the U.S.. Their findings revealed a positive correlation between attitudes toward technology and self-efficacy with technology.

Bai and Ertmer's (2008) quantitative research explored preservice teachers' attitudes towards technology and its use. The participants were preservice teachers (*n* = 96) enrolled in three courses as part of a teacher education program at a large midwestern university. Researchers performed a regression analysis, which revealed that formal instruction in an educational technology course was correlated with gains in preservice teachers' positive attitudes regarding technology.

Rehmat and Bailey (2014) conducted a qualitative study in order to examine preservice teacher attitudes and technology integration. The participants were preservice elementary teachers (*n* = 15) enrolled in a science methods course as part of a teacher-training program at a large southwestern university. Data was collected through open-ended surveys, lesson plans, and student artifacts. The resulting findings suggested that attitudes towards the implementation of technology improved after formal training in technology.

Wachira, Keengwe, and Onchwari (2008) conducted a mixed methods study to assess preservice teachers' beliefs about technology use. The participants were preservice teachers (*n* = 20) enrolled in a mathematics methods course at a large midwestern university. The authors gathered quantitative data on teachers' prior experiences with technology by analyzing responses to two questions in the required teaching portfolio. Qualitative data, on the other hand, was collected from the preservice teachers' personal philosophy statements and the researcher's notes from classroom discussions. The authors noted that the participants' conceptualization of appropriate technology use was subpar when compared with the National Council of Teachers of Mathematics Standards. Thus, they concluded that specific training and modeling of instructional technology are a priority for teacher education.

Yusop (2015) utilized a quantitative research design to describe the various independent and dependent variables influencing preservice teachers' planned use of technology. Participants in their study were preservice teachers (*n* = 100) enrolled in a bachelor of education program at a public university in Malaysia. A Likert-type survey was administered to assess the influence of attitude, subjective norms, and perceived behavioral control on behavioral intention and actual behavior. The findings, yielded by subsequent data analysis, suggest that attitude has a direct impact on behavioral intention, which in turn leads to actual behavior.

Perceived Usefulness of Technology

Davis (1989) developed a model to explain the factors that can predict current and future use of technology. The study participants (n = 152) completed a six-item survey that was developed through multiple rounds of validation and reliability testing. Davis found that perceived usefulness had the greatest correlation with current and future use of a technology. However, perceived ease of use was also significantly correlated with both current and planned use. In a more recent study, Sadaf et al. (2012) demonstrated that the perception of technology usefulness affected attitude toward technology. Similarly, Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur (2012) found that teachers who believed that technology was valuable for a specific purpose would utilize it in that manner.

In their quantitative study, Anderson, Groulx, and Maninger (2011) investigated the relationships between preservice teachers' attitudes, self-efficacy, beliefs about the usefulness of technology, and intentions to integrate technology in the classroom. They recruited a sample (n = 217) of preservice teachers enrolled in and instructional technology course at an American private university, who completed a 54-item survey at the end of the course. Analysis results revealed that self-efficacy was positively correlated with perceived value of technology (r = .42, p < .01), which was in turn positively correlated with intentions to use classroom technology in the future (r = 42, p < .01). Chen (2010) used a quantitative research design to study preservice teachers' use of technology and the mediating effects of perceived usefulness. The participants were preservice teachers (*n* = 206) in the U.S., who responded to an online survey. The resulting data were analyzed with SEM, the findings of which suggested that perceived value and self-efficacy both had a strong positive effect on technology use.

Knowledge and Skills with Technology

Teachers that deliberately focused on gaining instructional technology skills during their formal training as educators tend to feel that technology is valuable and have confidence in their own abilities (Akbaba, 2013). For example, Mayo et al. (2005) conducted a study of preservice teachers (*n* = 115) and found that training in instructional technology increased knowledge about technology from the pre-test to the post-test, which had a positive effect on participants' self-efficacy and comfort with technology. In their follow-up study, which was conducted once the original participants entered service (*n* = 24), the researchers found that the teacher candidates that attended a formal instructional technology class scored higher on all three outcomes compared to those who did not receive this training.

Pamuk (2012) conducted a qualitative study focusing on the technology integration practices of preservice teachers. The participants were junior level college students in a teacher education program (*n* = 78). The pertinent data was gathered through informal observations, open-ended questionnaires, interviews, and student coursework. Subsequent analysis yielded findings indicating that, although the preservice teachers had general knowledge about technology, a considerable number of the participants felt they had inadequate technology knowledge to support classroom implementation. Salentiny (2012) conducted a mixed methods study to explore attitudes, knowledge, and skills related to technology use among preservice teachers. The participants for the quantitative portion of the study were students (*n* = 275) in the education department of a rural public midwestern university, who completed a 48-item survey. The qualitative data was gathered through a focus group discussion in which a sample of respondents (*n* = 12) took part. The author reported 63.1% of the respondents believed the teacher training program had prepared them to use technology in the classroom.

Intrinsic Qualities

In a longitudinal quantitative study, Venkatesh (2000) developed a model which identified intrinsic qualities of enjoyment of subject matter and computer playfulness as predictors of technology acceptance. The study was conducted with four separate groups for a total of 246 participants. The participants completed a survey three times over a 90 day period. The survey was constructed of previously validated scales and piloted with a group of 30 undergraduate students. The intrinsic motivation scale was developed by Webster and Martoccio (1992) and has a Cronbach's alpha coefficient of .88.

Lee, Cheung, and Chen (2005) used structural equation modeling to identify factors that predict students' intentions to use technology. Intrinsic factors such as perceived enjoyment were found to be positively correlated with planned technology use in a sample of 628 university students.

Extrinsic Qualities of Good Students

A qualitative study by Manuel and Llamas (2006) found that there is agreement about the behavioral characteristics of good students. The sample was 50 students from a university in Spain who were interviewed about the traits of "good students." The following themes were identified which align with the current study:

- Plans and organizes their work adequately (Timeliness).
- Has enough resources to deal with problems (Autonomy).
- Gets good marks (High achievement).
- Not only passes a subject, but also learns (High achievement).
- Investigates (Relevant questions).
- Feels responsible for their own learning/self-educating (Autonomy).
- Demanding in their expectations for themselves (Attention to detail/High Achievement).

According to Reddy (2012), qualitative interviews on the traits of good student revealed the following themes:

> The concepts of focus, discipline, hard work, and not wasting time were common to many of the interviews…This subtheme also includes asking questions for clarification so that one does not stray from the teacher's purpose. Some participants also talked about going beyond the given assignments by reading or doing their own research. (Reddy, 2012, p. 134)

These findings are conceptually similar to the results of the present study.

Differences between the Online and F2F Instructors' Perceptions of Students

Heirdsfield, Davis, Lennox, Walker, and Zhang (2007) conducted a quantitative study to measure the differences between online and traditional students' learning experiences. The participants were 335 students in an early childhood teacher preparation program. Respondents reported a limited amount of student-teacher interaction. This is consistent with the teacher perceptions in the current study which revealed that instructors do not have enough interaction with online students to comment on their behaviors.

In a qualitative case study of online teacher candidates, Thompson, Miller, and Franz (2013) found that the participating students were unsuccessful in an online version of the course and cited lack of teacher contact as one of the reasons for retaking the class in a traditional format.

Summary of Findings

Technology supports the needs of the modern student entering the workforce. Adoption of appropriate classroom technologies ensures that students can take full advantage of the tools that facilitate positive learning outcomes. In several studies in this field, researchers found that students' self-efficacy with computers is positively correlated with the amount of time they spend using computers (Albion, 2001; Willis & Giles, 2014). Attitudes toward technology have an effect on classroom technology adoption, whereby higher levels of comfort and lower levels of anxiety pertaining to technology are predictive of more effective adoption (Kinzie et al., 1994). In addition, perceptions of usefulness are positively correlated with adoption of new technology (Davis, 1989; Sadaf et al., 2012; Ertmer et al., 2012). Moreover, knowledge and skills regarding technology have been shown to predict the extent to which preservice teachers will adopt technology in their classroom practice (Akbaba, 2013; Mayo et al., 2005).

Theoretical Framework

The theoretical framework for this study is based on a combination of expectancy theory and Bandura's social cognitive theory. Expectancy theory provides a framework for understanding the motivation to implement new technology, and Bandura provides support for the necessity of potential early adopters of technology to possess the self-efficacy, which leads to high motivational strength.

Albert Bandura's Social Cognitive Theory (1977) explains that self-efficacy is one's belief in his or her ability to successfully complete a task. An individual's perceived self-efficacy is has a direct relationship with the likelihood that he or she will attempt a task. In the context of the present study, this implies that teacher candidates who have low self-efficacy around technology are likely to avoid engaging in behaviors where they believe failure is probable.

Under Vroom's Expectancy Theory (1964), motivation is increased when a person believes that if he or she makes an effort that they will be able to complete a task, that the completion of the task will lead to a reward, and that the reward has value. A crucial part of this equation is the self-efficacy whereby a teacher has confidence is his or her ability to complete a task if effort is applied. Preservice teacher perceptions of the usefulness of the technology are also imperative because the result of effort must produce a reward that has personal value in order to increase motivation. Wigfield and Eccles (2000) elaborated on the predictors of achievement in expectancy-value theory. As individuals perceive that a task has extrinsic value in their lives, interest and motivation are increased leading to task engagement and mastery.

Conclusion

The review of literature supports the constructs of the study: (a) technology trends, (b) levels of use, (c) adoption of technology (d) personal technology use, (e) self-efficacy, (f) attitudes about technology, (g) perceptions of usefulness, and (h) knowledge and skills regarding technology. The following chapter will explain the methodology and procedures that were followed by the researcher in in order to accomplish the study objectives. Chapter 3 will commence with an overview of the research problem, followed by operationalization of theoretical constructs, and will describe research purpose and questions, research design, population and sample, instrumentation, and data collection procedures. It will also elaborate on the data analysis, and privacy and ethics considerations, before closing with the research design limitations.

CHAPTER III

METHODOLOGY

The purpose of this study was to examine the relationships between factors leading to early adoption of technology in preservice teachers. The study involved two groups of participants: (a) preservice teachers and (b) their instructional technology instructors. A purposeful sample of instructors teaching an undergraduate course in instructional technology as part of a formal teacher training program in a mid-sized suburban university in the Gulf Coast region was solicited to participate in semi-structured interviews. Qualitative data on student behaviors and performance indicative of early adoption of technology were collected from the instructors, along with mid-semester grades and coursework graded by rubric. Survey and demographic data were collected from a convenience sample of preservice teachers enrolled in the undergraduate instructional technology course. Quantitative data was analyzed using structural equation modeling (SEM), while a thematic coding process was used to analyze the qualitative data. This chapter will present an overview of the research problem, operationalization of constructs, research purpose and questions, research design, population and sample, instrumentation, data collection procedures, data analysis, validity, privacy and ethics considerations, and research design limitations for this study.

Overview of Research Problem

The demands of the modern workplace and the increasingly globalized job market imply that employees must possess technology aptitudes and skills. Research has shown that properly employed classroom technology increases student engagement, affective learning, and positive learning outcomes (Balanskat et al., 2007; Harrison et al., 2002; OECD, 2006). Several extant studies have shown that some teacher candidates will emerge as early adopters of new innovations, while others will require coaching and encouragement in order to begin utilizing the technology effectively (Aldunate & Nussbaum, 2013; Hall & Hord, 2011). The goal of this study is to develop a model to identify early adopters of technology that may be used during formal teacher training. The model would allow instructors to give potential early adopters more independence in learning while focusing instructional time on students who are more likely to struggle, the benefits of which have been supported in adult learning theory (Cox, 2015; Knowles, 2005).

Research Purpose and Questions

The purpose of this study was to examine the relationship between factors that lead to early adoption of technology in pre-service teachers. The current study addresses the following research questions:

RQ1: To what extent are the factors of personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology related to early adoption of technology in pre-service teachers?

RQ2: Is there a statistically significant mean difference between the pretest and posttest in personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology when preservice teachers complete an instructional technology course?

RQ3: What are instructional technology instructors' perceptions about the behaviors of early adopters of technology in their classes?

Operationalization of Theoretical Constructs

The study consists of the following six constructs: (a) personal use of technology, (b) self-efficacy, (c) attitude about technology, (d) perceived usefulness of technology, (e) knowledge about technology, and (f) adoption of technology. Personal use of technology is defined as the ways that teacher candidates utilize technological tools outside of the classroom and was measured using the *Students and Information Technology in Higher Education Survey* (Educause, 2008). Self-efficacy is defined as the extent to which a teacher candidate believes that he or she is capable of completing a technological task and reaching a goal and was measured using the *Computer Technologies and Strategies Scale* (Wang et al., 2004).

Attitudes about technology is defined as the overall levels of comfort and anxiety present in the teacher candidate and was measured using the *Attitudes toward Computer Technologies* (ACT) (Kinzie, Delcourt, & Powers, 1994). Perceived usefulness of technology is defined as the teacher candidates' beliefs about the advantages to using technology and was measured using the *Attitudes toward Computer Technologies* (ACT) (Kinzie et al., 1994). Knowledge and experience with technology was measured by the *Technological Knowledge Survey* component of the *Technological Pedagogical Content Knowledge* (TPACK) (Mishra & Kohler 2006). Adoption of technology is defined as acceptance and use of new technologies by preservice teachers enrolled in an undergraduate instructional technology course and was measured by students' mid-semester grades, the perceptions of course instructors in semi-structured interviews, and student work on an augmented reality assignment analyzed by the Aurasma course rubric (see Appendix G).

Research Design

A sequential mixed methods explanatory design was employed for this study (Ivankova, Creswell, & Stick, 2006). The design consisted of two distinct phases: an initial quantitative phase followed by a qualitative phase. The analysis of qualitative data helped to explain and elaborate on the quantitative data collected in the first phase. This research design is appropriate because multiple perspectives and data sources are necessary to fully answer the research questions and provide a thorough exploration of the quantitative results. A purposeful sample of instructors teaching an undergraduate course in instructional technology, as part of a formal pre-teacher training program in a suburban midsized university in the Gulf Coast region, were solicited to participate in semi-structured virtual focus groups. Qualitative data on student behaviors and examples of student work were also collected from the instructors. Survey data were collected from a convenience sample of preservice teachers enrolled in the undergraduate instructional technology course. Quantitative data were analyzed using structural equation modeling (SEM), and a thematic coding process was used to analyze the qualitative data and provide further triangulation of the data.

Population and Sample

For this study, the population consisted of all instructors in the teacher certification program at a mid-sized suburban university in the Gulf Coast region. The university has approximately 8,331 students and 946 preservice teachers in their School of Education. Table 3.1 describes the demographics of the instructors of the program in terms of gender, ethnicity, and instructional content area. The teacher certification program instructors are predominantly female (92.1%) and 61.8% identify as White (6.6% Black, 5.3% Hispanic, and 26.3% Unknown). Over half of the instructors work in the Teacher Education instructional content area (51.3%). The study involved two groups of participants: (a) technology instructors and (b) preservice teachers. A purposeful sample of five technology instructors teaching nine online and face to face (F2F) sections of an undergraduate course in instructional technology (INST 3313) and a convenience sample of their students enrolled in the course were solicited to participate.

Table 3.1

Teacher Certification Instructor Demographics

		Teacher Certification Instructors	
		Frequency (n)	Percentage (%)
1. Gender	Male	6	7.9
	Female	70	92.1
2. Race/Ethnicity	White	47	61.8
	Black	5	6.6
	Hispanic	4	5.3
	Unknown	20	26.3
3. Content Area	Early Childhood	11	14.5
	Instructional Technology	6	7.9
	Library	11	14.5
	Special Education	9	11.8
	Teacher Education	39	51.3

Participant Selection

For the qualitative portion of the study, a purposeful sample of five instructors of an instructional technology course (INST 3313) was solicited to participate. The majority of the instructors were female (80.0%, n = 4), and one respondent was male (20.0%). The participants were predominantly White (80.0%, n = 4), and one respondent was Black (20.0%). Four of the participants fell into the 40-49 age range (80.0%) with a single respondent in the 30-39 age group (20.0%). The majority of the instructors had a masters' degree and over 10 years of experience in teaching (80.0%, n = 4), and one participant had attained a doctoral degree (20.0%). Table 3.2 displays participant demographics in terms of gender, race/ethnicity, age, highest level of education, and years of teaching experience.

Table 3.2

INST 3313 Instructor Characteristics: Gender, Race/Ethnicity, Age, Highest Level of Education, and Years of Teaching Experience

	Preservice Teachers	
	Frequency (n)	Percentage (%)
1. Gender		
Male	1	20.0
Female	4	80.0
2. Race/Ethnicity		
White	4	80.0
Black	1	20.0
3. Age		
30-39	1	20.0
40-49	4	80.0
2. Highest Level of Education		
Master's degree	4	80.0
Doctorate	1	20.0
3. Years of Teaching Experience		
4-6 years	1	20.0
10 years or more	4	80.0

Instrumentation

Students and Information Technology in Higher Education (SITHE)

The *Students and Information Technology in Higher Education* (SITHE) survey was developed by the Educause Center for Academic Research (ECAR) at the University of Wisconsin in 2008 to measure students' personal and academic use of technology. The version in question was the fifth iteration of the annual survey, which was first piloted in 2004. Development began with an extensive literature review of other relevant surveys. Content experts in education and data collection collaborated to develop survey items and SPSS Text Analysis determined subscale groupings from the focus group transcripts. The 2008 version was administered to 50,274 students (including education majors) from

161 colleges in 11 countries. A principal components analysis using a varimax rotation and Kaiser normalization revealed three factors: (a) disposition, (b) personal usage, and (c) attitude.

The present study will only utilize the *Personal Usage* subscale. The 16-items on the *Personal Usage* subscale ask respondents "How often do you do the following (for work, school, or recreation)?" regarding specific technologies such as text messaging, social media, and online video games. The 7-point Likert scale ranges from 1 = *Never* to 7 = *Daily*. Composite scores range from 16-112, with higher scores indicating more frequent personal use of technology. The Cronbach's alpha coefficients for the scales were .85 (disposition), .86 (personal usage), and .91 (attitude).

Computer Technologies and Strategies Scale (CTS)

The *Computer Technologies and Strategies Scale* (CTS) survey was developed in 2004 by Wang, Ertmer, and Newby at Nova Southeastern University. Six subject matter experts in self-efficacy were solicited to provide feedback on the content validity of the instrument, and made suggestions for improvement. Construct validity was established through exploratory factor analysis. The survey was administered to 280 students in an Introduction to Instructional Technology course for preservice teachers. Exploratory factory analysis produced a two-factor solution, but the researchers were only interested in the first factor and removed the items related to the second factor from the instrument. The final version of the instrument contained 16-items which asked participants to rate their responses to statements from 1 = *Strongly Disagree* to 5 = *Strongly Agree*. Composite scores range from 16-80, with higher scores indicating higher self-efficacy with technology. Cronbach's alpha of this instrument is .94.

Attitudes toward Computer Technologies (ACT)

Kinzie, Delcourt, and Powers developed the *Attitudes toward Computer Technologies* (ACT) survey in 1994. The survey was validated with a pilot group of interdisciplinary sample of students that included 111 preservice teachers in addition to business and nursing students from three major universities in different regions of the U.S. The 19-item scale consists of 8-items measuring *Comfort and Anxiety* and 11-items measuring *Perceived Usefulness*.

Both the *Comfort/Anxiety* subscale and the *Perceived Usefulness* subscale follow the same structure. Each item consists of a statement rated on a 4-point Likert scale with responses ranging from 1 = *Strongly Disagree* to 4 = *Strongly Agree*. Composite scores range from 8 to 32 for the *Comfort/Anxiety* subscale with higher scores indicating higher levels of comfort with technology and composite scores range from 11 to 44 for the *Perceived Usefulness* subscale with higher scores indicating a higher levels of perceived usefulness of technology. The Cronbach's alpha of the entire instrument is .89 with .90 for the *Comfort and Anxiety* subscale and .83 for the *Perceived Usefulness* subscale.

Technological Pedagogical Content Knowledge (TPACK)

Mishra and Kohler developed the *Technological Pedagogical Content Knowledge* (TPACK) in 2006 to measure teachers' self-reported knowledge about technology. The researchers started with a review of relevant literature, and utilized three technology instruction experts to establish content validity in an iterative process. Reliability was established by administering the survey to 124 instructional technology students in a teacher training program at a large Midwestern University. Construct validity was established through principal components analysis using a varimax rotation, which revealed seven factors: Technological Knowledge (TK), Pedagogical Knowledge (PK), Content Knowledge (CK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK).

The present study will only utilize the items from the TK subscale. The TK scale consists of 6-items, such as "I frequently play around with technology" and "I know how to solve my own technological problems." Each statement is rated on a 5-point Likert scale where 1 = *Strongly Disagree* and 5 = *Strongly Agree*. Composite scores range from 6-30 with higher scores indicating higher levels of general knowledge about technology. The Cronbach's alpha for the each of the seven constructs are as follows: TK (α = .89), PK (α = .94), CK (α = .91), PCK (α = .94), TCK (α = .92), TPK (α = .95), and TPACK (α = .94).

Data Collection Procedures

Quantitative

Prior to beginning any data collection, the researcher obtained appropriate approval from the Committee for the Protection of Human Subjects (CPHS) at the participating university. Representatives from the school and the researcher met during the fall semester to review the purpose of the study, instrumentation, and data collection. A survey cover letter explained the purpose of the study and that participation is voluntary. A link to the online survey was emailed to all teacher candidates in the nine sections of the undergraduate instructional technology course at the beginning of the spring semester for the pre-test and near the end of the semester for the posttest. Percentage grades were collected about the students from the instructors in week four and week nine. This allowed the researcher to see a baseline of performance on the early assignments, which do not require much technological expertise and observe patterns of early adoption emerging by mid-semester. Additionally, grades on one specific augmented reality assignment were collected from the instructors at the conclusion of unit eight in the course. The rubric used to grade the augmented reality assignment is included in Appendix G. Coursework that earns a score representing the top quartile of the class was deemed exemplary and was used as confirmation of the potential early adopter's (PEA's) status as an early adopter of technology. Data were stored in two locations (laptop computer and data stick) and will be kept under password protection for five years before it is destroyed.

Qualitative

The researcher contacted the instructors of the instructional technology course prior to the beginning of the semester and arranged a virtual focus group session and one-on-one interviews near the midpoint of the semester. Virtual focus groups are an appropriate method of data collection since the course is about technology; it is assumed that the participants are well versed in the use of communication technologies. Also, since several of the instructors teach online sections and do not come to the campus, meeting face-to-face was impractical. The researcher sent invitations to the instructors with a link to virtual meetings using Adobe Connect software in February. During the 30 minute virtual focus group, the researcher asked interview questions about the hallmarks and strategies identified by the instructor in the exemplary coursework. In the focus group the instructors were not able to provide meaningful data and explained that it was too early in the semester to draw conclusions about student behaviors. After the percentage grades for the course and the augmented reality assignment were provided by instructors and the model was developed, the instructors were contacted again with the names of the PEAs in their respective sections of the course. Any student who was in the top quartile of his or her class on both assignments was designated as a PEA resulting in two to five PEAs per section of the course with a total of 27 students identified as PEAs from the sample of 169 preservice teachers. To arrange individual interviews, the instructors were contacted by email with the names of the PEAs in their sections of the class and were provided the questions that would be asked during the interview (see Appendix H). Two of the instructors were interviewed face to face, one participated in a virtual interview using Adobe Connect, and two gave their responses via email.

During the individual interviews the researcher interviewed the instructors about the behaviors of each PEA, and contacted each instructor by email with follow up questions. Table 3.3 shows the data collection schedule.

Table 3.3

Data Collection Timeline

	January	February	March	April
Pretest Survey	X			
Virtual Focus Group		X		
Baseline Grade Collection		X		
Mid-Semester Grade Collection			X	
Interviews				X
Posttest Survey				X

Data Analysis

Quantitative

To answer research question one, *To what extent are the factors of personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology related to early adoption of technology in pre-service teachers?*, survey data were downloaded from SurveyMonkey into Excel and imported into AMOS. Structural equation modeling (SEM) was utilized to determine if there was a statistically significant relationship between the independent variables of personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology related to the dependent variable of early adoption of technology. SEM allows for hypothesizing, analyzing, and depicting the relationships between variables and expands upon simpler regression and correlation models (Mueller, 1997). In the present study, SEM was used to conduct a path analysis of the direct and indirect relationships between factors and the strength of those relationships.

Early adoption of technology was operationalized as the mean of each preservice teacher's score earned on the augmented reality assignment and his or her mid-semester grade. Any student who was in the top quartile of his or her class on both assignments was designated as a Potential Early Adopter (PEA). The PEA status of each student was confirmed during the interviews with the instructors of the INST 3313 course. Model fit was assessed using the Goodness of Fit index (GFI), the Incremental Fit Index (IFI), and the Comparative Fit Index (CFI). According to Byrne (2001), a value over .80 is an acceptable fit and values approaching 1.0 are deemed excellent with these indices.

Correlation coefficients were computed among the five factors. A *p*-value less than .05 was required for significance.

To answer research question two, *Is there a statistically significant mean difference between the pretest and posttest in personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology when preservice teachers complete an instructional technology course?*, a two-tailed paired samples t-test was conducted to determine if there were mean differences in personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology from pretest to posttest. A *p*-value less than .05 was required for significance. Effect size was interpreted using the value of Cohen's *d*. A value $d < .2$ was deemed to be a small effect and $.2 < d <.8$ was labeled medium effect. Any *d*-value larger than .8 would have been designated as a large effect size.

Qualitative

Research question three, *How well does a model of early adoption of technology match actual patterns of technology adoption during formal teacher training?*, was answered using qualitative data to confirm and triangulate the findings of the quantitative model. Individual interviews with the instructional technology instructors were recorded on two separate audio recording devices and then transcribed in Microsoft Word. The resulting transcripts using pseudonyms for student names were imported into NVivo and coded by themes. Saldana (2013) describes a code as "most often a word or phrase that symbolically assigns a summative, salient, essence-capturing, and evocative attribute for a portion of language-based or visual data" (p. 3). The transcripts of the virtual focus group interviews were analyzed in NVivo to conduct data reduction, display data, formulate conclusions, and perform verifications (Coffey & Atkinson, 1996). Data reduction allowed the researcher to identify patterns and emergent themes. The transcript were first coded by participant, and then by large general themes. Next, the large themes were scrutinized to detect sub-themes within the data. The results were expressed in table form, with supporting quotes for each theme and sub-theme.

Validity

Triangulation of quantitative and qualitative data strengthened the results of this study. The researcher transcribed the interview sessions and conducted member checking by sending the preliminary results back to the groups for confirmation that it fairly represents the opinions expressed during the sessions. Throughout the research process, the researcher kept a journal recording the impressions and thoughts about the process. The researcher examined the journals as a form of data to consider bias in the data collection process.

Ethical and Privacy Issues

The researcher submitted the study for CPHS approval prior to starting data collection to ensure that participants are informed about the study procedures and that there are no ethical concerns that the researcher has overlooked. Due to the nature of the study and the need to confirm the quantitative model through qualitative triangulation, the survey was not anonymous, but aliases are used throughout the current study. Participants were assured that their responses to individual questions would not be shared, and only the PEA status was disclosed to the instructor during the qualitative interviews. During the virtual focus group and interviews, researchers asked participants not to disclose the discussions occurring there, but researcher made it clear that confidentiality could not be guaranteed. All data will be stored under password protection on a laptop and data stick for five years before it is destroyed.

Research Design Limitations

This study has several limitations to internal and external validity. First, the participants are a convenience sample by virtue of their enrollment in the course being studied, so generalizability of this study is limited to teacher candidates at the participating university. This limits external validity because preservice teachers enrolled at other institutions may behave differently than the study sample. Second, participants willing to respond to an online survey about technology may already have higher levels of interest and self-efficacy with technology than those who decline to respond, potentially resulting in sampling error. Third, there may be confounding variables if the teacher candidates that self-select into online sections of the course are already very different from the students in the face-to-face sections. Given that the researcher will not control for learning method, this may obscure trends in the data. Fourth, instructors in online sections may have more trouble identifying observable behaviors than the instructors of traditional F2F classes. Fifth, the nature of self-reported data presents a threat to validity since the researcher cannot determine if the participants' responses are accurate.

Conclusion

Chapter 3 discussed the purpose of the study, reiterated the research questions and described the research design that was utilized in this study. The purpose of this study was to examine the relationship between factors that lead to early adoption in pre-service teachers. The quantitative data was collected using an online survey, while the qualitative data was obtained through semi-structured focus groups and interviews regarding instructors' perceptions of the early adopters in their classes in which the preservice teachers are enrolled. The following Chapter 4 will report the findings of the data analysis and will align them with each of the research questions.

CHAPTER IV

RESULTS

The purpose of this study was to examine the relationships between factors that lead to early adoption of technology in preservice teachers. This chapter presents the results from the quantitative and qualitative data analysis of the study. Survey, interview, and student course grades were analyzed regarding personal use of technology, self-efficacy, attitude about technology, perceived usefulness of technology, knowledge about technology, and adoption of technology. This chapter begins with a presentation of the participant demographics, instrument reliability, and data analysis for each of the three research questions, concluding with a summary of the findings.

Demographic Characteristics of the Participants

Prior to the beginning of the spring 2016 semester, the researcher contacted via email the six instructors that were scheduled to teach INST 3313, Survey of Instructional Technologies. The course is designed to provide pre-service teachers with experience in the application of productivity tools, educational software, presentation graphics, multi-media, and telecommunication technologies. The instructors were solicited to have their students complete a survey, participate in one virtual focus group and one interview, and to provide data on students' grades. A purposeful sample of five instructors agreed to participate in this study and one instructor did not respond. The students in the nine sections of INST 3313 taught by those instructors formed a convenience sample of preservice teachers (n = 169). Five of the sections were taught in a traditional classroom format representing 53.5% of the students (*n* = 90) and the four online sections contained 46.7% of the students (*n* = 79). The majority of the students were female (81.1%, *n* = 137) and 18.3% were male (*n* = 31). One person did not respond to the question on gender. Almost half of the preservice teachers are White (47.9%, *n* = 81) and 38.5% are Hispanic (*n* = 65). The mean age of the preservice teachers is 32.8 years, and almost half of the participants are pursuing the EC-6 certification (48.5%, *n* = 82). Table 4.1 presents the demographics of the preservice teachers.

Table 4.1

Preservice Teacher Characteristics: Gender, Race/Ethnicity, Age, Course Format, and Certification Level

	Preservice Teachers	
	Frequency (n)	Percentage (%)
1. Gender		
Male	31	18.3
Female	137	81.1
2. Race/Ethnicity		
White	81	47.9
Hispanic	65	38.5
Black	10	5.9
Asian	7	4.1
Two or More Races	3	1.8
American Indian or Alaskan Native	1	.6
Native Hawaiian or Pacific Islander	1	.6
Other	1	.6
3. Age		
18-24	98	58.0
25-34	50	29.6
35-44	18	10.7
45-54	3	1.8
2. Course Format		
Classroom	90	53.3
Online	79	46.7
3. Certification Level		
EC-6^{th}	82	48.5
4^{th}-8^{th}	23	13.7
8^{th}-12^{th}	48	28.6
Early Childhood, non-certification	1	.6
Not an education major	14	8.3

Instrument Reliability

Cronbach's alphas were calculated to assess the reliability of the instrument and its subscales used in the study and are presented in Table 4.2. The reliability coefficients range from .76 to.93. Reliability coefficients that are greater than .70 are considered acceptable (Fraenkel & Wallen, 2006).

Table 4.2

Reliability Coefficients for Instrumentation

	Cronbach's α Mizell, 2016	Cronbach's α Educause, (2008), Wang, Ertmer and Newby, (2004), Kinzie, Delcourt and Powers, (1994), Mishra and Kohler, (2006)
1. Personal Use of Technology Scale	.81	.86
2. Self-Efficacy with Technology Scale	.93	.94
3. Attitude Toward Technology Scale	.88	.90
4. Perceived Usefulness of Technology Scale	.76	.83
5. Knowledge and Skills about Technology Scale	.91	.89
6. Overall Instrument	.91	---

*Cronbach's α for the SITHE was obtained from Educause (2008). Cronbach's α for the CTS was obtained from Wang, Ertmer and Newby, (2004). Cronbach's α for the ACT was obtained from Kinzie, Delcourt and Powers, (1994). Cronbach's α for the TPACK was obtained from Mishra and Kohler, (2006)

Research Question One

Research question one, *To what extent are the factors of personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology related to early adoption of technology in pre-service teachers?*, was answered using structural equation modeling (SEM) to determine if there was a statistically significant relationship between the factors of personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology related to early adoption of technology. Early adoption of technology was operationalized as the mean of each preservice teacher's score earned on the augmented reality assignment and his or her mid-semester grade. Any student who was in the top quartile of his or her class on both assignments was designated as a PEA. The PEA status of each student was confirmed during the interviews with the instructors of the INST 3313 course.

Figure 1 depicts the SEM model of the relationships between personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology, and early adoption of technology. The Goodness of Fit index (GFI) was .935, the Incremental Fit Index (IFI) was .892, and the Comparative Fit Index (CFI) value was .889. According to Byrne (2001), a value over .80 is an acceptable fit and values approaching 1.0 are deemed excellent. Correlation coefficients were computed among the five factors with interactions in the specified model. A *p*-value less than .05 was required for significance. The correlational analyses presented in Table 4.3 showed that seven out of the eight included correlations were significant.

Figure 1

Structural Equation Model of Factors Affecting Early Adoption of Technology

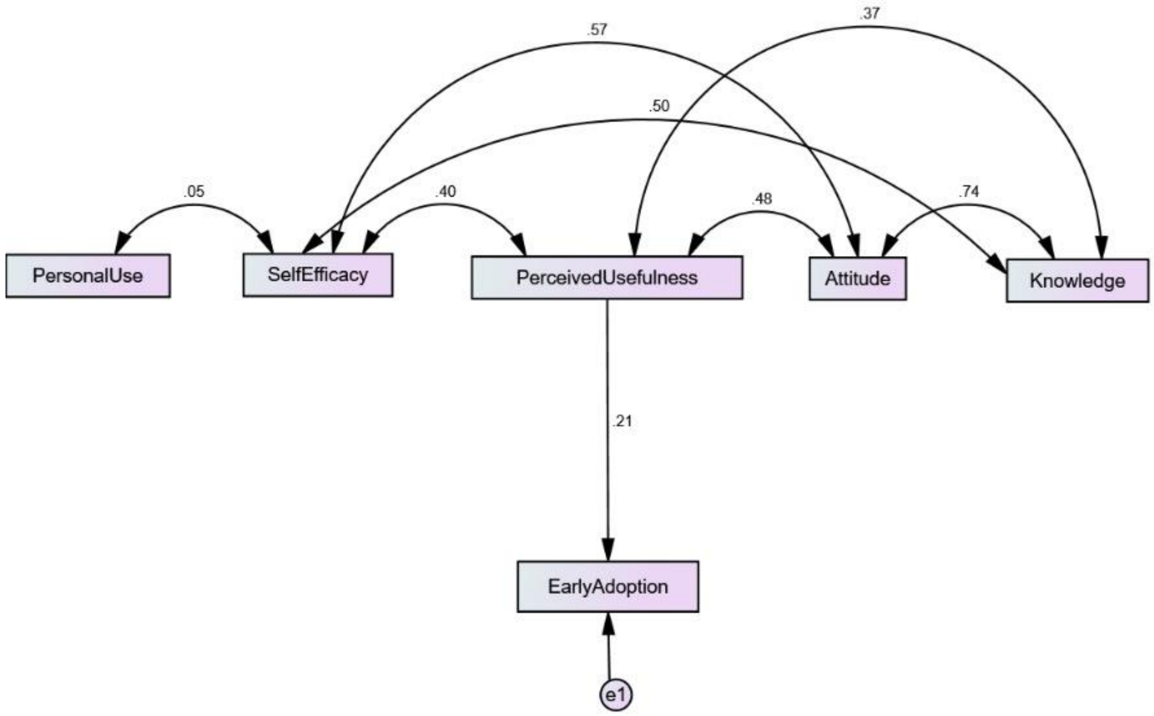

Figure 1. Path analysis of the direct and indirect relationships between factors affecting early adoption of technology. Rectangles in the top row denote dependent variables and the rectangle at the bottom represents the independent variable of Early Adoption, which is measured with the grades on an augmented reality assignment and mid-semester percentage grades.

Table 4.3

Correlation Coefficients among Personal Use, Self-Efficacy, Attitude, Perceived Usefulness, and Knowledge and Skills, and Early Adoption of Technology

	Personal Use (USE)	Self-Efficacy (SE)	Attitude (ATT)	Perceived Usefulness (PU)	Knowledge and Skills (KS)
USE					
SE	.05				
ATT	---	.57*			
PU	---	.40*	.48*		
KS	---	.50*	.74*	.37*	
ADOPT	---	.---	---	.21*	---

*Statistically significant (p < .05)

Research Question Two

Research question two, *Is there a statistically significant mean difference between the pretest and posttest in personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology when preservice teachers complete an instructional technology course?,* was answered by conducting a two-tailed paired samples t-test to determine if there were differences in personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology from pretest to posttest. A *p*-value less than .05 was required for significance.

Results indicate (see Table 4.4) that there was a statistically significant mean difference in the personal use of technology from pretest to posttest when preservice teachers take a course in instructional technology, $t(86) = 4.2$, $p < .001$, $d = .45$ (medium effect size), $r^2 = .05$. Preservice teachers used technology in their personal lives more frequently ($M = 3.97$) at the conclusion of the instructional technology course than at the beginning of the semester ($M = 3.60$). Five percent of the variation in preservice teachers' personal use of technology can be attributed to the instructional technology course.

Table 4.4

Paired t-test: Pre-scores and Post-scores on Personal Use of Technology

	N	M	SD	*t*-value	df	*p*-value	d-value	r^2
1. Pre-Scores	87	3.60	.76	4.2	86	<.001	.45	.05
2. Post-Scores	87	3.97	.80					

*Statistically significant (p < .05)

Results indicate (see Table 4.5) that there was a statistically significant mean difference in self-efficacy with technology from pretest to posttest when preservice teachers take a course in instructional technology, $t(86) = 4.0$, $p < .001$, $d = .43$ (medium effect size), $r^2 = .04$. Preservice teachers felt a stronger sense of self-efficacy with technology ($M = 3.74$) at the conclusion of the instructional technology course than at the beginning of the semester ($M = 3.53$). Four percent of the variation in preservice teachers' self-efficacy with technology can be attributed to the instructional technology course.

Table 4.5

Paired t-test: Pre-scores and Post-scores on Self Efficacy with Technology

	N	M	SD	*t*-value	df	*p*-value	d-value	r^2
1. Pre-Scores	87	3.53	.47	4.0	86	<.001	.43	.04
2. Post-Scores	87	3.74	.45					

*Statistically significant ($p < .05$)

Results indicate (see Table 4.6) that there was not a mean difference in the perceived usefulness of technology from pretest to posttest when preservice teachers take a course in instructional technology, $t(86) = 1.2$, $p = .25$. Preservice teachers had similar perceptions about the usefulness of technology ($M = 3.59$) at the conclusion of the instructional technology course as at the beginning of the semester ($M = 3.55$).

Table 4.6

Paired t-test: Pre-scores and Post-scores on Perceived Usefulness of Technology

	N	M	SD	*t*-value	df	*p*-value
1. Pre-Scores	87	3.55	.76	1.2	86	.25
2. Post-Scores	87	3.59	.80			

*Statistically significant ($p < .05$)

Results indicate (see Table 4.7) that there was a mean difference in attitudes about technology from pretest to posttest when preservice teachers take a course in instructional technology, $t(86) = 4.3$, $p < .001$, $d = .47$ (medium effect size), $r^2 = .05$. Preservice teachers had significantly more positive attitudes about technology ($M = 3.43$) at the conclusion of the instructional technology course than at the beginning of the semester ($M = 3.22$). Five percent of the variation in preservice teachers' perceived usefulness of technology can be attributed to the instructional technology course.

Table 4.7

Paired t-test: Pre-scores and Post-scores on Attitude about Technology

	N	M	SD	*t*-value	df	*p*-value	d-value	r^2
1. Pre-Scores	87	3.22	.62	4.3	86	<.001	.47	.05
2. Post-Scores	87	3.43	.54					

*Statistically significant (p < .05)

Results indicate (see Table 4.8) that there was a statistically significant mean difference in the knowledge and skills with technology from pretest to posttest when preservice teachers take a course in instructional technology, $t(86) = 4.9$, $p < .001$, $d = .53$ (medium effect size), $r^2 = .05$. Preservice teachers used technology in their personal lives more frequently ($M = 3.20$) at the conclusion of the instructional technology course than at the beginning of the semester ($M = 2.93$). Five percent of the variation in preservice teachers' knowledge and skills with technology can be attributed to the instructional technology course.

Table 4.8

Paired t-test: Pre-scores and Post-scores on Knowledge and Skills with Technology

	N	M	SD	*t*-value	df	*p*-value	d-value	r^2
1. Pre-Scores	87	2.93	.69	4.9	86	<.001	.53	.05
2. Post-Scores	87	3.20	.62					

*Statistically significant ($p < .05$)

Research Question Three

Research question three, *How well does a model of early adoption of technology match actual patterns of technology adoption during formal teacher training?,* was answered using qualitative data to confirm and triangulate the findings of the quantitative model. Qualitative data was collected from interviews with five of the instructors of the instructional technology class to confirm that the preservice teachers identified by the model as PEAs demonstrated behaviors and coursework that were consistent with that conclusion. A virtual focus group was conducted during the fourth week of the semester but no meaningful data was obtained. Instructors explained that it was too early in the semester to identify trends in student behaviors, especially in the online sections of the course. Instructors provided mid-semester grades and scores for the augmented reality assignment. Any student who was in the top quartile of his or her class on both assignments was designated as a PEA resulting in two to five PEAs per section of the course with a total of 27 students identified as PEAs from the sample of 169 preservice teachers. The students (identified by pseudonyms) that were designated as PEAs and their corresponding grades are presented in Table 4.9. To arrange individual interviews, the instructors were contacted by email with the names of the PEAs in their sections of the class and were provided the questions that would be asked during the interview (see Appendix H). Two of the instructors were interviewed face to face, one participated in a virtual interview using Adobe Connect, and two gave their responses via email. All of the instructors agreed to be identified by their real names. The interviews were recorded on two separate audio recording devices and then transcribed in Microsoft Word. The resulting transcripts using pseudonyms for student names were imported into NVivo and coded by themes. The resulting codes were collapsed into three larger categories, leading to three themes with eight sub-themes.

Table 4.9

Potential Early Adopters, Mid-Semester Grades, Augmented Reality Score and Instructor Confirming PEA Status

Course Section of INST 3313	Potential Early Adopter (pseudonyms)	Mid-Semester Grade (%)	Augmented Reality Score (%)	Instructor Confirming PEA Status
01	Mary Anderson	100	100	George
01	Carrie Bates	88	100	George
01	Darla Cane	89	100	George
01	Carmen Davis	100	100	George
02	Lisa Ellis	100	100	George
02	Jane Ferguson	99	100	George
02	Steve Gomez	90	100	George
02	Kelly Hansen	100	100	George
03	Mandy Ivers	100	100	George
03	Edward Johnson	91	100	George
04	Donna Knight	99	100	Wilson
04	Dana Lynch	98	100	Wilson
06	Deanna Marks	100	100	Wilson
06	Carl Nelson	100	100	Wilson
07	Bob Olson	100	100	Richards
07	Richard Phillips	100	100	Richards
07	Valerie Quincy	98	100	Richards
08	Amy Roberts	99	100	Simons
08	Jeanette Swanson	98	100	Simons
08	Holly Travis	99	100	Simons
08	Lucille Underwood	99	100	Simons
09	Marissa Vincent	100	100	Carlson
09	Alexis Wilson	99	100	Carlson
11	Karen Young	100	100	Simons
11	Julia Adams	100	100	Simons
11	Maggie Benson	100	100	Simons
11	Kaitlyn Cooper	99	100	Simons

In all 27 cases, the instructors agreed that the students identified as PEAs were in fact the early adopters of technology in their respective classes. Hence, the conclusions drawn by the quantitative model were supported and triangulated by the qualitative data.

The results of the thematic analysis demonstrated that the instructors perceived common traits in the students identified by the quantitative model as early adopters. These observable behaviors are not specifically connected to the intrinsic constructs and perceptions reported by the preservice teachers in the quantitative phase, although they may be tangentially related. Table 4.10 depicts the frequency of each parent and child code cited by the participants. Next, each of the themes are defined and supported with quotes from the participants.

Table 4.10

Frequencies of Codes in Qualitative Interviews

Parent Code	Child Code	Frequency
Intrinsic qualities	Enjoyment of subject matter	7
	Coaching other students	7
Extrinsic qualities of good students	Attention to detail	7
	High achiever	7
	Relevant questions	4
	Autonomy	3
	Timeliness	3
Differences between online and F2F instructor perceptions	Inability to observe behaviors	4
	Student contact is problem focused	3

Intrinsic Qualities

Instructors of the instructional technology course identified two aspects of PEA behavior, enjoyment of subject matter and the willingness to coach other students, which can be considered intrinsic qualities of an early adopter. Supporting quotes for each sub-theme seem to convey that these are inherent traits, which are categorically separate from the qualities of overall good students.

Enjoyment of subject matter. Enthusiasm for the content was described by several instructors as one of the traits exhibited by early adopters of technology. Kelly George described the passion of her student thus: “She understands it. She loves it. She thinks it's exciting, so ... Yeah.” Another instructor, John Wilson, went further to explain the reason why some students enjoy this subject: “I think this is due in part to students finding educational technology alluring and more engaging than the pencil and paper type of learning.” Since all of the PEAs demonstrated high levels of self-efficacy and a positive attitude about technology, it is not surprising that they tend to enjoy the subject matter more. Hence, Karen Carlson’s observation that the students who were performing poorly in her class at mid-semester did not seem to enjoy the subject matter as much as the PEAs is further support for this correlation.

Willingness to coach other students. Students who achieved early mastery of technology demonstrated a willingness to reach out to students who were struggling with the same lessons. When asked if the students chosen as PEAs by the model tended to be classroom leaders, Tracy Richards talked about Bob, one of the preservice teachers that demonstrated such mastery of the content when assisting his classmates that he “could probably teach that course.”

John Wilson made the following statement about the two students flagged by the model as PEAs: “That class, it's an interesting dynamic but those two would be the students that I would choose as a coach where they can coach other students and be fine.” He gave more detail about his student Deanna’s tendency to make certain that all of the online course components are functional and figure out the steps to successfully complete each project before the rest of her class attempts the assignments:

> She does work with the group and she does make sure that things are there so she kind of helps other people out with that, ‘You didn't get it, I got it. Okay this how you do it and stuff right there,’ so she probably has more experience with some of the basics of the course.

This statement gives support to the concept that early adopters have a tendency to coach and assist the students in class who do not have a strong affinity for technology.

Extrinsic Qualities of Good Students

The second theme, extrinsic qualities of good students, contained five sub-themes related to qualities shared by all good students: attention to detail, high achievement, relevant questions, autonomy, and timeliness. This is an important theme, because without the classroom interactions, which allow the F2F instructors to observe behaviors, the online instructors were generally unable to distinguish between early adopters of technology and generally good students.

Attention to detail. One of the themes consistently mentioned by the instructors during their interviews was that the PEAs possessed an attention to detail that set them apart from the rest of the class. One instructor, Kelly George, gave this example of her student’s work “Her lesson plans are perfect, she writes them perfect. I don't know how that happens, but some of them could take a lesson from her because she's really good at it.” Tracy Richards spoke about another student with similar behaviors that “has really gone through that course with a fine tooth comb and he will point out any little discrepancy.” It is possible that the affinity for technology shared by the PEAs allows them to focus on the intricacies of the assignment since they have a firm grasp on the broad concepts. Conversely, Karen Carlson noted that students who struggle with technology tend to overlook details in the assignments. Similarly, Tracy Richards reported that lagging adopters seem to overlook details, saying “They would often leave out key parts of the assignment.”

Autonomy. Instructors identified the ability of the students to work independently and complete high quality work without assistance as another hallmark of an early adopter of technology. Kelly George made the following statements about the autonomy of her early adopters: “They never ask for help” and “She must have picked up some technology from something because it's always easy for her. She never has to ask questions and she can always get it first draw.” Tracy Richards said that she has more students than usual who are able to meet her expectations without assistance “I have a really good group. They complete their assignments, they follow the rubric.” In addition, Tracy Richards spoke specifically about her student Valerie saying “She never has to question how to do anything.”

High achievement. It makes intuitive sense that a student flagged as an early adopter of technology would get higher grades than the lagging adopters, but this point did not go unspoken by the interviewees. The following statement from Kelly George was representative of the remarks coded under this theme: “Yeah, she (one of her PEAs) has one of the highest grades in here. It's just that her stuff is spot on. It's excellent. She turns it one time and she gets it every time.” Tracy Richards also saw this trait in her student Richard. She noted his impeccable coursework and his drive to succeed: “I mean he's on it. I would say that he's probably beyond a high achiever.” John Wilson agreed that achievement is a consistent theme with early adopters when he spoke about Deanna who “you can tell has high goals for herself so I think not just in my class but in probably all her classes, she wants to make sure that she does her best." Kelly George seemed to equate general achievement with early adoption of technology when she said, "I think the majority of those not considered early adopters have a lot on their plate and don't have the time to put into it. I don't think it's that they can't do it (technology)."

Relevant questions. Although the ability to complete assignments without seeking assistance was a trait mentioned by the instructors, so was the tendency to ask questions that demonstrated solid comprehension of the topic. Kelly George describes her student Carmen's high-level inquiries:

> She will sometimes ask for clarification on something. She usually gets things correct, though. Sara I would say is definitely an early adopter because she's very ... She loves all the stuff and she always wants approval and, 'Does this look right? Is this good?' Da, da, da... I would say she's one."

Regarding Carl and Deanna, the two early adopters in one class, John Wilson confirmed that asking relevant questions was part of the profile of his early adopters. "Those two, they actually ask questions, a very good component." When asked about Donna and Dana, John Wilson responded, "I believe actually both of those students, they both ask questions if they don't understand the steps of the assignment. They make sure that they ask if they didn't get it."

Timeliness. Completing assignments by the deadline or ahead of schedule was cited as another behavior shared by early adopters of technology. Kelly George said that her early adopter Carmen "always turns her work in ahead of time. She's on it." Andrea Simons's remarks also cited the timeliness of early adopters that "always had their work done on time." John Wilson spoke about a student who was proactive about contacting him to let him know about technology platforms that were not working properly, noting that she was always the first to start working on any assignment: “She's always was ahead of the course so she is one the one that told me, ‘But hey, the links on this don't work. Can you pick it up? I'm trying to get it done.’” Conversely, Tracy Richards reported, “The students who aren’t early adopters seemed to have more issues using the technology and wouldn’t submit on time because of one issue or another.”

Differences Between the Online and F2F Instructors’ Perceptions

During the interviews, the F2F instructors were able to comment on students’ in class behaviors that supported the identification of PEAs as true early adopters of technology. In stark contrast, the online instructors consistently reported an inability to comment on student behaviors, relying solely on timely completion of assignments and high performance. This formed the third theme and two emergent sub-themes were identified in this overarching theme:

Inability to observe behaviors. Throughout the study, when the online instructors were asked to describe student behaviors, a common theme in their responses was that since they only have online interaction with their students that they could not provide feedback on the way that the preservice teachers act and interact. Karen Carlson said, “Remember that my class is 100 percent online, so any tendencies you have noticed online are the same that I have noticed.” This statement seemed to indicate that she believed the researcher had access to her online classroom, which was not the case. Andrea Simons expressed the same concerns when she said “It is hard for me to gauge some of these things since it is an online class.” Tracy Richards echoed these sentiments during the focus group by saying “I’m not even sure how to answer the question. I mean, all of my students are online so I can only tell you how they do on their assignments. As far as leadership or other behaviors, I don't really see that."

Online student contact is problem focused. Once the online instructors conveyed the message that they can't report on behaviors that they do not see, the researcher asked if there are interactions over email that demonstrate the PEAs levels of comfort or self-efficacy with technology. The online instructors were able to send examples of the email communications they had received from their PEAs, but it seemed that these students only reached out to their instructors when there was some sort of problem or technical difficulty. Karen Carlson sent this excerpt from her PEA Alexis Wilson:

> I was emailing to let you know that my assignment for unit ten will be late. I'm not sure if you know but I am expecting and last night I thought I was going into labor. Long story short, it was a false alarm and I am just now getting home. I have parts of the assignment complete but I will not finish by tonight. So just a heads up that it will not be on time. Thank you for understanding.

Another PEA, Melissa Vincent, only contacted her instructor when she received a zero on an assignment she had submitted: "Here is the link to my video. I'm sorry, I didn't realize I had it set to private."

These communications are consistent with the findings that early adopters of technology only email their instructors if there is a problem that they are unable to solve on their own. This may be due to the higher levels of autonomy and attention to detail which have previously been discussed.

Summary of Findings

Surveys were sent to 169 preservice teachers enrolled in INST 3313. The population was even distributed by gender and the majority of participants were Caucasian. Structural equation modeling resulted in a model that adequately described the factors affecting early adoption of technology and demonstrated that perceived usefulness of technology was the most important factor directly influencing technology adoption. Quantitative analysis resulted in statistically significant mean differences between the pretest and the posttest in personal use of technology, self-efficacy with technology, attitude about technology, and knowledge and skills with technology. The only factor that did not significantly change over time was perceived usefulness of technology. Qualitative analysis illustrated that there were similarities in the perceptions of the instructors of INST 3313 with regards to the behaviors of early adopters of technology. Three themes and eight sub-themes were matched to participant responses: intrinsic qualities contained the subcategories of enjoyment of subject matter and willingness to coach other students. Extrinsic qualities of good students included attention to detail, autonomy, high achievement, relevant questions, and timeliness. Differences between online and F2F instructors were noted, specifically in their inability to comment on student behaviors and the perception that online student contact is problem focused. Responses from participants supported the quantitative model of factors leading to the early adoption of technology among preservice teachers.

Conclusion

This chapter presented the results of the quantitative and qualitative data analysis of this study. Structural equation modeling demonstrated that perceived usefulness of technology was the sole factor directly influencing technology adoption, but there were significant correlations between the factors of personal use of technology, self-efficacy with technology, attitude about technology, and knowledge and skills with technology. Quantitative analysis resulted in statistically significant mean differences between the pretest and the posttest in personal use of technology, self-efficacy with technology, attitude about technology, and knowledge and skills with technology. Perceived usefulness of technology was the only factor that did not change over time. Qualitative analysis illustrated that there were similarities in the perceptions of the instructors of INST 3313 with regards to the behaviors of early adopters of technology.

In the next chapter, the findings of the present study will be compared and contrasted with prior studies in the research literature. Additionally, the implications of the results of this study will be discussed with considerations toward instructional practices and impact on preservice teachers. Further avenues for research will also be identified.

CHAPTER V

SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this study was to examine the relationships between factors that lead to early adoption in preservice teachers. This study was completed during the spring of 2016 with 169 preservice teachers from a midsized suburban university in the Gulf Coast region who were solicited to participate in this study. Instructors were solicited to participate in focus groups and interviews. Structural equation modeling, paired sample t-tests, and thematic coding were used to analyze the data collected. This chapter includes a summary of the findings, implications, and recommendations for further research.

Summary

The research questions address whether or not there were identifiable factors that could form a model of the technology adoption behaviors of preservice teachers. Research question one asked to what extent are the factors of personal use of technology, self-efficacy with technology, attitude about technology, perceived usefulness of technology, and knowledge and skills with technology related to early adoption of technology in pre-service teachers. Quantitative analysis demonstrated that the independent variable Perceived Usefulness had the strongest direct effect on the dependent variable Early Adoption of Technology. These results are similar to the results from extant research that demonstrates a positive correlation between perceived usefulness of technology and technology adoption (Anderson et al., 2011; Chen, 2010;

Davis, 1989; Ertmer et al., 2012, Sadaf et al., 2016). The findings are also consistent with the theoretical framework of expectancy-value theory which says that when individuals perceive that a task has extrinsic value in their lives, interest and motivation are increased leading to task engagement and mastery (Wigfield & Eccles, 2000). The indirect effects between the dependent variables which were observed in the present study are also mirrored in previous research. Researchers have noted positive correlations between self-efficacy and attitude (Kinzie et al., 1994), while Anderson, Groulx, and Maninger, (2011) saw a relationship between self-efficacy and perceived usefulness. Other researchers suggest that perceived usefulness is the greatest determinant of attitude regarding technology (Parchman, 2013; Yusop, 2015), which is consistent with the current study's findings. Hogarty, Lang, and Kromrey (2003) and Willis and Giles (2014) identified the connection between personal use and self-efficacy which was also found in the present study. Building preservice teachers' knowledge and skills through formal training and instructor has yielded gains in self-efficacy (Akbaba, 2013; Albion, 2001; Banas & York, 2014; Mayo et al., 2005; Nathan, 2009; Salentiny, 2012; Southall, 2012; Willis & Giles, 2014) and improved attitude regarding technology (Abbitt, 2011; Bai & Ertmer, 2008; Miranda & Russell, 2011; Wachira, Keengwe, & Onchwari, 2008; Willis & Giles, 2014).

However, the present study found a lack of significant relationship between personal use and attitude regarding technology, which is contrary to extant research (Hogarty, Lang, & Kromrey, 2003; Lei, 2009; Yeung et al., 2014). It is possible that the present study population simply behaves differently than the previously studied groups. Since the current study data were collected through an online survey, it is worth considering that participants willing to respond to an online survey about technology may already have more positive attitudes about technology than those who decline to respond, which might have changed the data outcomes.

Research question two asked if the model of early adoption of technology changed between the pretest and the posttest when a treatment of an instructional technology course is given to preservice teachers. Quantitative analysis demonstrated that there was a significant difference between the pretest and posttest means for personal use of technology, self-efficacy with technology, attitude about technology, and knowledge and skills with technology. These results support previous research demonstrating the link between gains in these variables and formal training and mentoring (Abbitt, 2011; Akbaba, 2013; Albion, 2001; Bai & Ertmer, 2008; Banas & York, 2014; Mayo et al., 2005; Miranda & Russell, 2011; Nathan, 2009; Salentiny, 2012; Southall, 2012; Wachira, Keengwe, & Onchwari, 2008; Willis & Giles, 2014). The present study did not find a statistically significant difference in the pretest and posttest means of perceived usefulness of technology. In similar findings, Parchman (2013) explored the attitudes, self-efficacy, and perceived usefulness of technology of preservice teachers and also did not find a change in perceived usefulness from the pretest to the posttest.

Research question three asked how well a model of early adoption of technology matched instructor perceptions of actual patterns of technology adoption during formal teacher training. Qualitative analysis demonstrated agreement from the instructors regarding the model's identification of early adopters, thus confirming and triangulating the quantitative data. Emergent themes in the qualitative data revealed consistency about instructor perceptions of early adopters' behaviors, including the intrinsic factors of enjoyment of subject matter and the willingness to coach other students, extrinsic factors related to good students such as attention to detail, autonomy, high achievement, asking relevant questions, and timeliness, and differences between the perceptions of online and F2F instructors.

The findings surrounding intrinsic qualities were similar to previous research by Venkatesh (2000), who developed a model which identified intrinsic qualities of enjoyment of subject matter and computer playfulness as predictors of technology acceptance. Lee, Cheung, and Chen (2005) used structural equation modeling to identify factors that predict students' intentions to use technology. Their findings, which are comparable to those of the present study, demonstrated that intrinsic factors such as perceived enjoyment were found to be positively correlated with planned technology use.

The theme surrounding the extrinsic qualities of good students is consistent with the findings of Manuel and Llamas (2006), who found that there is agreement about the behavioral characteristics of good students. The following themes were identified which align with the current study:

- Plans and organizes their work adequately (Timeliness).
- Has enough resources to deal with problems (Autonomy).
- Gets good marks (High achievement).
- Not only passes a subject, but also learns (High achievement).
- Investigates (Relevant questions).
- Feels responsible for their own learning/self-educating (Autonomy).
- Demanding in their expectations for themselves (Attention to detail/High Achievement).

According to Reddy (2012), qualitative interviews on the traits of good student revealed the following themes:

> The concepts of focus, discipline, hard work, and not wasting time were common to many of the interviews…This subtheme also includes asking questions for clarification so that one does not stray from the teacher's purpose. Some participants also talked about going beyond the given assignments by reading or doing their own research. (Reddy, 2012, p. 134)

These findings are conceptually similar to the results of the present study.

The third qualitative theme, differences between the online and F2F instructors' perceptions of students, is in agreement with extant research from Heirdsfield et al. (2007), who conducted a quantitative study to measure the differences between online and traditional students' learning experiences. Respondents reported a limited amount of student-teacher interaction. This is parallel with the teacher perceptions in the current study which revealed that instructors do not have enough interaction with online students to comment on their behaviors. In a qualitative case study of online teacher candidates, Thompson et al. (2013) found that the participating students were unsuccessful in an online version of the course and cited lack of teacher contact as one of the reasons for retaking the class in a traditional format concurring with findings reported for this study.

Implications

As the results from this study are examined and explored, there are many factors worth considering. The instrumentation and operationalized constructs used in this study identified a model that met established criteria for acceptance. However, these measures do have areas of weakness that would lend themselves to improvement. In particular, the variable of Early Adoption was quantified as the mean of each student's mid-semester grade and performance on a specific assignment. During the qualitative interviews, the researcher learned that it was common practice to allow students to resubmit work for a higher grade. Thus, the scores may be the result of students' making corrections based on instructor feedback, and not a good indicator of affinity with technology. Another possibility was that high scores on assignments early in the semester might be the result of students retaking the course after withdrawing during a previous semester and therefore turning in assignments completed during the prior class. Additionally, the assignment chosen to distinguish between early adopters and lagging adopters did not have as much variation in performance necessary to be a useful tool of discernment. Despite the limitations in this study, it seems prudent that this model for early adoption of technology be used during formal teacher training. The model will allow instructors to tailor their instruction to the vastly different needs of different types of students.

Technology has the potential to positively influence all facets of education, and the advantages to classroom technology use are myriad. The literature review revealed evidence to support the benefits to incorporating technology into the curriculum. Given that modern students' needs can be well served by appropriate classroom technologies, teachers must be well versed in the technological tools available to enhance instruction and be prepared to put them into practice.

The results of this study revealed the need for a model to identify preservice teachers who would be likely to embrace classroom technologies and distinguish them from preservice teachers who would need additional support to learn the skills necessary to implement technology. These individuals would be invaluable resources in further technology adoption initiatives, as they may assist with the professional development of others on the same campus.

Implications for Instructional Technology Teachers

During formal teacher preparation, some teacher candidates will emerge as early adopters of new tools and resources, while others will need coaching and encouragement in order to begin utilizing the technology effectively (Aldunate & Nussbaum, 2013; Hall & Hord, 2011). This can present a challenge for instructors who need to meet widely disparate student needs. The model developed in the present study would allow instructors to distinguish between students who will need more intensive coaching from those who are likely to succeed without much assistance. Having identified these early adopters, instructional technology teachers could allow the early adopters to coach and mentor the students who struggle with technology. The advantage to this practice is twofold: the burden on the instructor to attend to the needs of the lagging students is lessened and the skills of the early adopters are reinforced and honed as they explain the concepts to other students. Another option would simply be to allow the early adopters to work at their own accelerated pace, which has been shown to be beneficial (Cox, 2015; Knowles, 2005).

Implications for Preservice Teachers

No matter if the application of the model results in paired mentoring or increased independence for early adopters, all of the students in the instructional technology course can benefit from the instructor's awareness of where they fall on the early adoption spectrum. If peer coaching is used as a classroom practice, both the early adopters and the lagging adopters learning is reinforced during their interaction. If the instructor focuses additional time and attention on the students who need it the most, then those students benefit from direct instruction while the early adopters enjoy the advantages of accelerated independent learning. Specifically, they are more likely to enjoy the learning process and make deeper connections without becoming bored by moving through the content too slowly (Cox, 2015).

Implications for Administrators

As the preservice teachers begin their careers, it is important for the administrators in the hiring district to be assured that the new teachers are fully prepared to use modern instructional tools. If a teacher education program developed a reputation for excellence with regards to graduates' use of classroom technology, that program's students would be in high demand during hiring and training processes as well as in the identification of candidates to lead campus technology initiatives and implementations. The critical role of early adopters was made clear by Aldunate (2013) as they serve as change agents with the ability to move teams to higher levels of use. Ideally, a campus with a high percentage of CBAM Level 5 (Integration) and Level 6 (Renewal) technology users (Hall & Hord, 2000) would be poised to seamlessly integrate technology into the curriculum and maximize learning for modern students.

Recommendations for Future Research

Several recommendations are suggested for future research. This study should be replicated using a different method for operationalizing the variable of early adoption. It may be possible to gather grades based solely on first attempts so that the effects or resubmissions on course performance are minimized. A different assignment within the course may be a better choice to differentiate early adopters for the rest of the class.

Given that there were vast differences in the perceptions of online and F2F instructors, conducting separate studies may produce better results. Future studies may benefit from a larger sample size, which could be achieved by including participants from multiple academic institutions, which would also expand the generalizability of the findings. The survey could be administered to inservice teachers if an applicable outcome measure could be identified, and district technology coordinators could serve as the confirmatory data source.

Conclusion

This study examined the relationships between factors that lead to identification of early adoption of technology in preservice teachers. Survey, interview, and student course grades were analyzed regarding personal use of technology, self-efficacy, attitude about technology, perceived usefulness of technology, knowledge about technology, and adoption of technology. The data was analyzed using SEM to construct a model that adequately described the factors affecting early adoption of technology and demonstrated that perceived usefulness of technology was the most important factor directly influencing technology adoption. Quantitative analysis resulted in statistically significant mean differences between the pretest and the posttest in personal use of technology, self-efficacy with technology, attitude about technology, and knowledge and skills with technology. The only factor that did not significantly change over time was perceived usefulness of technology. Qualitative analysis illustrated that there were similarities in the perceptions of the instructors of INST 3313 with regards to the behaviors of early adopters of technology. Intrinsic qualities, extrinsic qualities of good students, and differences between the online and F2F instructors' perceptions were the emergent themes that were present in the qualitative data.

In conclusion, this study contributes to existing research regarding preservice teachers' self-perceptions about technology and their ability to effectively master it and instructor perceptions about the traits of early adopters of technology.

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APPENDIX A

SURVEY COVER LETTER

APPENDIX A

SURVEY COVER LETTER

Dear Preservice Teachers,

I am a doctoral student at UHCL and I am conducting a survey with preservice teachers' adoption of technology. With that in mind, I have designed a study to explore the relationship between factors in a model of early adoption of technology. The purpose of this study is to examine the relationships between personal use of technology, self-efficacy with technology, attitudes about technology, perceived usefulness of technology, knowledge and skills with technology, and early adoption of technology.

The data collected from the preservice teacher surveys will only be used for educational and/or publication purposes. Your participation as a survey respondent is entirely voluntary, and you may decide to cease participation after you have begun. The individual responses was kept confidential, but all responses was compiled, summarized and shared with UHCL for the purposes of program improvement. **If you choose to participate, complete the attached survey. If you decline, do nothing further. There are no benefits and no penalties for choosing or declining to participate, and you may withdraw any time during the study without consequences and your data will not be included. Your willingness to participate in this study is implied if you proceed with completing the survey. You may keep this cover letter for your records.**

Please try to answer all the questions, since responding to each item will the make survey results more useful. The anticipated time commitment for completing the survey was approximately 30 minutes. No obvious undue risks are associated with completing the survey. While you will receive no direct benefit from your participation in the survey process, your participation will help the researcher better understand the early adoption of technology.

*Insert link to Survey Monkey

Sincerely,
Staci Mizell
The University of Houston-Clear Lake
(936)525-9618
stacimizell@gmail.com

APPENDIX B

INSTRUCTOR CONSENT FORM

APPENDIX B

INSTRUCTOR CONSENT FORM

Informed Consent to Participate in Research

You are being asked to participate in the research project described below. Your participation in this study is entirely voluntary and you may refuse to participate, or you may decide to stop your participation at any time. Should you refuse to participate in the study or should you withdraw your consent and stop participation in the study, your decision will involve no penalty or loss of benefits to which you may be otherwise entitled. You are being asked to read the information below carefully, and ask questions about anything you don't understand before deciding whether or not to participate.

Title: FACTORS CONTRIBUTING TO EARLY ADOPTION OF TECHNOLOGY

Student Investigator(s): Staci Mizell
Faculty Sponsor: Jana Willis, Ph.D.

PURPOSE OF THE STUDY

The purpose of this research is to examine the relationships between personal use of technology, self-efficacy with technology, attitudes about technology, perceived usefulness of technology, knowledge and skills with technology, and early adoption of technology.

PROCEDURES

The research procedures are as follows: Semi-structured interviews regarding the behaviors and coursework of students in the participant's class that meet the criteria foor potential early adopters of technology.

EXPECTED DURATION

The total anticipated time commitment was approximately one hour.

RISKS OF PARTICIPATION

There are no anticipated risks associated with participation in this project.

BENEFITS TO THE SUBJECT

There is no direct benefit received from your participation in this study, but your participation will help the investigator(s) better understand the factors that contribute to the early adoption of technology in preservice teachers.

CONFIDENTIALITY OF RECORDS

Every effort was made to maintain the confidentiality of your study records. The data collected from the study was used for educational and publication purposes, however, you will not be identified by name. For federal audit purposes, the participant's documentation for this research project was maintained and safeguarded by the Student Investigator for a minimum of three years after completion of the study. After that time, the participant's documentation may be destroyed.

FINANCIAL COMPENSATION

There is no financial compensation to be offered for participation in the study.

INVESTIGATOR'S RIGHT TO WITHDRAW PARTICIPANT

The investigator has the right to withdraw you from this study at any time.

CONTACT INFORMATION FOR QUESTIONS OR PROBLEMS

The investigator has offered to answer all your questions. If you have additional questions during the course of this study about the research or any related problem, you may contact the Student Researcher, Staci Mizell at phone number 936-525-9618 or by email at TaborS2113@UHCL.edu. The Faculty Sponsor Jana Willis, Ph.D., may be contacted at phone number 281-283-3568 or by email at Willis@UHCL.edu.

SIGNATURES:

Your signature below acknowledges your voluntary participation in this research project. Such participation does not release the investigator(s), institution(s), sponsor(s) or granting agency(ies) from their professional and ethical responsibility to you. By signing the form, you are not waiving any of your legal rights.

The purpose of this study, procedures to be followed, and explanation of risks or benefits have been explained to you. You have been allowed to ask questions and your questions have been answered to your satisfaction. You have been told who to contact if you have additional questions. You have read this consent form and voluntarily agree to participate as a subject in this study. You are free to withdraw your consent at any time by contacting the Principal Investigator or Student Researcher/Faculty Sponsor. You was given a copy of the consent form you have signed.

Subject's printed name: ____

Signature of Subject: ____

Date: ____

Using language that is understandable and appropriate, I have discussed this project and the items listed above with the subject.

Printed name and title: ____

Signature of Person Obtaining Consent: ____

Date: ____

THE UNIVERSITY OF HOUSTON-CLEAR LAKE (UHCL) COMMITTEE FOR PROTECTION OF HUMAN SUBJECTS HAS REVIEWED AND APPROVED THIS PROJECT. ANY QUESTIONS REGARDING YOUR RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UHCL COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (281-283-3015). ALL RESEARCH PROJECTS THAT ARE CARRIED OUT BY INVESTIGATORS AT UHCL ARE GOVERNED BY REQUIREMENTS OF THE UNIVERSITY AND THE FEDERAL GOVERNMENT. (FEDERALWIDE ASSURANCE # FWA00004068)

APPENDIX C

PERSONAL USE OF TECHNOLOGY SCALE

APPENDIX C

PERSONAL USE OF TECHNOLOGY SCALE

6. How often do you do the following (for school, work, or recreation)?

	Never	Once per year	Once per quarter or semester	Monthly	Weekly	Several times per week	Daily
a. Instant message							
b. Text message							
c. Use the Internet from a cell phone or PDA							
d. Download web-based music or videos							
e. Use the college/university library website							
f. Spreadsheets (Excel, etc.)							
g. Presentation software (PowerPoint, etc.)							
h. Graphics software (Photoshop, Flash, etc.)							
i. Audio-creation software (Audible, GarageBand, etc.)							
j. Video-creation software (Director, iMovie, etc.)							
k. Social networking websites (Facebook, MySpace, Bebo, LinkedIn, etc.)							
l. Online multiuser computer games (World of Warcraft, Everquest, Poker, etc.)							
m. Online virtual worlds (Second Life, etc.)							
n. Podcasts							
o. Webcasts							
p. Social bookmark/tagging (del.icio.us, etc.)							

APPENDIX D

SELF EFFICACY WITH TECHNOLOGY SCALE

APPENDIX D

SELF EFFICACY WITH TECHNOLOGY SCALE

11. I feel confident I can provide individual feedback to students during technology use.	SD	D	NA/ND	A	SA
12. I feel confident I can regularly incorporate technology into my lessons, when appropriate to student learning.	SD	D	NA/ND	A	SA
13. I feel confident about selecting appropriate technology for instruction based on curriculum standards.	SD	D	NA/ND	A	SA
14. I feel confident about assigning and grading technology-based projects.	SD	D	NA/ND	A	SA
15. I feel confident about keeping curricular goals and technology uses in mind when selecting an ideal way to assess student learning.	SD	D	NA/ND	A	SA
16. I feel confident about using technology resources (such as spreadsheets, electronic portfolios, etc.) to collect and analyze data from student tests and products to improve instructional practices.	SD	D	NA/ND	A	SA
17. I feel confident that I will be comfortable using technology in my teaching.	SD	D	NA/ND	A	SA
18. I feel confident I can be responsive to students' needs during computer use.	SD	D	NA/ND	A	SA
19. I feel confident that, as time goes by, my ability to address my students' technology needs will continue to improve.	SD	D	NA/ND	A	SA
20. I feel confident that I can develop creative ways to cope with system constraints (such as budget cuts on technology facilities) and continue to teach effectively with technology.	SD	D	NA/ND	A	SA
21. I feel confident that I can carry out technology-based projects even when I am opposed by skeptical colleagues.	SD	D	NA/ND	A	SA

APPENDIX E

ATTITUDE ABOUT TECHNOLOGY

APPENDIX E

ATTITUDE ABOUT TECHNOLOGY

Part Two: Attitudes Toward Computer Technologies

This survey has 19 statements about computer technologies. After reading each statement, please indicate the extent to which you agree or disagree by circling the number to the right of each statement. Please respond to all statements. There are no correct or incorrect responses.

	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree
1. I don't have any use for computer technologies on a day-to-day basis.	1	2	3	4
2. Using computer technologies to communicate with others over a computer network can help me to be more effective in my job.	1	2	3	4

	Strongly Disagree	Slightly Disagree	Slightly Agree	Strongly Agree
3. I am confident about my ability to do well in a task that requires me to use computer technologies.	1	2	3	4
4. Using computer technologies in my job will only mean more work for me.	1	2	3	4
5. I do not think that computer technologies will be useful to me in my profession.	1	2	3	4
6. I feel at ease learning about computer technologies.	1	2	3	4
7. With the use of computer technologies, I can create materials to enhance my performance on the job.	1	2	3	4
8. I am not the type to do well with computer technologies.	1	2	3	4
9. If I can use word processing software, I will be more productive.	1	2	3	4

10. Anything that computer technologies can be used for, I can do just as well some other way.	1	2	3	4
11. The thought of using computer technologies frightens me.	1	2	3	4
12. Computer technologies are confusing to me.	1	2	3	4
13. I could use computer technologies to access many types of information sources for my work.	1	2	3	4
14. I do not feel threatened by the impact of computer technologies.	1	2	3	4
15. I am anxious about computer technologies because I don't know what to do if something goes wrong.	1	2	3	4
16. Computer technologies can be used to assist me in organizing my work.	1	2	3	4
17. I don't see how I can use computer technologies to learn new skills.	1	2	3	4
18. I feel comfortable about my ability to work with computer technologies.	1	2	3	4
19. Knowing how to use computer technologies will not be helpful in my future work.	1	2	3	4

APPENDIX F

KNOWLEDGE AND SKILLS WITH TECHNOLOGY

APPENDIX F

KNOWLEDGE AND SKILLS WITH TECHNOLOGY

3. Technology Knowledge (TK)

Technology is a broad concept that can mean a lot of different things. For the purpose of this portion of the survey, 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 nor disagree."

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
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 with the technology.	○	○	○	○	○
5. I know about a lot of different technologies.	○	○	○	○	○
6. I have the technical skills I need to use technology.	○	○	○	○	○

APPENDIX G

AUGMENTED REALITY RUBRIC

APPENDIX G

AUGMENTED REALITY RUBRIC

REQUIREMENT (as described in instructions noted above)	**POINTS AWARDED**
Inspiration Lesson Plan Map (Explain)	
Inspiration Map Complete - Left side - objective, method, materials Right side - Explain section, additional bubbles for technology integration description, and URL to newly created WebQuest	10
Project Wild or Project Learning Tree clearly identified (name and page number)	5
Lesson objective has been written in ABCD format (Audience, Behavior, Condition, Degree).	10
Method reflects instructional method (http://www.adprima.com/teachmeth.htm)	10
Digital Story Template	
Digital Story Template complete (name, book, activity, page number(s), target age)	10
Explanation of the topic detail included	10
Content related sentences (7-12)	10
Craftsmanship • Complete sentences • Grammar/spelling/punctuation/capitalization	10
Graphic version of lesson plan map is inserted correctly on the Digital Story Template	5
Digital Story Component	
Movie Maker file uploaded to YouTube and inserted correctly on the Google Sites ePortfolio Explain page.	10
Digital story is relevant to lesson topic	10
Appropriate sentences are incorporated (age appropriate/content related)	10
Appropriate images are used (no text on images)	10
Citations in APA format included for all images (citation text included on Digital Story Template)	10
Craftsmanship • Complete sentences • Grammar/spelling/punctuation • Sentences not in all CAPS	10
Create Aura using Aurasma	
Trigger image and Aura name inserted on **Google Sites Course ePortfolio Explain page**	10
Aura functions correctly - Aura Share link is included on Google Sites ePortfolio Explain page	10
Create Prezi to present Digital Story	
Introductory points to the lesson digital story (slides)	10
Key elements to be included in the digital story (see Digital Story Template)	10

Digital story created in Movie Maker (YouTube version).	10
Discussion points and/or questions for follow-up to the digital story.	10
Google Sites ePortfolio Component - Explain	
Submit the URL to your Google Sites Course ePortfolio in the Assignment Materials area of the course Submission tool.	10
Inserted .png version of lesson plan map to the Explain page of your **Google Site Course ePortfolio** (see tutorial on Resources link located on Course Menu).	10
Uploaded Digital Story Template as attachment on the Explain link on your **Google Site Course ePortfolio**.	10
YouTube Movie Maker is correctly inserted on the Explain link on your **Google Site Course ePortfolio**.	10
Prezi is correctly embedded on the Explain link on your **Google Site Course ePortfolio**.	10
TOTAL	**250**

APPENDIX H

INTERVIEW GUIDE

APPENDIX H

INTERVIEW GUIDE

1. What are some behaviors that students exhibit that indicate a student was an early adopter of technology?

2. Your student_______________ has a profile from the survey that indicates he/she is a potential early adopter of technology.
    a. Does that surprise you?
    b. Can you think of examples of things he/she has said in class that would support that conclusion?
    c. Are there examples of things he/she has said in class that would tend to disprove this conclusion?
    d. Can you think of examples from his or her coursework that would support that conclusion?
    e. Can you think of examples from his/her coursework that would tend to disprove that conclusion?
3. Are there any students in your class that you feel are early adopters of technology that I have not already asked you about?
    a. What behaviors or assignments led you to that conclusion?

RÉSUMÉ

STACI MIZELL

EDUCATION

University of Houston-Clear Lake
Ed.D. in Educational Leadership, specialization in Research Design, Measurement, and Statistics **2016**

University of Houston-Clear Lake
Master of Business Administration **2001**

University of Houston-Clear Lake
B.S. in Human Services **1999**

PRESENTATIONS

Mizell, S. (2016, February). *Factors affecting early adoption of technology.* Paper presented at the annual meeting of the Southeastern Educational Research Association (SERA), New Orleans, LA.

Sovine, M., & Mizell, S. (2016, February). *The relationships between instructors' verbal immediacy, students' affective learning, and intent to persist in college*. Paper presented at the annual meeting of the Southeastern Educational Research Association (SERA), New Orleans, LA.

AWARDS

Leadership Academy Fellowship, Lone Star College System 2012 – 2013
Award for Teaching Excellence, League City Intermediate School 2000 – 2001

EXPERIENCE

University of Houston-Clear Lake
Graduate Research Assistant **2015-present**
Collect quantitative and qualitative data during field visits to school districts. Prepare literature reviews for studies under consideration in STEM Curriculum and Instruction doctoral program. Write grant proposals for submission to federal funding agencies. Serve on Quality Enhancement Program committee.

Lone Star College-Kingwood
Interim Department Chair- Business **Jan 2014-June 2014**
Attended regular meetings with all chairs and deans, supervised adjuncts, and conducted adjunct training sessions. Represented department at Workforce Council. Served on hiring committees. Reported on department goals for SACS accreditation.

Professor **2006-2015**
Co-chair of curriculum team for Administrative Services. Managed data concerning learning outcomes in Compliance Assist program for SACS accreditation. Instructed in multiple disciplines. Faculty advisor for student organization.

Cooperative Education Coordinator **2009-2012**
Wrote the master course for all co-op courses taught in LSCS and facilitated the class. Assessed students' readiness for the co-op/internship capstone course. Conducted site visits of interns' workplaces. Helped students and supervisors write measurable internship objectives. Recruited employers to accept interns.

SOFTWARE PROFICIENCIES

SPSS, NVivo, AMOS, Adobe Connect, Survey Monkey, Excel, Word, PowerPoint

MEMBERSHIPS

Board of Directors, Texas Cooperative Education and Internship Association
Member, American Educational Research Association