Reflecting on Technology Integration in Teacher Education Programs

A doctoral thesis presented by

Kelly Jane Keane

To

The School of Education

In partial fulfillment of the requirements for the degree of

Doctor of Education

in the field of

Education

College of Professional Studies
Northeastern University
Boston, Massachusetts
February 20, 2015
Abstract

This instrumental case study, using interviews and document analysis, examined the perceptions and reflections of newly hired teachers about the instruction they received regarding technology integration in their teacher education program and how it applied to their instruction in the classroom once hired. The Technological Pedagogical Content Knowledge (TPACK) framework was used as an analytic lens for this examination. The main research questions guiding this study were: What technology-related components of their teacher education program did newly hired teachers find to be most useful for classroom technology integration? and How does teachers’ knowledge of content and pedagogy facilitate their inclusion of technology? and What technology-related components or instruction do newly hired teachers identify as lacking in their teacher education programs? Findings indicated that the teacher education program was able to help teachers learn how to integrate technology into their classrooms. Content knowledge was found to be the central consideration among participants when creating lesson plans, supported by pedagogy and technology. Technology integration was limited by several obstacles, yet the benefits of technology integration were widely documented and identified specifically as an increase in student motivation and engagement, Overall, the key implication that has emerged from this study is that we need to strengthen the use of TPACK as being a foundational framework introduced in the teacher education program and extend its application through the professional development offered to current teachers so that it becomes a widely used model of technology integration.

Keywords: technology integration, TPACK framework, teacher education program
Chapter One: Introduction ........................................................................................................8

Statement of the Problem and Topic ..................................................................................8

Research Problem .............................................................................................................8

Justification for the Research Problem ...............................................................................9

Deficiencies in the Evidence .............................................................................................10

Relating the Discussion to the Audience ..........................................................................11

Significance of Research Problem ......................................................................................11

Positionality Statement .....................................................................................................13

Central Research Question ...............................................................................................14

Theoretical Framework ......................................................................................................14

Chapter Two: Literature Review .......................................................................................17

Introduction .......................................................................................................................17

Quality Control of Teacher Education Programs ..............................................................18

Accurately Measuring the Quality of Teacher Education Programs .................................20

Further Evaluations of Teacher Education Programs .......................................................24

Current Status of Teacher Education Programs Focusing on TPACK ...............................26

Development of Technological Knowledge ......................................................................28

Development of Pedagogical Knowledge .........................................................................30

Development of Content Knowledge ..............................................................................32

Criticisms of TPACK .......................................................................................................35

Technology Integration As Part of Teacher Education Programs ....................................36

Similar Studies ..................................................................................................................39

Chapter Summary ............................................................................................................42
Chapter Three: Methodology

Introduction

Research Design

Research Paradigm

Research Tradition and Rationale for Case Study Design

Participants

Recruitment and Access

Data Collection

Interviews

Document Analysis

Data Storage

Data Analysis

Stage 1 – Individual Descriptions

Stage 2 – Cross Participant Analysis

Trustworthiness

Potential Threats to Internal Validity

Chapter Summary

Chapter Four: Research Findings

Introduction

Context of the Study

The Elementary Education Program

Phases of the Program

Required Technology Coursework
Appendix D: Initial Email to Participants.................................................................130
Appendix E: Statement of Consent Form..............................................................131
Appendix F: Interview Protocol...........................................................................134
Appendix G: Major Findings and Notable Quotations.................................138
Chapter One: Introduction

Statement of the Problem and Topic

Effective teacher education programs are the foundation for improving student achievement in schools, as teacher quality is connected to every aspect of student learning (Goldhaber, Liddle, & Theobald, 2013). It is understandable then, that in the current midst of national reform in education, teacher education programs are being intensely scrutinized (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009; Walsh & Riddell, 2013). These programs are being subjected to higher standards and increased accountability (Walsh & Riddell, 2013). One of the more recent updates to teacher education programs is the widespread inclusion of technology integration instruction for teacher candidates (Betrus, 2012; Hew & Brush, 2007). By offering teacher candidates technology-related experiences and more opportunities to engage in learning experiences supported by technology, they will be better prepared to utilize the educational technologies that will be available to them as classroom teachers (Diana, 2013).

This study examined the perceptions and reflections of newly hired teachers about the instruction they received regarding technology integration in their teacher education program and how it applied to their instruction in the classroom once hired.

Research Problem

Based on my experience as a teacher educator, I have observed that technology advancements are plentiful and today’s young learners are much more widely exposed to technology outside of the classroom. However, it is difficult for all teachers, both experienced and new, to remain up to date with technology integration measures. Even more difficult is to prepare teacher candidates for classroom technology integration when the technologies and tools are constantly changing and there are more technology applications, programs, and software
programs from which to choose (Betrus, 2012). Evidence suggests that teacher candidates are often perceived as unprepared when it comes to technology integration in their classrooms once hired (Kay, 2006). Add to this the current state-wide implementation of new educational standards in the form of Common Core Standards and a focus on developing students’ 21st century skills, and the resulting demands of what is expected of teacher education programs and the qualifications of beginning teachers is significantly changing. Teacher education programs must provide instruction focusing on not only the skills and knowledge necessary to teach content meeting new standards, but also provide instruction to teacher candidates about how to best integrate constantly changing technologies into this instruction (Hammonds, Matherson, Wilson, & Wright, 2013; Betrus, 2012).

**Justification for the Research Problem**

In an analysis of the evolution of instructional technology in teacher education programs, Betrus (2012) found that we are currently in a time of particularly dynamic and rapid technology change. The following topics and tools are now frequently taught in teacher education programs: SMART boards, wikis, blogs, professional and social networking sites, podcasts, twitter, instructional games taught in a digital context, mobile devices, document cameras, course management systems, and programs that offer collaborative authoring abilities; however, these technologies did not exist ten years ago (Betrus, 2012). In today’s classrooms, these technologies are used on a regular basis. What may gain even further prominence on the educational technology landscape moving forward is the implementation of mobile technologies (Betrus, 2012). Consequently, choosing which technologies to include in teacher education programs is a daunting task.
In addition to the vigorously changing tools and topics surrounding technology integration and the resulting need for updates and changes to teacher education programs, further research indicates that teacher education programs need to make technology-related improvements (Ottenbreit-Leftwich et al., 2012; Vannatta & Beyerbach, 2000). More specifically, there is a need to provide more instruction to teacher candidates that supports communication practices, requires teacher candidates to utilize technology to analyze data, and uses technology to support higher-order thinking skills. Additionally, teacher education programs need to spend less time on using technology to support professional growth in the form of portfolios (Ottenbreit-Leftwich et al., 2012).

In order to properly prepare teacher candidates in a changing world of technologies, its integration must be meaningful and effective. The technology-related instruction of teacher education programs needs to lead students’ toward more authentic, student-centered learning so that students are not learning from technology, but rather with it (Doering, Hughes, & Huffman, 2003). And while the technology content of teacher education programs is typically not described as cutting edge, teacher education programs are often the setting in which teacher candidates are first exposed to such technologies. Therefore, providing teacher candidates with the skills necessary to evaluate new technologies and the ability learn with the technology as opposed to just from it are also important objectives for technology-related teacher education programs (Betrus, 2012).

**Deficiencies in the Evidence**

To date, little research has thoroughly examined current technology integration practices of teacher education programs and their impact on classroom experiences (Hew & Brush, 2007; Lawless & Pellegrino, 2007). The significant change in curriculum brought about by the recent
implementation of Common Core State Standards, which alters technology integration and needs to be reflected in teacher education programs, adds an additional dimension, not yet documented in the research related to technology integration and teacher education. Therefore, the scant information on the connection between teacher education and technology integration coupled with the paucity of information on technology integration and the implementation of Common Core State Standards point to the need for inquiry on new teacher technology integration experiences.

**Relating the Discussion to the Audience**

The results of this study may inform the design of technology integration in teacher education programs and increase relevance, thereby proving useful to future teachers. Additionally, the results of this study may better inform the decision-making of faculty who teach technology integration classes within teacher education programs with regard to course content and requirements. The results may also be used by school administrators to more accurately align the technology training and practices of teacher programs and the professional development practices of their school systems with newly hired teachers. Teacher candidates, newly hired teachers, faculty who teach education courses, and school administrators who lead professional development practices will benefit from the findings of this research. The results of this study will specifically allow me to promote positive change in the teacher education program.

**Significance of Research Problem**

The National Council for Accreditation of Teacher Education (NCATE), which is the accrediting body for professional teacher preparation, asserts that the use of technology for instruction and assessment is vital to teacher preparation. According to NCATE standards,
technology must be integrated into the knowledge, skills, and dispositions of teacher candidates, as well as used in the field and clinical experiences of teacher candidates (NCATE, 2013). Teacher candidates must be part of a training program that accurately and thoroughly educates them about the ever-growing use of technologies in our current education system. This training program should also foster the development of personal learning networks to support the ongoing continuous acquisition of emerging technologies and technology tools. While the inclusion of technology integration is only one component of what is required to enable high-quality teaching, it is essential to the success of learners in 21st century classrooms. This study was significant on a national level in that it analyzed the technology integration practices of teacher education programs in order to determine what preparation is most successful.

At the state level, the recent implementation of Common Core State Standards (CCSS) has resulted in widespread changes to curriculum in the state of Maryland. In the 2010-2011 school year, the Maryland Common Core State Curriculum Framework was developed and this new 600-page document identifies and defines what students need to know and be able to do to meet the CCSS. This framework is the foundation of Maryland’s new State Curriculum (Maryland State Department of Education, 2010). This enormous change in state curriculum is significant to teachers and it is essential that teacher education programs adapt to the changing curriculum in order to provide meaningful and practical instruction to teacher candidates. This study was significant on a state level in that the findings can be used to improve the content and emphasis of technology integration classes as part of teacher preparation programs that take into account the new statewide curriculum. Ultimately, this study was significant through its provision of current information about effective technology integration practices aligned with new Common Core State Standards that can in turn aide teacher training programs with their
Positionality Statement

An individual’s perception of their place in time and their perspectives on the world around them affects them (Parsons, 2008). I believe that technology integration is essential for capturing students’ attention, improving their communication and social skills, and engaging them in work that is applicable to future careers. Technology in the classroom not only requires frequent interaction and feedback, but it requires active engagement and allows for connections to be made from the classroom to the real world. All of this, in my opinion, is very important for enhancing the learning process.

As a former faculty member for the College of Education teaching in the Department of Educational Technology at a large urban university, I am constantly seeking ways to improve the technology-related instruction of our teacher education program. Being able to provide instruction for future teachers about how to successfully integrate technology into their teaching is a task that requires constant revising and changing, as the technologies are evolving and the needs of the learners are shifting. I feel a responsibility to be aware of the current happenings in the field of education, particularly relating to Common Core State Standards and technology integration because these timely topics affect teacher preparation to a great extent.

On a daily basis I have worked with pre-service teachers and regularly interacted with recent graduates of our teacher program who are now locally employed. I anticipate being able to understand and interact with current teachers because of my professional experiences related to instruction of teacher candidates, my own experiences as a classroom teacher of many years, and my desire to improve the teacher education program at the University.
Central Research Question

My positionality is influenced by my experience and perceptions, and my strong tendencies for using technology, but my own personal awareness of this will ensure that it does not become problematic. I will be representing the experiences of those with whom I interact, and my cognizance of how my perspective can potentially influence my research will be continuously considered. Consequently, this study endeavored to answer the following research question: How and in what ways can teacher education programs be improved to prepare teacher candidates to successfully integrate constantly changing technologies and prepare 21st century teachers?

Theoretical Framework

The Technological Pedagogical Content Knowledge (TPACK) framework was used to guide this research because it provides valuable insights into the knowledge teachers must possess to teach effectively with technology (Koehler & Mishra, 2009). Essentially, the TPACK framework identifies the knowledge that teachers need to effectively teach with technology and divides this knowledge into three main areas: technological knowledge, which refers to both simple and complex digital tools, pedagogical knowledge, which refers to the method and practice of teaching, and content knowledge, which refers to subject matter being taught and learned (Koehler & Mishra, 2009).

The TPACK framework also identifies the interplay among these three main areas to develop additional knowledge areas. For example, the overlap of technological knowledge and pedagogical knowledge is identified as technological pedagogical knowledge. This refers to the teachers’ understanding of how teaching and learning are influenced by the use of particular technologies. Additionally, the overlap of pedagogical knowledge and content knowledge is
identified as pedagogical content knowledge. Pedagogical content knowledge refers to the teachers’ interpretation of the subject matter and their ability to adapt and individualize it to students’ needs and create conditions that promote learning. The overlap of technological knowledge and content knowledge is known as technological content knowledge. This refers to the teachers’ understanding of how subject matter can be changed by the application of various technologies. Lastly, the overlap of all three main areas including technological knowledge, pedagogical knowledge, and content knowledge is known as technological pedagogical content knowledge. An understanding of all three of these areas and how they interact wholly is the basis of effective teaching with technology (Koehler & Mishra, 2009).

The TPACK framework is an extension of Schulman’s (1996) Theory of Pedagogical Content Knowledge (PCK). Koehler and Mishra (2008) added technology to the interacting components of pedagogy and content and the resulting TPACK framework takes into account the teachers’ integration of technology along with their knowledge of content and their knowledge of pedagogy. Admittedly, the relationships among technology, pedagogy, and content are complicated and full of nuances, and Mishra and Koehler (2006) assert that understanding these complex interplays is essential to successful teaching with technology. TPACK emphasizes the new kinds of knowledge that emerge at the intersections between the areas of technological knowledge, content knowledge, and pedagogical knowledge (Figure 1).
The purpose of this qualitative research study was to investigate the current content of technology integration classes taught as part of a teacher education program and the actual ways in which newly hired teachers use technology in their classroom to support teaching and learning. The goal was to determine what improvements can be made to teacher education programs by analyzing how teachers reflect on their technology training as part of teacher education and its application in their classrooms. The TPACK Framework, when applied to this research, can aid faculty of teacher education programs in the identification of areas in need of improvement relative to technology, content, and pedagogy. Identifying the specific knowledge areas in need of improvement and bringing to the surface the key factors that influence learning with technology can improve teacher education programs improved to better prepare teacher candidates.
Chapter Two: Literature Review

Introduction

Teacher education programs are often the catalyst when it comes to preparing teacher candidates to integrate technology into their teaching practices (Coggshall, Bivona, & Reschly, 2012). Throughout the United States, teacher education programs have developed specific courses that focus on technology integration (Dexter & Riedel, 2003; Brantley-Dias & Ertmer, 2013). However, the broad and complex knowledge that must be disseminated to teacher candidates regarding how to effectively integrate technology remains a challenge for teacher education programs (Polly & Brantley-Dias, 2009; Shih-Hsiung, 2012; Shin et al., 2009). As technology tools and resources continue to emerge and expand, new opportunities for instruction arise (Duran, 2006). Teacher education programs are tasked with the difficult job of preparing teacher candidates to not only operate such tools and resources, but integrate them seamlessly into their future instruction while helping their students master content-related learning objectives (Coggshall, et al., 2012; Young, Young, & Hamilton, 2013).

Many teacher education programs have begun to implement the technological pedagogical content knowledge (TPACK) framework (Archambault & Barnett, 2010; Brantley-Dias & Ertmer, 2013; Graham, Borup, & Smith, 2012; Graham et al., 2009; Hofer & Grandgenett, 2012) as a way to overcome these difficulties and improve their instruction for teacher candidates (Brantley-Dias & Ertmer, 2013; Koehler, Shin, & Mishra, 2011). TPACK can be described as the realm of knowledge where all the configurations of a teacher’s knowledge intersect (Mishra & Koehler, 2006). It is the domain necessary for teachers to effectively plan and successfully implement technology-enriched learning experiences. Instructors who implement TPACK effectively are essentially determining whether or not there
is a fit between the three areas of technology, pedagogy, and content in any given lesson (Mishra & Koehler, 2006). Determining this fit requires a strong knowledge in each of these three areas and an understanding of how these areas interact (Mishra & Koehler, 2006; Shin et al., 2009).

While TPACK is a helpful component of teacher education programs, it is a complex and interdependent type of knowledge and understanding, so much so that it provides challenges for teacher education programs (Mishra & Koehler, 2006; Pamuk, 2012).

The purpose of this chapter is to present a review of research and literature that identifies current quality control measures of teacher education programs, the role of TPACK in teacher education programs, and the current status of technology integration in such programs. This literature review contains the following sections: Quality Control of Teacher Education Programs, Accurately Measuring the Quality of Teacher Education Programs, Further Evaluations of Teacher Education Programs, Current Status of Teacher Education Programs Focusing on TPACK, Development of Technological Knowledge, Development of Pedagogical Knowledge, Development of Content Knowledge, Criticisms of TPACK, Technology Integration As Part of Teacher Education Programs, and a Summary.

**Quality Control of Teacher Education Programs**

As demands on teacher accountability increase, there is a need for greater accountability of teacher education programs (Coggshall et al., 2012). Currently, most states use three regulators to monitor the quality of their program. The first regulator is approval from the state department of education related to program requirements and standards. The second regulator is accreditation from a non-government agency such as the national Council for the Accreditation of Teacher Education (NCATE) or the Teacher Education Accreditation Council (TEAC). These agencies review teacher education programs periodically and use their own national standards.
The third and final regulator of teacher program quality is certification. Teacher candidates must pass skill-based tests and obtain a degree in a specific subject (Coggshall et al., 2012). However, research indicates that these regulators do not always determine the success of new teachers (Wilson & Youngs, 2005; Crowe, 2010). In addition to national accreditation agencies, the federal government also exerts influence on teacher education programs.

In 1998, the reauthorization of the Higher Education Act (HEA) called for systematic data collection focusing on the characteristics and outcomes of teacher education programs. The data collected includes pass rates of certification exams, licensure requirements, and administrative information about teacher education programs including admissions requirements, enrollment details, and information about clinical experiences. There are 440 data points elements that all states much collect and report on each year (Duncan, 2011). According to HEA, states must also not only identify, but assist their low-performing teacher preparation programs. However, states are reluctant to do this, as evidenced by the thirty-one states in 2007 that did not report their low-performing programs (Carey, 2007). Consequently, the usefulness of these reporting requirements is questionable.

In an effort to renew our nation-wide focus on the accountability of teacher education programs and perhaps yield useful changes, a multi-billion dollar grant was offered in 2009. The Race to the Top grant requires winning states to implement highly defined accountability measures for teacher preparation. The winning states have agreed to provide data that links student achievement back to the programs that prepared those teachers, provide public reports of this information, and aid in expanding programs that are successfully producing teachers who are later measured as effective (Wiseman, 2012).
In addition to the HEA and Race to the Top grant, accountability efforts continue to increase in government-supported ways. President Obama’s 2011 reform plan for education titled Our Future, Our Teachers – The Obama Administration’s Plan for Teacher Education Reform and Improvement, identified that reporting requirements have not assisted with productive change and this reform plan also questioned the validity of the HEA data points (U.S. Department of Education, 2011). Likewise, Secretary of Education Duncan questioned the need for such requirements and instead recommended focusing on the outputs of teacher education programs instead of the inputs (Duncan, 2011). Once again, the usefulness of data collection is being questioned because it is not yielding positive changes. While not yet proven useful in their entirety, overall, this reauthorization of legislation, and the government issued grant initiatives and reform plans are aiding in the building momentum surrounding teacher preparation programs and change.

**Accurately Measuring the Quality of Teacher Education Programs**

A single program measure is insufficient in evaluating the quality or effectiveness of a teacher education program (Coggshall et al., 2012; Madson, Melchert, & Whipp, 2004); therefore, multiple methods must be explored. Reviewing the candidate selection process, the content of the teacher education program, and measuring the quality of the field experiences of teacher candidates are some of the multiple ways to evaluate teacher education programs.

Regarding candidate selection, research suggests that a positive correlation exists between teacher candidates’ academic aptitude before starting a teacher education program and their ultimate effectiveness as a teacher (Levine, 2006; Koop & Farr, 2011) as does a positive correlation exist between teacher candidates’ achievement during their teacher education program and their ultimate effectiveness as a teacher (Kukla-Acevedo, 2009). Teacher
candidates with higher test scores on individual aptitude tests and in their courses produced students with higher academic achievements (Henry, Bastian, & Smith, 2012; Kukla-Acevedo, 2009). Contrary to this, findings by Henry et al. (2013) indicate that a teacher’s later effectiveness is not predicted by rating instruments. Furthermore, a teacher candidates’ scores on standardized exams were also not found to predict their later effectiveness. Whether or not measuring teacher candidates’ individual aptitudes and knowing that they will eventually produce students with higher academic achievement is accurate, it is difficult to ascertain if there are other just as important factors at work (i.e. internal motivation or persistence) and more research is necessary (Coggshall et al., 2012).

The content of the teacher education program can also be used to evaluate its ultimate effectiveness. NCATE (or a similar accreditation group) will generally analyze syllabi as a way to measure course content and requirements. A syllabus does not provide data revealing whether or not course objectives were met, but it does provide documentation of learning activities and assessments, as well as “a framework for using evaluation feedback to make program modifications and improvements at the course level” (Madson et al., 2004, p. 549). An analysis of 88 syllabi from technology specific courses within a teacher education program revealed that syllabi review provided an assessment of the development of skill sets within a curriculum and a foundation for guiding program development and improvement (Madson et al., 2004). However, a course syllabus may or may not include all of the content and pedagogy covered in the class and should not be used as a single method of evaluating an entire teacher education program (Coggshall et al., 2012; Madson et al., 2004).

In addition to reviewing syllabi, another way to evaluate the content of a teacher education program is to review coursework. Boyd, Grossman, Lankford, Loeb, and Wycoff,
(2009) discovered that teacher candidates who were required to take both math and English language arts courses as part of their teacher education program were able to positively influence the academic achievements of their students as second year teachers. Contrary to this, research by Harris and Sass (2011) indicates that the amount of coursework taken in a particular subject area is not associated with later teacher effectiveness in math and reading. Monk (1994) identified diminishing returns to additional math courses and later student performance when examining the impact of coursework and student achievement, but did find that math pedagogy courses were more impactful than math content courses.

Measuring the quality of student teaching experiences (also referred to as field experiences) is another way to evaluate teacher education programs. Research by Greenberg, Pomerance, and Walsh (2011) utilized the following five standards to evaluate the student teaching program of teacher education programs:

1. The student-teaching experience, which should last no less than 10 weeks, should require no less than five weeks at a single local school site and represent a full-time commitment.

2. The teacher preparation program must select the cooperating teacher for each student teacher placement.

3. The cooperating teacher candidate must have at least three years of teaching experiences.

4. The cooperating teacher candidate must have the capacity to have a positive impact on student learning.
5. The cooperating teacher candidate must have the capacity to mentor an adult, with skills in observation, providing feedback, holding professional conversations and working cooperatively. (p. 3)

Through an analysis of surveys, handbooks, manuals, and other documents relative to the student teaching experience collected from multiple teacher education programs, ratings for how well each program met these established standards were provided. The top-ranked programs met or exceeded each of these standards. In further support of measuring the quality of student teaching experiences, teacher education programs that provided highly-supervised student teaching experiences or required teacher candidates to create a detailed report at the end of their experience were found to produce first year teachers who were able to effectively increase student achievement (Boyd et al., 2009).

When evaluating the quality of teacher education programs, it is evident that we need to take into account multiple program measures (Coggshall et al., 2012) and this proposed research study will do just that. The research findings from this section will be used to inform the selection of participants and the composition of interview questions. Findings from Levine (2006), Koop and Farr (2011), and Kukla-Acevedo (2009) indicate that teacher candidates’ academic aptitude is a factor in determining their later success as a teacher, therefore the inclusion of this indicator as it relates to the participants will be foundational to the research. Coggshall et al. (2012) and Madson et al. (2004) found content and coursework of teacher preparation classes to be a factor in the success of the program and these will be two additional indicators used in the research study. Lastly, a teacher candidate’s field experience provides them with an authentic context to apply the knowledge and skills they learned in their teacher preparation program and the quality of the field experience is critical to a candidate’s ultimate
success (Greenberg et al., 2011). This final and fourth indicator as it relates to the participants’ experiences will also be considered when implementing the research study.

**Further Evaluations of Teacher Education Programs**

After eight years of development and ten pilot studies, the National Council on Teacher Quality created a set of sixteen standards based on common competencies, national recommendations, practices of higher performing states and nations, panels of experts, and implications from Common Core Standards to evaluate teacher education programs (Greenberg, McKee, & Walsh, 2013). The standards include references to four main areas: selection, content preparation, professional skills, and outcomes. Selection refers to whether or not the program screens candidates based on academic ability; content preparation refers to the content preparation offered in the subject(s) area the candidate intends to teach; professional skills refers to the acquisition and practice of skills related to how to teach; outcomes focuses on the program’s attention to outcomes and evidence of impact. For example, one of the standards under professional skills identifies the importance of classroom management in a statement about the teacher education program training teacher candidates to successfully manage classrooms. These standards were used to evaluate more than 2,400 elementary, secondary, and special education programs from 1,130 higher education institutions from every state and the District of Columbia (Greenberg et al., 2013).

Findings indicate that the field of teacher preparation is “chaotic” at best and “as a whole is in disarray” (Greenberg et al., 2013, p. 99). Teacher education programs are not restricting admission of teacher candidates, are lacking in Common Core Standard instruction, and often place teacher candidates in field experiences with volunteer teachers as opposed to effective teachers. The coursework required of elementary teacher candidates relative to reading is
limited, academic freedoms on the part of the professors teaching in teacher education programs are being abused, and materials being used to instruct teacher candidates are vast, widespread, and at times, contradictory in nature. Emerging from teacher education programs, first-year teachers are inadequately prepared and have not learned the classroom management skills and content knowledge that is required to teach a large population of students who are diverse in many ways (Greenberg et al., 2013).

Of the numerous teacher education programs reviewed, only four earned the highest ranking of four stars and less than ten percent earned a three star ranking. Greenberg et al. (2013) call for a change in the foundation of teacher education programs, and suggest that the top-ranking programs serve as a guide for rebuilding our current system. Overall, much more rigorous teacher preparation programs are needed (Greenberg et al., 2013).

Another study examining multiple exemplary teacher education programs found these common features throughout the programs: a common vision of good teaching, defined standards used to evaluate course work and clinical experiences, a strong core curriculum, extended clinical experiences, extensive use of case methods, teacher research, assessments, and portfolio evaluation, strategies to assist teacher candidates in overcoming their own beliefs and assumptions about people different from themselves, and strong relationships and shared beliefs among school and university based faculty (Darling-Hammonds, 2006, p. 6). To improve our teacher education programs, we need them to include a stronger connection between coursework and field experiences, a critical and evident connection between theory and practice as part of teacher education, and the development of closer relationships with diverse schools (Darling-Hammond, 2006).
Specialized parties including accreditation committees, the federal government, and various education councils are attentive to teacher education programs as are the general public of students, faculty, and local school systems. Replicating this variety of interested groups and the diversity of their involvement and agendas, the evaluation methods of teacher education programs are also varied and inconsistent (Greenberg et al., 2013). Multiple strategies have been suggested to aide in the consistency of teacher education programs and increase the quality of such programs. These strategies include an improvement in coursework and a restructuring of materials (Greenberg et al., 2013), an increase in rigor (Greenberg et al., 2013), and the creation of stronger connections between diverse schools and universities, faculty members and local teachers, coursework and field experiences, and theory and practice (Darling-Hammonds, 2006). While these measures apply generally to teacher education programs, an area in the literature that is very specific with regard to its current status and how, where, and why improvements can be made is technology integration. Technology integration relative to teacher education programs encompasses coursework, materials, rigor, and connections among involved parties as well as theory and practice. It is a rapidly growing area in teacher education programs and one that may aide in the measures needed to improve these programs. The following sections will focus on technology integration as it relates to teacher education programs.

**Current Status of Teacher Education Programs Focusing on TPACK**

Previous coursework for teacher candidates focused primarily on instruction of technology skills separate from the instruction about pedagogy and content (Graham, Culatta, Pratt, & West, 2004) and a variety of frameworks were created to guide technology integration in the classroom. Some of these well-known frameworks include the Levels of Technology Integration (LoTI) Scale by Moersch (2002), the Apple Classrooms of Tomorrow (ACOT)
continuum by Sandholtz (1997), the North Central Regional Educational Laboratory’s engagement model by Lemke (2003), and the International Society for Technology in Education (ISTE) Standards by ISTE. Because of the generalist perspective of these frameworks and the simplistic ways in which they characterize technology use independent of content and sometimes pedagogy, combined with the understanding that content is a large factor in determining technology integration, technology instruction has shifted in such a way that it must be integrated across content and pedagogy (Graham et al., 2009).

In 2006, a framework was proposed by Mishra and Koehler that combined three essential aspects of teacher knowledge: pedagogical knowledge, content knowledge, and technology knowledge. This framework was called Technological Pedagogical Content Knowledge (TPCK or TPACK) and it “considers how content, pedagogy, and technology dynamically constrain each other” (Mishra & Koehler, 2006, p. 1046). In addition to the main areas of content knowledge, pedagogical knowledge, and technology knowledge, the TPACK framework proposes four additional areas that include the overlapping of the main areas of knowledge.

Since its introduction in 2006, TPACK has been used not only to design instructional strategies, but also as a lens to analyze how to most successfully integrate technology into teaching. TPACK is useful in that it addresses the complex needs related to rapid changes in technology use and teacher preparation and provides a framework that incorporates the core knowledge components of technology, pedagogy, and content knowledge. TPACK should be introduced in teacher preparation programs and a central focus of such programs (Thomas, Herring, Redmond, & Smaldino, 2013; Han et al., 2013). Once teacher candidates are familiar with TPACK components, they are better able to accommodate new and changing technologies because they have the foundational knowledge needed to guide their technology implementation.
Because TPACK can be used to help assess teacher knowledge broadly, a discussion of the different components of TPACK is warranted.

**Development of Technological Knowledge**

Technological Knowledge refers to the teacher candidate’s knowledge of simple as well as complex digital tools (Koehler & Mishra, 2009). Requiring teacher candidates to design and deliver instruction that required the use of technology was an effective way to ensure that they then integrated technology as part of their clinical experience (Dexter & Riedel, 2003). Most importantly, these technology-focused opportunities were critical in helping teacher candidates construct their own understanding of technology as a pedagogical support. Similarly, Glazewski, Berg, & Brush (2002) assert the importance of providing teacher candidates with authentic technology-enhanced experiences in order to achieve a more realistic understanding of all that is encompassed in teaching with technology. Hixon and So (2009) laud technology as a viable option to increase access to quality classrooms and indicate that technology can be most useful in assisting teacher candidates’ with understanding how theories are put into practice.

Focusing on teacher knowledge and technological knowledge, Graham et al. (2012) analyzed the instructional decisions teacher candidates made before and after taking a technology integration course. The TPACK framework was used as the analytical lens with which to view the teacher candidates’ instructional decisions. Findings indicate that the decisions made before the experience of the technology course were limited, superficial, and focused on a general knowledge of pedagogy and learners. After completing the course, which included multiple methods of modeling of technology integration and project work, teacher candidates’ responses increased in quality and quantity, but overall a deep content understanding was not found. Teacher candidates must be exposed to more rich content-specific technology integration
examples throughout their teacher education programs (Polly & Brantley-Dias, 2009), and the timing of when such examples are taught is critical. Additionally, instructors of such courses should be content experts (Graham et al., 2012).

Research by Shih-Hsiung (2012) demonstrated that technology integration should be a component of core education courses and not limited to being taught in isolated courses. Likewise, Shin et al. (2009) found that teacher candidates’ TPACK-related responses and perceptions improved with exposure to technology-rich environments. Findings also indicated that teacher candidates’ knowledge of TPACK can be influenced as separate components such that courses focusing specifically on technology will result in changes related distinctly to technology and the domains that intersect it (Shin et al., 2009).

In summary, multiple studies identify teacher candidates’ technological knowledge as a key factor of their success in teacher education programs and beyond. Requiring teacher candidates to deliver and instruct technology-based lessons as part of their coursework aided in their experience and understanding of how technology can support their teaching style (Dexter & Riedel, 2003), helped them identify associated obstacles of technology integration (Glazewski et al., 2002), and aided teacher candidates’ understanding of theories in practice (So, 2009). The literature also provides several recommendations for increasing teacher candidates’ technological knowledge. These recommendations include exposing teacher candidates to high quality samples of technology integration in a timely fashion (Polly & Brantley-Dias, 2009), having them learn from adept, technologically-proficient faculty members who are experienced technology integrators (Graham et al., 2012), exposing teacher candidates to technology integration throughout multiple courses (Shih-Hsiung, 2012), and immersing them in technology-rich environments (Shin et al., 2009).
Development of Pedagogical Knowledge

The next type of knowledge identified in the TPACK framework is Pedagogical. Pedagogical Knowledge refers to the methods and processes of teaching such as classroom management, lesson planning, and assessment measures (Koehler & Mishra, 2009). Pamuk (2012) used the TPACK framework to evaluate achievement barriers of pre-service teachers. Qualitative findings indicate that teacher candidates most struggled with developing new content knowledge and that their personal lack of pedagogical experience restrained their integration of technology approaches. Most notably, acquiring pedagogical content knowledge must be a priority in teacher education programs and this should be reflected in the teaching opportunities made available to teacher candidates (Pamuk, 2012).

Pedagogy-focused instruction was found to be essential to teacher education programs and instructors of such programs must work collaboratively (Young et al., 2013). Research by Young et al. (2013) indicates that technology integration is a difficult concept to teach because of its complexities. Shifting instructing about pedagogy to the forefront of technology integration courses is necessary, as is exposing teacher candidates to technology integration concepts from the very beginning of their coursework. Teacher candidates should enroll in technology integration courses before methods courses in order to develop and extend their knowledge. Furthermore, the instructors of both technology integration courses and methods courses should coordinate their coursework to develop authentic cross-curricular learning activities for teacher candidates (Young et al., 2013).

Likewise, according to Darling-Hammonds (2006), the most difficult part of teacher education programs is structuring teacher candidates’ experiences in the classroom in such a way that allows them to apply what they are learning. To solve this, teacher education programs must
provide opportunities and experience for teacher candidates to learn in ways different from their own experiences, model for teacher candidates how to teach and act like professional teachers, and replicate the constantly changing dynamic of teaching and working in groups so that teacher candidates are prepared to do this on their own (Darlings-Hammond, 2006). In support of providing technology-based opportunities and experience for teacher candidates to learn in authentic and new ways, Han, Eom, and Shin (2013) investigated the effects of multimedia case based learning. Most notably, they found that content knowledge relative to technology integration was not developed through the use of video case studies; however, the implementation of video cases in teacher education programs improved teacher candidates’ technological and pedagogical knowledge, as well as the integration of both of these areas (Han et al., 2013).

Research by Grant and Gillette (2006) also found that pedagogical knowledge is central to effective teaching and teacher education programs must find ways to develop it. A depth of pedagogical strategies is key, as is teaching content in a way that others find applicable and relevant. Additionally, Shulman (1987) asserts the importance of pedagogy and connects it strongly to content knowledge. Teacher education programs must focus on the relationship between pedagogy and content knowledge and provide opportunities for teacher candidates to reflect on the content as well as how and why it should be taught. The most effective teachers can transform the required content knowledge into pedagogically pleasing ways for the students and their varying abilities and backgrounds (Shulman, 1987).

In summary, the acquisition of pedagogical knowledge is a prerequisite for successful technology integration. Because the literature ascertains that a lack of pedagogical experience and knowledge hinders the technology integration practices of teacher candidates (Pamuk, 2012),
this particular area of knowledge must be specifically addressed from the onset of teacher education programs (Pamuk, 2012; Young et al., 2013). Exposing teacher candidates to varied learning experiences different from what they are familiar with and the incorporation of a variety of teaching styles, along with appropriate modeling of professionalism and constant opportunities for collaboration (Darlings-Hammond, 2006) will aide in teacher candidates’ attainment of pedagogical knowledge. Additionally, the literature recommends the completion of technology based cross-curricular learning activities (Young et al., 2013), reflection by teacher candidates on their experiences (Shulman, 1987), and guiding teacher candidates in understanding how pedagogical knowledge connects to the two other kinds of knowledge identified in the TPACK framework (Shulman, 1987). All of these measures will aide in teacher candidates’ learning of the essential pedagogical knowledge.

Development of Content Knowledge

The final kind of knowledge identified in the TPACK framework is Content Knowledge, which simply addresses the subject matter being taught and learned (Koehler & Mishra, 2009). Research by Ball & McDiarmid (2008) focuses on the development of teachers’ subject matter or content knowledge. Their research indicates that teachers rarely develop a deep understanding of subject matter and are often inadequately prepared to teach a particular subject. This is in part due to their own misconceptions from previous schooling, the superficial courses offered as part of their teacher preparation program, and a lacking real world application to their content area (Ball & McDiarmid, 2008). The inadequacy of subject matter preparation is also identified by Darling-Hammond (2006) who reflects on the connection between teachers’ content knowledge and the learners themselves. Darling-Hammond (2006) found that a much more extensive knowledge base of greater depth is needed to teach today’s students whose differences are based
on language, culture, and learning styles. Not only do teachers need to continuously evaluate and reshape the content and the way in which they teach it, but they also must learn from their teacher education programs how to overcome difficult problems of teaching and be able to learn from their own practices.

Grant and Gillette (2006) believe that content knowledge has become the central focus of the foundation of effective teachers as a result of the national spotlight on student achievement. Their research indicates, however, that effective teachers most possess more than just content knowledge. In addition to cultural responsiveness, self-knowledge and acceptance, a strong philosophy of teaching, the ability to make connections to the outside world, and the capacity to reflect on one’s teaching, effective teachers must know how to best use technology as a teaching and learning tool (Grant and Gillette, 2006). Effective teachers not only know the possible applications of software and websites, but they also know how to implement assistive technologies and use technology to enhance communication. They recognize the digital divide and find ways to overcome it.

Hofer and Grandgenett (2012) followed the development of teacher candidates’ TPACK knowledge. Their longitudinal mixed methods research revealed that significant growth of technological and pedagogical knowledge occurred as teacher candidates matriculated through the teacher education program, but the development of technological content knowledge was limited. This research indicates that the components of TPACK do not develop simultaneously nor in the same way, making it important for teacher education programs to implement TPACK-related components across all courses, not just those focused on education and methods (Hofer & Grandgenett, 2012).
In summary, the importance of content knowledge instruction cannot be overlooked in teacher education programs. The literature indicates that adequate content knowledge is currently lacking in such programs (Ball & McDiarmid, 2008; Darling-Hammond, 2006) and the most effective teachers will possess not only adequate content knowledge, but also cultural responsiveness and reflective qualities (Grant & Gillette, 2006). Teacher candidates have to possess a deep understanding of the material they are going to teach as well as understand how the nature of knowledge varies in different content areas (Schmidt et al., 2009).

Overall, TPACK has emerged as a thorough and useful construct for identifying technology integration focus areas. By applying it to the research findings, we are able to determine what learning experiences are most useful and beneficial to teacher candidates’ technology integration practices. The literature related to all three of the knowledge areas including technological, pedagogical, and content suggests that when technology integration is taught separately from instruction about content and pedagogy, teacher candidates are less successful in their technology-related endeavors. Across all three knowledge domains, the literature also consistently calls for meaningful, collaborative instruction from technologically experienced faculty from the very beginning of a teacher candidate’s experience in their education program. TPACK justifiably serves as the theoretical framework for this study because it brings clarity to the content and process of technology related integration for teacher candidates, thereby improving our ability to instruct them. Data generated from this study will contribute to a deeper understanding of how technology connects to pedagogy and content. Findings from this study will also provide specific recommendations for how we can improve teacher education programs so effective technology integration becomes more meaningful as learners are able to thoughtfully and intentionally connect it to content and pedagogy.
Criticisms of TPACK

While the components of TPACK have been identified and analyzed singly and as a whole throughout research related to teacher education programs, there are some criticisms of it. Brantley-Dias and Ertmer (2013) argue that TPACK is much too large of a construct while simultaneously being too small, once the concept has been divided into seven indistinguishable subtopics. Additionally, the concept of TPACK is too vague and ambitious of a construct to enable reasonable application (Brantley-Dias & Ertmer, 2013; Archambault & Barnett, 2010). Despite more than three hundred manuscripts publishing on the topic of TPACK (Koehler et al., 2011), little headway has been made in developing a concise definition of the framework and little action has been taken to ensure a robust way to measure it (Graham, 2011). While designed primarily to be used by teacher educators and educational researchers, the TPACK framework has since been broadened beyond its intended audience (Brantley-Dias & Ertmer, 2013) and the implications of this are unknown. More than one hundred instruments and measures have been developed to analyze the seven types of TPACK knowledge (Koehler et al, 2013) and the framework itself has undergone refining efforts and multiple conceptualizations (Voogt, Fisser, Pareja, Tondeur, & van Braak, 2013). The TPACK framework has brought a significant amount of attention to an area in need in teacher education, but because of its juxtaposing vagueness and intricacy (Archambault & Barnett, 2010), additional unraveling is needed (Brantley-Dias & Ertmer, 2013).

While technological knowledge is part of the TPACK framework, many studies focus on technology integration without connecting it to pedagogical and content knowledge. The following section identifies literature that encompasses general technology integration measures as part of teacher education programs without recognizing the TPACK framework and related
knowledge domains. Acknowledgement of this literature is necessary because the findings illuminate additional factors that contribute to the effectiveness of technology integration within teacher education programs.

**Technology Integration As Part of Teacher Education Programs**

Ottenbreit-Leftwich et al. (2012) acknowledged the difficulty of determining the depth and quality of instruction related to technology integration received by teacher candidates as part of the teacher education program. Through a rigorous mixed-methods research design, Ottenbreit-Leftwich et al. (2012) examined how teacher education programs integrate technology and how this compared to documented ways in which current teachers are using technology. Findings suggest that the wide variety of technology topics included in teacher education programs align well with current teacher practices. In particular, using technology for classroom preparation, personal productivity, information presentation, and the access and use of electronic resources to support teaching and learning were the most prevalent topics addressed in teacher education programs and implemented in the classroom by practicing teachers (Ottenbreit-Leftwich et al., 2012).

However, four specific technology topics were identified as differing in how much and how well they were taught as part of teacher education programs versus their use in the classroom. Differing in varying capacities between their inclusion in teacher education programs and their implementation in the classroom are the topics of using technology to support communication, using technology to support analysis of student data, using technology to support professional growth, and using technology to support the facilitation of higher-level thinking skills (Ottenbreit-Leftwich et al., 2012). Ottenbreit-Leftwich et al. (2012) suggest forming collaborative partnerships between teacher education programs and teachers to further
develop and discuss best practices and implementation of technology tools. Research by Nelson and Thomeczek (2006) suggests that a specific partnership between teacher candidates and mentor teachers who effectively use technology with their students in local school systems is most effective in teaching teach candidates how to effectively use technology.

A case study documented by Dutt-Doner, Allen, and Corcoran (2005) also highlighted the need for a culture of collaboration as part of teacher education. Along with meaningful technology-related teaching experiences and course content focusing on technical literacies and web resources, collaboration was found to be essential in teacher preparation.

In addition to the formation of collaborative partnerships, three essential elements that contribute to the preparation of educators who are proficient with technology are core course work, effective faculty modeling of instructional technology, and technology-rich field experiences (Duran et al., 2006) and any comprehensive teacher education program must include these three elements. Duran et al. (2006) proposed a theoretically based model that focuses on these three elements. Their model provides a structure for the collaboration that occurs among various entities as part of integrating technology in teacher education programs. The model facilitates engagement, interaction, and collaboration and removes the detachment between teacher preparation and K-12 schools. Findings indicate that the implementation of this model resulted in increased confidence levels of teacher candidates with regard to their own technology-related abilities, increased competence with advanced technology tools, a growing awareness about pressing social issues, and the creation of a stronger sense of community (Duran et al., 2006). This supports not only research by Ottenbreit-Leftwich et al. (2012), but also adds to the understanding that multiple technology-related components must be addressed in teacher education programs.
One such component is the role of faculty members in the instruction of technology integration. A quantitative analysis of more than 200 surveys determined that teacher education programs provide regular exposure to and use of technology for teaching and learning to teacher candidates (Hernández-Ramos, 2005). However, the proportion of faculty members who use technology and model it as part of the teacher education program was recorded as much less (Hernández-Ramos, 2005). Focusing specifically on the faculty of teacher education programs, Popham and Rocque (2004) studied the impact of technology integration on faculty members’ attitudes about technology use in teacher education courses. Findings demonstrated that faculty members are not only accepting of technology integration measures, but also willing faculty can excel with the proper supports in place. These findings add further support to the view that technology integration is multi-faceted and the process extends beyond the individual teacher candidates. Faculty members who are responsible for the technology-related instruction of teacher education programs are essential forces in determining the teacher candidates’ success with such integration.

In summary, the literature suggests that teacher education programs are on target with their technology instruction related to classroom preparation, personal productivity, the presentation of information, and the use of electronic resources (Ottenbreit-Leftwich et al., 2012). However, instructional areas in need of improvement with regard to technology include communication practices, the analysis of student data, professional growth, and the facilitation of higher-level thinking skills (Ottenbreit-Leftwich et al., 2012). Similar to findings from the literature focusing on TPACK, collaboration is identified as essential to the success of technology integration. Improved collaborative partnerships between teacher education programs and teachers as well as between teacher candidates and mentor teachers are
recommended (Ottenbreit-Leftwich et al., 2012; Nelson & Thomeczek, 2006; Dutt-Doner et al., 2005). Also indicated in the TPACK related literature and evident in this literature is the need for core course work focusing on technology integration (Duran et al., 2006), effective modeling by capable faculty (Duran et al., 2006; Hernandez-Ramos, 2005), and technology-rich field experiences (Duran et al., 2006). Taking into account the TPACK framework or not, a multitude of factors must be addressed in order for effective technology integration instruction to occur.

**Similar Studies**

Several studies have addressed the technology-related perceptions of pre-service and veteran teachers. Berlin & White (2012) explored pre-service teachers’ attitudes and perceptions about math, science, and technology integration. Their longitudinal, quantitative study found that pre-service teachers exhibit positive attitudes and perceptions about the value of integrating technology education, but need more experience with instructional strategies, resources, and access to resources. Additionally, technology education was valued by all participants in this seven-year study before, during, and after their teacher education program, however the pre-service teachers’ attitudes and perceptions related to the feasibility of integration changed as they completed coursework in their teacher education program. Findings indicate that pre-service teachers must engage in teamwork and collaborative efforts as they learn how to design, implement, and manage their own teaching and their work with colleagues to remedy the decrease in their perceptions and attitudes (Berlin & White, 2012).

Similarly, Chen (2011) investigated pre-service teachers’ perceptions about technology integration, and its role in mathematics and society at large. Pre-service teachers were found to have a “subtle and ambiguous” understanding about technology integration and its impact on society. A recommendation was made to provide pre-service teachers with opportunities within
their education program that enhance their understanding of the characteristics of technology (Chen, 2011).

Likewise, using an interpretive research methodology, McRobbie, Ginns, and Stein (2000) analyzed pre-service primary teachers’ perceptions of design and technology before and after their engagement in independently based technology projects. Pre-service teacher participation in such projects was strongly recommended for several reasons, all of which contributed to the expanding technology perceptions of the pre-service teachers. Engagement in an independent technology project heightened pre-service teachers’ awareness of technology integration, stimulated changes in their thinking, and led to the formation of new ideas relevant to technology and its integration in the classroom. The pre-service teachers’ awareness of ways for teaching technology in the classroom was heightened as they participated in their independent project and engaging in the projects was also found to increase personal learning and reflective practices (McRobbie et al., 2000).

Another study that explored perceptions was conducted using quantitative methods in 2003. Williams & Kingham (2003) compared the technology-related perceptions of pre-service teachers and veteran teachers. Their findings indicate that veteran teachers have not fully integrated technology into the curriculum they teach and findings also reflect a lack of technology-related professional development for these teachers. Contrary to this, pre-service teachers were found to be significantly incorporating technology into their lesson planning and subject areas. These findings support the need for prioritizing technology related professional development for practicing teachers (Williams & Kingham, 2003), ensuring that they are skilled in best practices of technology integration no matter how long they have been teaching.
Lastly, in a research study that sought to evaluate the teacher preparation program at their College of Education, Hassan, Khaled, and Al Kaabi (2010) surveyed teacher candidates from 2003-2007 and examined their perceptions of how prepared they felt to teach, their perceived strengths and weaknesses, and their suggestions for program improvement. Related to technology, the teacher candidates indicated that they felt highly prepared and able to use a variety of technology and multimedia in their classrooms. However, critical thinking skills, active learning strategies and problem solving strategies were found to be lacking in their teacher preparation coursework. At the conclusion of this mixed methods study, recommendations were made to improve the teacher education program including the provision of more instruction about communication skills as well as “how to better integrate technology into the school curriculum” (Hassan et al., 2010, p. 30).

While all of these studies explored pre-service teachers’ perceptions of technology integration (and veteran teachers’ perceptions in one case), their findings lack the specificity needed to improve our existing practices within teacher education programs and inform related professional decision-making. Findings of the previously mentioned literature reveal needs for improved collaboration (Berlin & White, 2012), more opportunities for pre-service teachers to enhance their understanding of technology integration (Chen, 2011), a need for individual technology integration projects as part of teacher education (McRobbie et al., 2000), and improving technology integration into the curriculum of schools (Williams & Kingham, 2003; Hassan et al., 2010). The previously mentioned five pieces of literature represent an inquiry into the role of technology with some understanding of pre-service teachers perceptions, which helps educators increase their understanding of the complexity of integrating technology in education, but the findings do not propose recommendations that are specifically applicable or detailed
enough so that education programs can truly benefit. The purpose of the proposed research study is to determine how and in what ways teacher education programs can be improved to prepare teacher candidates to successfully integrate constantly changing technologies and prepare 21st century teachers and the intention is to conceive multiple, specific recommendations that relate to content including coursework and learning opportunities for pre-service teachers, and pedagogy including definitive teaching methods and techniques.

Chapter Summary

Despite review and quality control measures, teacher education programs vary greatly in their effectiveness with regard to technology integration measures (Boyd et al., 2009; Greenberg et al., 2013; Wilson & Youngs, 2005; Crowe, 2010). The purpose of this chapter was to establish that, despite the wide range of efforts to effectively prepare teacher candidates for technology integration, many barriers and differing views exist about how to do so. All sections of this literature review support the argument for implementing multiple program measures to evaluate the quality and effectiveness of technology integration in teacher education programs and call for an improvement in connections between various parties responsible for teacher education (Darling-Hammonds, 2006).

Similarly, multiple technology components must be addressed in teacher education programs (Glazewski et al., 2002; Polly & Brantley-Dias, 2009; Duran et al., 2006). Teacher education programs must be taught by high quality faculty members who are competent with their technology use and model it regularly (Graham et al., 2012; Duran et al., 2006). Additionally, collaboration among faculty of these courses is essential (Young et al., 2013). There is also a need for collaborative partnerships between teachers and teacher education programs (Ottenbreit-Leftwich et al., 2012; Nelson & Thomeczek, 2006; Dutt-Doner et al.,
2005), and some research suggests teacher education programs need to further develop their relationships with diverse schools (Darlings-Hammond, 2006). Stronger connections must be made between coursework and field experiences (Darlings-Hammond, 2006), between all courses within the sequencing of classes in a teacher education program (Hofer & Grandgenett, 2012) and a critical and evident connection must be made between theory and practice as part of teacher education (Young et al., 2013).

These findings and this collection of research are also important because they demonstrate how TPACK is being used to measure and improve technology integration in teacher education programs. Additionally these findings and research suggest that technology integration benefits from a careful alignment of content, pedagogy, and the technology itself. TPACK must be integrated in teacher education programs and should be a focus of such programs (Thomas et al., 2013; Han et al., 2013; Shin et al., 2009). Doing so will result in teachers who are better able to accommodate new and changing technologies because they have the foundational knowledge needed to guide their technology implementation (Han et al., 2013). The balance of teaching technological knowledge, pedagogical knowledge, and content knowledge is difficult to ascertain, as the literature suggests all of these areas are critical (Shin et al., 2009; Pamuk, 2012; Young et al., 2013; Grant & Gillette, 2006; Graham et al., 2012) and there is much overlap when instructing teacher candidates relative to each one. Ultimately, this literature review supports the need for further examination of the specific ways in which effective teachers become competent across all three of the TPACK domains and how their teacher preparation courses contribute to this.
Chapter Three: Methodology

Introduction

Preparing teacher candidates for meaningful and effective technology integration is a difficult task (Betrus, 2012). Constantly changing technologies, the new state-wide implementation of Common Core Standards, and a focus on developing students’ 21st century skills contribute to the complexity of teacher preparation, as does the wide range of technology components addressed in teacher education programs. This study was designed to explore the reflections of newly hired teachers regarding the instruction they received about technology integration as part of their teacher education program as well as to explore their insights about technology integration in their own classrooms. This case study determined how and in what ways teacher education programs can be improved to prepare teacher candidates to successfully integrate constantly changing technologies and prepare 21st century teachers. Specifically, the following research questions were answered:

1. What technology-related components of their teacher education program did newly hired teachers find to be most useful for classroom technology integration?
2. How does teachers’ knowledge of content and pedagogy facilitate their inclusion of technology?
3. What technology-related components or instruction do newly hired teachers identify as lacking in their teacher education programs?

The following section identifies the research design and tradition. Next, the participants, recruitment, and access will be described. Then, the data collection, storage, and analysis will be reviewed. The final section describes the procedures used to contribute to the credibility, validity, and trustworthiness of this study.


**Research Design**

This study was classified as qualitative for several reasons. Qualitative research is conducted to explore a problem when a “complex, detailed understanding of the issue” (Creswell, 2007, p. 40) is needed. The research questions of this study were designed to examine how newly hired teachers reflect on the technology education of their teacher education in contrast to how they actually use technology in the classroom as teachers. The thorough examination necessary to investigate this complex problem requires that the researcher study the natural setting, collect data personally from intentionally selected individuals, rely on multiple sources of data including interviews and documents, and focus specifically on the meaning that the participants have about the issue, all of which are characteristics of qualitative research (Creswell, 2007).

The extensive data gathered through interviews and multiple documents met the rigorous data collection procedures required of qualitative work. The ensuing multiple levels of analysis from narrow themes to broader themes to abstract themes further illustrated this research as qualitative. Furthermore, qualitative research relies on an inductive analysis of research (Creswell, 2007) and throughout this study, the data was thoroughly utilized to identify emerging themes on multiple levels. Ultimately, this study resulted in a more thorough understanding of the differences and similarities between what and how teacher candidates learn with regard to technology integration in their teacher education programs and what they employ in their classroom once hired. This development of a comprehensive account and thorough understanding of the problem is a necessitous element of qualitative research (Creswell, 2007).
Research Paradigm

With this need for qualitative research in mind, a constructivist paradigm informed the design of this research study. Constructivism allows for the meaning of experiences and events to be constructed by individuals, meaning that the participants will be constructing their own realities (Charmaz, 2006). As the researcher, I sought to understand how the participants constructed their individual meanings and perspectives about their own technology use. I engaged in reflective and transparent processes and articulated my own assumptions and experiences through the conception of reflective analytical memos that were written throughout the data gathering and analysis processes. My experiences teaching elementary school students and pre-service teachers as part of their teacher training program, along with my affinity towards technology provided me with a professional lens for approaching this research. I have been an instructor for the technology courses in a teacher education program and this experience has provided me with a strong understanding of the technology curriculum taught as part of the teacher certification process. Specifically, I brought to this research process a general understanding of what successful technology integration entails, a critical perspective about the value of technology integration and how it improves student motivation, engagement, and marketable skills, an appreciation of the complex factors and barriers that prevent technology integration, and a desire to improve the technology component of teacher education programs.

Research Tradition and Rationale for Case Study Design

The purpose of a case study is to develop an “in-depth description and analysis of a case” (p. 78) through the comprehensive collection of multiple data sources over time and “within a bounded system” (Creswell, 2007, p. 73). A case study seeks a greater understanding while acknowledging the unique and intricate attributes of the case and how they interact (Stake,
This type of research tradition is used when the researcher wants to fully understand “a real-life phenomena in depth, but such understanding encompassed important contextual conditions – because they were highly pertinent to your phenomenon of study” (Yin, 2009, p. 18). A case study was an appropriate method of examination of teacher technology preparation because this content requires such an in-depth examination. This research focused on the phenomena of the technology training of a teacher education program and its subsequent usefulness and practicality by richly describing the program and analyzing the perspectives of graduates of the program. A case study approach provided a methodological congruence for this complex exploration.

Furthermore, a case study was selected as the research tradition because instruction and application of technology integration is an authentic and complicated issue that must be understood in context. A case study allows for the thorough examination of the teacher education program and its resulting application in the settings in which they occur. Case studies rely on the examination of the context (the technology components of the teacher training) and many different sources of data (Creswell, 2007). Interviews and documents were utilized to enable the development of thick descriptions (Creswell, 2007) of technology preparation and integration, which aligns well with the central tendency among case studies to develop an in-depth understanding of a case (Creswell, 2007).

This case study was bounded (Creswell, 2007) by graduates from the same University within a four-year period. While all research was conducted within a single year, a period of acclimation between the year of graduation for teacher candidates and their transition into becoming full-time teachers is accounted for. Furthermore, this study was an instrumental case study (Stake, 1995) because it facilitated our understanding of the technology component of
teacher education programs and identified potential areas for improvement. Stake (1995) identifies as instrumental case study as one in which “a case is examined to provide insight into an issue” (p. 237) and “the case is of secondary interest; it plays a supportive role, facilitating our understanding of something else” (p. 237). This instrumental case study required an in depth exploration of the case (Stake, 1995) focusing on how the technology instruction received as part of the teacher education program impacts later instruction because this “pursues the external interest” (Stake, 1995, p. 237) of potential improvements to said program.

The unit of analysis (Creswell, 2007) was graduates from the same Elementary Education program at the University, all of whom are currently employed by public schools in the state of Maryland. This allowed for a thorough examination and investigation of the research questions and for the development of multiple descriptions that recounted the experiences relative to technology instruction in the same teacher education program (Creswell, 2007). This development of multiple descriptions aided in understanding the complexity of each participant’s experience (Creswell, 2007). Furthermore, this study investigated the teachers’ current technology integration practices to provide a comprehensive review of their practices and identify specifically how their technology integration has been shaped by their teacher education. Technology integration was defined as occurring when “classroom teachers use technology to introduce, reinforce, extend, enrich, assess, and remediate student mastery of curricular targets” (Hamilton, 2007, p. 20).

Because this study sought to: (1) examine the perceptions and reflections of newly hired teachers about the instruction they received regarding technology integration in their teacher education program, (2) describe its application to their instruction once hired, and (3) ultimately
illuminate how teacher education programs can improve their technology integration instruction, an instrumental case study (Stake, 1995) was appropriate for this investigation.

**Participants**

Participants in this case study were (1) undergraduates from the Department of Elementary Education at The College of Education at a large urban University in an eastern state between 2010-2013, (2) currently teaching in elementary schools in said state’s Public School System, and (3) purposefully selected based on their regular technology integration in the classroom. This homogeneous sampling (Creswell, 2012) ensured that all participants received similar technology training as part of their teacher education program, had transitioned beyond their first year of teaching, and were accountable for students’ mastery of the same statewide technology standards. The final and defining characteristic of current, regular technology integration in their classroom ensured that the participants were able to provide beneficial information to the researcher. Participants were chosen because they had relevant experiences to the phenomenon being researched (Creswell, 2007).

To clarify, technology integration occurs when “classroom teachers use technology to introduce, reinforce, extend, enrich, assess, and remediate student mastery of curricular targets” (Hamilton, 2007, p. 20). To determine if these teachers were integrating technology, potential participants completed a short questionnaire (Appendix A). This questionnaire required participants to identify how frequently they use various technologies in their instructional practices. Selected participants were those who indicated the highest frequencies of technology use.

A total of three teachers were selected, as recommended by Creswell (2007) who ascertains that a small number of participants will yield substantial opportunity to establish
themes of the case as well as cross-case analysis. This sample size allowed for a thorough investigation of the experiences, impressions, strategies, and knowledge of the participants. By including rich thick descriptions throughout this study, others will be able to determine the degree to which the findings can be generalized or applied to their own setting (Creswell, 2007). Detailed descriptions of the participants’ educational experiences and current technology use were provided so that others can make their own determination of whether or not findings can be transferred based on similarities.

**Recruitment and Access**

Participants were recruited in two ways: (1) with a series of fliers posted in the College of Education at the University (Appendix B) and (2) through direct advertisement in graduate classes. The fliers were posted near the classrooms that graduate students use, as many of the graduate students have matriculated as undergraduates from the College of Education and will potentially meet the requirements of participants. I also verbally advertised this research study and the required characteristics of potential participants in the graduate classrooms at the University by seeking permission from my colleagues who teach for the College of Education. I requested to speak with their students for a short time at the end of a class session (Appendix C).

Potential participants were asked to contact me via email or cell phone. Once contact was initiated, I asked the potential participants to complete the abovementioned short questionnaire (Appendix A). After I collected this information and developed a pool of candidates, I narrowed the selection by choosing to include the participants who use technology the most frequently. Chosen participants were notified of their selection with an email.
(Appendix D) inviting them to voluntarily participate in this research study. Stipends of $25.00, in the form of a gift card to a bookstore, were offered to all of the selected participants.

Once determined, participants received a Statement of Consent form (Appendix E) as an email attachment for their review prior to meeting. At our first face-to-face meeting, I read this form to the participants and answered any questions. Participants were asked to sign the Statement of Consent at that time and received a copy of the form for their records. I also stored signed copies of consent forms in a locked storage cabinet.

The Statement of Consent outlines the purpose of the study, the role of the investigator, the potential risks, what is being asked of participants including a potential time commitment, the voluntary nature of their participation, procedures for maintaining the confidentiality of the data, and potential benefits. This document that participants received also emphasized the participants’ right to withdraw from the study at any time without penalty and provided assurance that participation in the research in no way affected their employment status positively or negatively.

In order to maintain participant confidentiality and ethical standards of research, I ensured that potential participants were informed that their participation in the study was voluntary and their confidentiality was maintained. Actual participants’ names were not used. The participants were referenced as Teacher A, Teacher B, and Teacher C. Pseudonyms were used for the University and any schools or people mentioned. Interview transcripts were coded, data was stored on a password-protected computer, and printed materials were filed in a locked storage cabinet. Names and any other identifying information collected during the interviews with participants were eliminated from written transcripts in preparation for the data analysis.
Potential risks associated with participation in the study were unlikely and of low probability. Participants were asked to self-report information about their experiences as part of the teacher education program and the ways in which they currently use technology in their classroom. These questions had the potential of minimal psychological risk if participants were upset or reluctant to share their professional or personal experiences, but there was no foreseeable harm.

These procedures and protections are in accordance with the Northeastern University Institutional Review Board (IRB) and approval from the IRB was sought and received by submitting the required application, consent forms, and recruitment materials approximately one month prior to the start of this research study. I also sought and received approval from the IRB at the University. No contact was made nor was any data collected from participants until formal IRB approval from both institutions were received.

**Data Collection**

The primary means of data collection for this study was two, one-on-one, semi-structured interviews of the newly hired elementary school teachers. The use of semi-structured interviews is recommended when the researcher desires specific information, as is the case for this research (Rubin & Rubin, 2012). Both interviews took place in a private location specified by the participant. The first interview began with an introductory protocol that reviewed the focus of the study, highlighted the confidentiality of responses, and helped to establish rapport with the participants (Appendix F). The interviewer then guided the discussion by asking a series of open-ended questions, which were formulated from the Technological Pedagogical Content Knowledge (TPACK) framework and research literature findings (Appendix F).
**Interviews**

In the first interview, the questions focused on the participants’ experiences with technology in their current position as a classroom teacher. Interview questions focused on the technologies they use (Graham et al., 2009; Harris & Hofer, 2009), their decision making process for selecting technologies (Sandholtz, 1997; Judson, 2006; Harris & Hofer, 2009; Koehler & Mishra, 2009), obstacles faced relative to technology integration (Brzycki & Duda, 2005; Chen, 2008; Halverson & Smith, 2009), technology professional development (Bos, 2011; Brock, 2009) and how technology integration is connected to pedagogy and content (Koehler & Mishra, 2009). Participants were asked to bring up to 3 current technology inclusive lesson plans that they have recently used. In the second interview, the questions focused on the participants’ experience in their teacher education program and they were asked to bring and explain up to 3 samples of work that they completed as part of their program. Interview questions focused on the skills, knowledge, and technologies that they acquired as part of their teacher education program (Ottenbreit-Leftwich et al., 2012; Lei, 2009; Glazewski et al., 2002; Graham, Borup, & Smith, 2012; Han, Eom, & Shin, 2013), the role of technology in the instruction they received (McRobbie, Ginns, & Stein, 2000; Madson, Melchert, & Whipp, 2004), the technologies used as part of their student teaching experience (Greenberg et al., 2011), and how teacher technology standards were addressed (Glazewski et al., 2002; Ball & McDiarmid, 2008). The second interview was also used to follow up as needed from the first interview.

When conducting interviews as part of qualitative research, Creswell (2012) suggests the use of “icebreakers” to begin the interview, open-ended questions that permit maximum flexibility in their responses, the researcher keeping opinions to themself, the use of probes for clarification and elaboration, and the provision of verbal transitions between questions to ensure
all questions receive a response, even if out of order. I adhered to these suggestions and I also took short notes by hand during the interviews. All interviews were audiotaped using Notability after receiving participant permission. I then transcribed the transcripts by hand to later be entered into Dedoose, a qualitative software analysis program.

I anticipated the first interview would last approximately forty-five minutes and the second interview will last for the same duration. These approximations were accurate. The interviews occurred in the classroom of the participants at a time chosen for their convenience.

**Document Analysis**

In addition to the data documented in transcripts from both interviews, I collected secondary sources of data in the form of documents. These documents were a useful addition to this research study, as they provided the favor of already being in the language and words of the participants and the documents did not require transcription (Creswell, 2012). The documents collected included no more than 3 examples of technology-related coursework from the participants’ teacher education program and no more than 3 technology inclusive lesson plans recently utilized. These documents were analyzed for elements of TPACK, meaning that I reviewed the selections of technology, pedagogy, and content, and the connections between them.

**Data Storage**

With consent of the participants, all interviews were audio-recorded as separate files using Notability. Participants were identified as Teacher A, Teacher B, and Teacher C and all files, notes, and sources of data utilized this same identification system in order to ensure confidentiality. I diligently removed names and any other identifying information from documents submitted by participants. Materials were organized by participant, meaning all
interview responses, notes, and secondary documents from the same person were stored and filed together. All digital files were stored on a password-protected computer and printed materials were filed in a locked storage cabinet that is only accessible to me. A back up of files was secured on a hard drive stored in the locked cabinet. Upon completion of the research, I will destroy all printed materials and computer files will be deleted, excluding the informed consent documents that will be kept for three years. To ensure confidentiality throughout the data collection process, I will be the only person with access to these files and documents.

Data Analysis

Data analysis can be represented as a spiral image to indicate that it is not a straightforward linear process (Creswell, 2007). Collecting and analyzing data, along with report writing, occur simultaneously and tend to be interrelated (Creswell, 2007). Figure 1 shows The Data Analysis Spiral.

![Figure 1. The Data Analysis Spiral (Creswell, 2007).](image)

The analytical process began with data collection. This included conducting 2 separate one-on-one interviews with each participant and making copies of the coursework samples and current
technology-rich lesson plans from the participants. Next, data management occurred, when I organized the data by participant and converted files to the necessary units. The interviews were audio taped using Notability, transcribed by hand by the researcher, and data was entered into Dedoose, a qualitative analysis software program.

Once the data was organized, I read the transcripts line-by-line and recorded initial notes and memos as short phrases and key ideas as part of this initial exploration. Next, I moved into the describing, classifying, and interpreting loop of the spiral by recording rich descriptions, developing themes through a classification system, and providing interpretations as guided by the literature. During this process, codes or categories were developed that matched text segments and I developed and reduced codes as needed. Finally, the final phase of the spiral lied in the packaging of the data so that others can view a representation of the levels and themes that emerged (Creswell, 2007). Using this data analysis spiral as a guide, I yielded a rich and detailed description of the cases and focused on a few key issues or analysis of themes (as suggested by Creswell, 2007), in order to understand their complexity.

Within the describing, classifying, and interpreting loop of the Data Analysis Spiral (Creswell, 2007), a specific coding process was used. This process was divided into two stages. Stage 1 focused on an in-depth analysis of each participant’s experience and Stage 2 focused on the cross-case analysis of their experiences.

**Stage 1 – Individual Descriptions**

The experience of each participant were analyzed and written up separately so that a contextual description and interpretation could be provided for each (Creswell, 2007). The following strategies informed the data analysis process.
1. **Line-by-Line Open Coding & Provisional Coding.** For each participant, the first interview, which focused on his or her experiences in their teacher education program, was reviewed using line-by-line open coding (Emerson, Fretz, & Shaw, 1995). After transcribing the text, I segmented it, assigned labels, identified patterns across and within the data, and recorded emerging themes (Saldaña, 2012) using Dedoose.

These same first interviews were then provisionally coded (Saldaña, 2012) a second time using the TPACK framework as a guide. Provisional coding relies on a start list of codes generated from the study’s conceptual framework and research questions, the literature review, and the researchers’ knowledge and experiences (Saldaña, 2012). I began with a short list of codes, known as “lean coding” (Creswell, 2007, p. 152), which was ultimately expanded to approximately 20-25 categories. The four starting codes for provisional coding were (1) technological knowledge, (2) pedagogical knowledge, (3) content knowledge, and (4) interrelated knowledge areas. These categories then blended into the five or six major themes that were used when writing the narrative (Creswell, 2007). The emerging information from these two different rounds of coding – open coding followed by provisional coding - aided in the construction of follow up questions as part of the second interview. For each case, the second interview, which focused on the participants’ current technology integration, was then coded similarly, using open coding and provisional coding based on the TPACK framework.

Because multiple data sources are often used in case study research in order to provide a comprehensive view of the problem of practice (Creswell, 2007), I also relied on analysis of the collected documents. These documents included coursework from the participants’ teacher education program and current lesson plans. I engaged in open coding followed by provisional coding to analyze these documents as well.
2. **Second Cycle Coding.** The purpose of this phase is to reorganize and reanalyze the data previously coded (Saldaña, 2012). During this second cycle coding, I reduced the overlap and repetitiveness among the codes and categories in an effort to glean the most significant themes. Some of the codes were collapsed or eliminated due to redundant meanings, and some categories were broadened to include similarly categorized text (Saldaña, 2012). The purpose of this second cycle coding was to develop a categorical or thematic organization to the previously determined first cycle codes (Saldaña, 2012).

3. **Analytic Memo Writing.** I wrote memos during the data collection and analysis to document and reflect on my coding choices and emerging patterns. These analytic memos also summarized key ideas, noted areas for follow up, and identified any issues that required further exploration (Saldaña, 2012).

4. **Diagramming and Word Tables.** Following the examination of the previously created memos and a thorough review of the emerging codes and themes, I created a map that connected concepts that are linked together. I identified contextual factors, situations, outcomes, and the similarities and differences among them. Furthermore, a word table is often used as part of case study research to display data from different participants in order to identify similarities and differences (Yin, 2009). In addition to the diagrams, I created word tables to represent and visually display the information, complimenting the final step of Creswell’s (2007) Data Analysis Spiral. These diagrams and word tables identified the main themes, categories, and concepts from each case and aided me in writing the descriptions of the participants’ experiences. This analysis of each participant individually occurred in anticipation of the cross participant analysis and guided me in establishing background information and understanding clearly the ways in which technology was being used in the past and is being used in the present.
Creation of these diagrams and tables allowed me to create a more holistic representation of technology use across participants’ experiences and triangulate the findings.

**Stage 2 – Cross Participant Analysis**

In this second stage of analysis, I compared the main themes and categories determined for each participant in order to explore how different concepts and processes varied among the three of them. This thematic analysis to identify similarities and differences is known as a cross-case analysis (Creswell, 2007). Using the TPACK framework to guide this final stage of analysis, the key themes that were identified for each participant were re-examined to determine how issues were addressed differently across all three. Commonalities and unique features were identified to propose potential contextual factors that account for the variations. Additionally, explanation building and time-series analysis as recommended by Yin (2009) was included in the analysis.

In order to best describe the overall case, I purposefully integrated all pieces of data while attending to the TPACK framework. First, I provided an in-depth description of the teacher education program. I identified and described the three regulators used to monitor the quality of the program including approval from the state, national accreditation, and the teacher certification process (Coggshall et al., 2012). I addressed the candidate selection process (Levine, 2006; Koop & Farr, 2011) and the content of the teacher education program (Madson et al., 2004), including a review of required courses (Boyd et al., Harris & Sass, 2011; Monk, 1994). Additionally, I provided a detailed review of the student teaching experience process (Greenberg et al., 2011).

I then provided thematic descriptions and comprehensive case contexts for each participant (Yin, 2009) derived from the within case analysis. These descriptions included
details about the settings, the participants, a general chronology of events, and a detailed view of the particulars of the case (Creswell, 2007). Next, the emerging themes from the cross-case analysis (Yin, 2009) were shared. The categories and themes that emerged during the within-case analysis and the cross-case analysis were used to determine “naturalistic generalizations” (Creswell, 2007, p.163) concerning the technology component of teacher education programs. Finally, along with these naturalistic generalizations, I provided interpretations and meanings of the overall case, along with implications for future teacher education programs.

**Trustworthiness**

The trustworthiness of any research study is essential to evaluating its worth and in order to establish trustworthiness, the researcher must institute credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). The following strategies focus on validation efforts: (1) prolonged engagement and persistent observation in the field, (2) triangulation to provide corroborating evidence, (3) peer review or debriefing as an external check, (4) negative case analysis, (5) early clarification of researcher bias, (6) member checking to ensure credibility of the findings, (7) rich thick descriptions to help determine transferability, and (8) external audits to examine process and product (Creswell, 2007, pp. 207-209). Multiple strategies should be employed (Creswell & Miller, 2000) and when selecting such strategies, the researcher should acknowledge the lens being employed in the study as well as the paradigm assumptions of the researcher (Creswell & Miller, 2000). With that in mind, this qualitative research study with a constructivist paradigm relied on triangulation, early clarification of researcher bias, member checking, and rich thick descriptions.

The use of triangulation ensured that the data from interviews and documents is accurate by drawing on these multiple sources about the participants’ views and behaviors regarding
technology integration. The data was examined to see whether the different sources corroborated each other, aiding in the credibility (Creswell, 2007). The data was also triangulated through multiple participants to substantiate the findings. Furthermore, I relied on member checking by requiring the participants to review their interview transcripts for accuracy and validity, along with any additional insights. Finally, rich thick descriptions were included so that readers of this research study will be able to determine whether or not the findings can be transferred based on similarities. The purpose of rich thick description is to “create verisimilitude, statements that produce for the readers the feeling that they have experienced, or could experience, the events being described in a study” (Creswell & Miller, 2000, p. 129). By providing as much detail as possible of the descriptions and setting, the credibility and applicability of the findings were established.

**Potential Threats to Internal Validity**

To minimize researcher bias, I clarified my own biases so that readers will be able to see the vantage point of this study and assess on their own the degree of transferability (Creswell, 2007). As a result of my background as an elementary teacher who regularly employed technology and my experience as a faculty member at a University teaching pre-service teachers about technology integration, I have biases about the importance of technology integration. I believe that regular, appropriate, and thoughtfully selected technology integration is essential to not only preparing students for future employment, but also for engaging them in the learning process. I believe technologies should be chosen specifically with careful consideration being given to not only the learning styles and preferences of the students, but with the pedagogy and content of the lesson in mind. I believe that technology integration can and should occur
regularly in elementary school classrooms. This explanation and clarification of these biases will allow the reader to understand how they might impact the research study (Maxwell, 2005).

**Chapter Summary**

This chapter explained the rationale for the design of this research study and described the strategies that will be used for data collection and analysis procedures. A qualitative study based in a constructivist paradigm was used to gain a detailed understanding of the differences and similarities between what and how teacher candidates learn with regard to technology integration in their teacher education programs and what they employ in their classroom once hired. This development of a comprehensive account and thorough understanding of the problem is a necessitous element of qualitative research (Creswell, 2007). Specifically, a case study method was used for this complex and authentic study because it allowed for a thorough examination of the teacher education program and its resulting application in context. Case studies rely on the examination of the context and many different sources of data (Creswell, 2007). Because it facilitated our understanding of the technology component of teacher education programs and identified potential areas for improvement, this study was classified as an instrumental case study (Stake, 1995).

Conducive to case study research, a small number of participants was selected who met the previously described criteria. All interaction with the participants adhered to the procedures and protections in accordance with the Northeastern University Institutional Review Board (IRB). The main source of data was two one-on-one semi-structured interviews and the secondary source of data was the technology inclusive course work and lesson plans submitted by the participants.
Creswell’s Data Analysis Spiral (2007) guided the data analysis. Dedoose, a qualitative software analysis program, was used to aide with the organization, storage, and coding of data. Two stages of coding occurred. The first focused on an in-depth analysis of each participant’s experience. Line by line open coding, provisional coding, second cycle coding, analytic memo writing, diagramming, and the construction of word tables was used as part of the data analysis. These procedures were followed by the second stage consisting of a thematic cross case analysis to identify similarities and differences (Creswell, 2007). Ultimately, I composed thorough contexts and descriptions of each participant’s experience. I identified multiple themes in the individual participant’s experiences and then conducted a comprehensive cross-case analysis that identified the similarities and differences among the participants’ experiences. Lastly, I incorporated the assertions and generalizations that make sense of the data and themes and included interpretations and meanings of the overall case study and implications for future constructs. Four strategies were used to ensure the trustworthiness of this case study: triangulation, early clarification of researcher bias, member checking, and rich thick descriptions.
Chapter Four: Research Findings

Introduction

The purpose of this study was to investigate the current content of technology integration classes taught as part of a teacher education program and the ways in which newly hired teachers use technology in their classroom to support teaching and learning. An analysis of how teachers reflect on technology training as part of their teacher education and its application in their classrooms will help determine what improvements can be made to teacher education programs. This chapter summarizes the themes that emerged from the findings of multiple interviews with three recent graduates of the same teacher education program at Bradlin University, all of whom are now employed in different elementary schools across the same eastern state. Specifically, the participants were composed of a third grade teacher, a fourth grade teacher, and a fifth grade teacher, all of whom also utilize technology in their classroom on a daily basis. In addition, multiple documents from these teachers, including coursework from their teacher education programs and current lesson plans, were analyzed to supplement information learned from the interviews.

The first research question focused on the most useful technology-related components of the participants’ teacher education program. To explore this question, the participants were asked to identify the digital tools and resources they were exposed to during their teacher education program, describe projects and coursework that they completed that utilized technology, pinpoint specific digital tools, websites, and resources that they learned about as part of their teacher education program, identify the role technology played in the instruction they received, recognize how the Maryland Teacher Technology Standards and the Technological Pedagogical Content Knowledge (TPACK) framework were addressed, and also to elaborate on
how they now use the technology integration skills they learned in their teacher education program.

The second research question focused on how teachers’ knowledge of content and pedagogy facilitates their inclusion of technology. To better our understanding of how the TPACK framework is utilized by newly hired teachers, the participants were asked to describe their thinking processes and the factors that affect the types of technology they use, identify how technology use has influenced their instructional methods as well as the content they teach, identify obstacles that interfere with technology integration, and describe a technology-rich lesson plan they have recently taught identifying in particular the content, objectives, instructional strategies, technology components, and any assessments used. The third and final research question addressed the technology-related components that newly hired teachers identify as lacking in their teacher education programs. To further investigate this question, participants were asked to recall the digital tools and resources they currently use on a regular basis, describe any technology-related professional development they have received, share how they were prepared for the technology integration they do on a regular basis, and to identify relative to technology, any areas they wish they had received more instruction.

To fully examine these research questions, participants were interviewed two separate times. Additionally, the technology resources physically present in the participants’ classrooms were identified, and multiple documents including coursework and projects from their teacher education program, along with current lesson plans were collected from each participant. Information received from interviews and these documents was then analyzed and coded. Through examination of the codes, five eminent themes emerged, leading to a greater understanding of the technology component of the teacher education program.
Context of the Study

In order to fully interpret and understand these findings, the context of the teacher education program at Bradlin University, the school from which all of the participants graduated, must first be examined. This large public University with nearly 19,000 undergraduate students offers more than 100 degree programs, elementary education among them (At A Glance, 2015). Bradlin University has full accreditation from the National Council for Accreditation of Teacher Education (NCATE) and data from the State Department of Education confirm that this University graduates the largest single number of initial teacher certification candidates in the state (College of Education, 2015). The culture of the University values high quality teaching, a commitment to diversity, and a commitment to technology (College of Education, 2015). In particular, the Department of Elementary Education promotes a belief that well prepared teachers in elementary school classrooms are facilitators of active learning (Department of Elementary, 2015a).

The Elementary Education Program

The Elementary Education program provides a liberal arts background, a planned sequence of courses, and professional preparation including field experiences for teacher candidates in multiple grade levels (Department of Elementary, 2015a). The following competencies provide an overview of what graduates of the Elementary Education program will be able to do. Upon graduation, teacher candidates will be able to:

- understand education and learners in context, differentiate instruction and skillfully engage all children in learning, consider multicultural and social justice issues when teaching, possess critical analysis and reflection skills, use effective classroom management strategies, use theory and data to inform instruction, use cutting edge
teaching strategies, develop a thoughtful philosophy of education, and engage in ongoing professional development. (Department of Elementary Education, 2015b, para. 1)

Additionally, the University touts an intentional academic advising program in which teacher candidates work closely with over 30 faculty in the Elementary Education Department to strategically plan and support their personal and professional successes (Department of Elementary, 2015a).

**Phases of the Program**

Students move through the program at Bradlin University in five phases (Department of Elementary, 2015c). The first phase consists of all prerequisite courses required for acceptance into the Elementary Education major. The second phase is marked as the first semester of the Elementary Education program. Students in this phase enroll in courses focusing on literacy instruction and begin their first field placement in an elementary school for half of one day each week. The third phase is the second semester of the Elementary Education program and in this phase, students focus on math and science instruction and also increase their field placement to two half days each week. The next phase is the third semester of the Elementary Education program and is marked by the commencement of a year-long internship in one or more elementary schools. Students are designated as interns during this phase and their coursework is of an advanced level. Field placements for two full days each week are part of this phase, as is completion of the Praxis exams. In the fifth and final phase of the program, the interns return to the schools where they completed previous internships and engage in full time student teaching placements (Department of Elementary, 2015c).

**Required Technology Coursework**

As part of the previously identified third phase and the University’s commitment to
technology, all teacher candidates are required to take a 300-level course introducing them to various forms of electronic and digital technologies while also providing opportunities for engagement and reflection on the role these technologies play in the teaching and learning process. Titled “Utilization of Instructional Media,” this course provides students with the experience of using many of the digital tools found in today’s schools and also exposes students to basic learning theories, the National Educational Technology Standards for Teachers, the Maryland Teacher Technology Standards, the Interstate New Teacher Assessment and Support Consortium Standards, and the University’s own framework of standards that focus on excellence in teaching (Department of Elementary, 2015c). This required course for all Elementary Education students is traditionally taken during the junior or senior year and is the main technology course for all teacher candidates in the College of Education. While this required course specifically focuses on technology integration, technology has been infused throughout the entirety of the students’ experiences at the University and is perceived as integral to the teaching and learning process (College of Education, 2015).

Available Digital Resources

At the Educational Technology Center at Bradlin University teacher candidates at any phase have access to 30 Windows XP computers, 15 Mac systems, printers, scanners, digital cameras, CD writers, and audiovisual media equipment. Students are permitted to borrow equipment as needed and staff is available for technical support for students as well as faculty. Faculty has access to these tools, as well as two mobile carts of 30 iPads, one mobile cart of 30 mini iPads, and one mobile cart of 30 netbooks (Technology Facilities, 2015).

Five classrooms in the College of Education building have 30 networked Windows machines and a networked printer along with a teacher station with a desktop computer, DVD
drive, and document projector, all of which can be displayed through a large-screen LCD projector and are connected to an audio system. Additionally, two of these classrooms contain SMART boards and one contains a Promethean Activboard (Technology Facilities, 2015). Faculty in the College of Education at the University has access to a unique resource in the form of an Innovation Lab. The Education Innovation Lab, created exclusively for faculty, provides resources for technology support, workshops and seminars, and assistance with technology integration. The Education Innovation Lab houses full time support staff for faculty, eight computer stations, one Promethean Activboard, one SMART board, one DVD/VHS player, one Elmo Document Camera, two LCD projectors, one set of 32 SMART Responders, and two whiteboards (Education Innovation Lab, 2015). An extensive offering of software programs is available in the Education Innovation Lab including Acrobat Pro, ActivInspire, Adobe Bridge, ArcSoft, Audacity 1.3, Cam Studio, Captivate, Dreamweaver CS5, FlipShare, Image Now 6, Inspiration 9, Internet Explorer 8, Jing, Kidspiration 3, MS Office 2007, Mozilla Firefox, One Note 2007, Photoshop Elements 8, Photostory 3, Power DVD DX, Quick Time 7, Roxio Creator DE, Second Life, Sharepoint Designer 2007, Silverlight 4, SMART Notebook, Soundbooth, Wimba Pronto, and Windows XP (Education Innovation Lab, 2015). With access to an abundance of digital resources, tools, and software, the teacher candidates and faculty at Bradlin University have the potential to be well prepared when it comes to technology integration.

**Positive Reputation of the Teacher Education Program**

The final contextual element of importance that surfaced during this research study is that the University is known as an excellent institution for future teachers to attend. During the interviews, Teacher A remarked about having heard of the University as a “really good teaching school” and noted that it had “a very high success rate of getting its teachers hired.” Participant
B commented she knew the University “had a good teaching program” and she immediately knew she wanted to attend because of that. Participant C also mentioned the positive reputation of the University as a factor in her decision to attend. The University’s positive reputation as a successful school for teachers is certainly established as all of the participants mentioned it as a factor in their decision to enroll in the teacher education program there.

**Major Findings**

Taking into account the context of the Elementary Education program along with these descriptions of the labs, classrooms, and technology tools and resources available to students and faculty, as well as the University’s positive reputation, the main findings that emerged from the coding and analysis of interviews and documents are as follows: the successes of the teacher education program, content knowledge as the first consideration when lesson planning, the benefits of technology in the classroom, resources desired by newly hired technology-competent teachers, and suggested improvements for the teacher education program as identified by its graduates.

**Successes of the Teacher Education Program**

*Faculty Modeling of A Variety of Technologies*

The first theme that emerged in this study is that the teacher education program is successful in multiple ways. An initial success of the program relates to the faculty and their exceptional modeling of technology integration along with their noted enthusiasm for it as well. Faculty at Bradlin University were described as “providing lots of different examples of how to use technology” and “really supportive of sharing these technologies.” More specifically, Participant A recalled
most of my teachers were trying to figure out what was the newest piece of
technology, how it could be included in the lesson, and how it could be used to motivate
everyone. I feel like they [the faculty] definitely positively trained us how to properly
incorporate technology as much as possible by using it with us.

This participant also recalled the passion that one of her professors had for technology
integration and commented that it made her want to incorporate it as well. Through observation
of her own professors, this participant’s own motivation and excitement to integrate technology
increased as she completed coursework in the teacher education program.

Similarly, all of the participants noted various digital tools and software programs they
were exposed to by faculty who teach for the program. These resources included Promethean
and ActiveInspire boards, flip charts, Powerpoints, email, videos, Adobe programs, Google docs,
mobile labs, Microsoft programs including word and excel, clickers, webcasts, podcasts, and
wikis. Teacher A recalled not only learning about these resources, but including flip charts,
videos, and an interactive online song as part of a lesson she created about transformations in
math early on in the teacher education program. Likewise, Teacher B recalled an education
professor who would always start the class with an engaging video clip. Teacher B remarked
that she “definitely had exposure to different ways technology can be used in the classroom.”

Participants recounted receiving specific information about how to use particular websites and
online resources and learning how to use them through modeling.

Teacher C identified the high expectations faculty members had for technology
integration. “I had to use different parts of technology for lesson plans and it was expected in
my student teaching and in my coursework that we were using technology in our lesson plans
and that it was regularly incorporated.” This modeling of technology integration by faculty and
the enthusiasm and high expectations shared by faculty are successes of the program. By
providing teacher candidates with a positive experience surrounding technology integration, the
faculty is ensuring that these teacher candidates will be comfortable and proficient technology
users as they enter their own classrooms.

Technology Integrated throughout Coursework

Coursework from the teacher education program submitted by the participants also
showed a high level of technology integration. For example, Teacher A submitted a lesson plan
completed as part of her coursework about prefixes and suffixes for a second grade class.
Aligned with literacy standards, Maryland Teacher Technology Standards, and standards set
forth by the International Society for Technology in Education, the lesson required students to
use www.padlet.com, an online bulletin board that allows students to post responses in real time,
to first determine their prior knowledge of prefixes. The lesson also utilized an online video, the
Promethean board, and interactive flipcharts in addition to more traditional supplies including
construction paper, glue, and markers. The lesson required that the teacher model how to use
padlet and how to manipulate the flipcharts, and the teacher also led students through guided and
independent practices before closure.

Another lesson plan submitted was written for a first grade classroom and it focuses on
nonstandard measures. This lesson was aligned with math standards, Maryland Teacher
Technology Standards, and standards set forth by the International Society for Technology in
Education. Instructional materials included the Promethean board, computers, flipcharts, a
projector, math manipulatives, and a traditional worksheet. The lesson began with a short online
video and continued with teacher modeling, an interactive game using the flipcharts, a review of
problem solving strategies, and individual and group use of manipulatives.
Interesting to note in both these lesson plans is the combination of technology integration with more traditional pedagogies and materials. In these lesson plans, students were asked to use digital media to communicate and work collaboratively while meeting objectives appropriate for their grade level and ability. The technologies used were well aligned with the content of the lesson as well as the pedagogy. Appropriate standards were addressed and the clear writing of the lesson plans in combination with their thoroughness provides a sense that these are of a high quality. These lesson plans submitted by teacher candidates exemplify the characteristics not only of a strong lesson plan, but lesson plans that include appropriate levels of thoughtful technology integration.

*Teachers’ Comfort Level with Classroom Technology Integration*

A final favorable outcome of the teacher education program that emerged in this study and is attributed to the above mentioned successes can be identified as the high level of comfort graduates of the teacher education program now have with teaching themselves how to integrate a new technology, tool, or resource. Teachers A, B, and C all indicated that they are comfortable teaching themselves how to use a new technology and are willing to try a new technology, even if they have not received extensive training or professional development on how to use it. While Teachers B and C indicated that time is what limits this self-teaching process, all participants possess a willingness to explore new technologies and technological resources. This can be attributed to the technology-rich environment in which they participated in, practiced in, and learned in as part of their teacher education program. Their willingness to self-teach and embrace new technologies can also be credited to the positive attitudes and high expectations of the faculty from which they learned. Teacher B noted, “You know what’s hard with technology is that it’s always changing. You know even from year to year, there’s always something new.
It’s always changing.” She then continued to describe a willingness to teach herself about these new technologies. What is remarkable about the teacher education program being explored in this study is that it manages to not only teach students about the most current technologies and technological resources of the given time, but it also prepares them in such a way that these teachers are then comfortable to continue their own exploration of updated, frequently changing, new technologies as they emerge.

The successes of the teacher education program are numerous. The extensive faculty modeling of technology integration as observed by the participants, the exposure the participants received to a variety of digital tools, software programs, and resources in the program, their personal reflections of feeling well prepared to integrate technology, and the comfort level they possessed upon graduation to engage in self-teaching and exploration of technologies were evident in the analyses of interviews, coursework, and lesson plans. The mission of the College of Education is “to inspire, educate, and prepare educators as facilitators of active learning for diverse and inclusive communities of learners in environments that are technologically advanced” (Mission Statement, 2015) and they are doing it well. The teacher education program is successfully preparing teacher candidates to teach and learn with technology and making technology integration a top priority.

**Content Knowledge**

The second theme that developed in this study relates to the TPACK framework and addresses the second research question of how teachers’ knowledge of content and pedagogy facilitates their inclusion of technology. All three participants identified content knowledge as the first consideration when writing lesson plans and teaching. Technology and pedagogy, while considered, were consistently considered after the content. Teacher C determined the content
first and then “applies technology if it’s applicable to what I am doing.” She described pedagogy as the third consideration and notes that it is often changing depending on the content. For example, she says,

In math we do some whole group work first and then we do a lot of small group work and then there is usually an independent practice. When we do whole group work is when I use the technology. Sometimes I have the kids come up and use my laptop that is projected or sometimes I’m just doing it. For writing, it’s usually whole group and then they do their independent writing. For writing, we do small groups, independent work, and then they have centers.

She continues by saying that the technology and pedagogy are often dependent on the content. Teacher A also considered the content first, but in doing so, accesses technology-based resources to help her determine what she will teach and what technologies and materials she will use. She begins by viewing the school district’s curriculum online, accessing the wiki created by the county that links to other sources, and reviewing the different activities, standards, and videos on the wiki. After determining the content, she decides what technology to include that will “match” the content. For example, Teacher A recalls a lesson she recently taught that started with consideration of content. She was teaching a language arts based lesson focused on comprehension skills and ultimately created a lesson plan that required students to either design a new cover for the novel they had just read or write a different final chapter for the novel. After deciding on this content, Teacher A selected which technologies to include and she introduced Google docs to the students along with two different comic design programs. She brought the mobile carts to her classroom and allowed students to work in pairs or small groups to complete the project. In this example, the content was enhanced by the inclusion of technology and the
pedagogy was complimentary of the technology, meaning that selecting Google docs as the technology allowed for collaborative work, the pedagogy, to occur in a meaningful context. While this lesson plan includes an appropriate balance of content, technology, and pedagogy, content is once again the first consideration.

Similarly, Teacher B begins with the content and objectives and then chooses the pedagogy and technology. She also recounted the helpfulness of electronic resources provided by the school district and noted that each subject has a grade-level wiki. Teacher B stated, It’s like a house of information so you can click on specific content areas. Third grade this year has rolled out a new science curriculum. So in science in particular, they have some links you can go to, like a youtube or a video of related content. It’s all through the wiki. It’s all laid out for you in terms of the technology resources.

Despite access to these helpful technology resources, the content was her main consideration and the technology and pedagogy were considered secondarily.

All participants unanimously considered content first, yet all participants also described the wealth of technology-based resources available to them from the local school district as being helpful. Teacher A described the math wiki written by the district as “really in-depth and broken down by all the different standards. And for each standard, there are different lesson plans, games, videos, all those things to help us teach it and then there’s also assessment pieces on there.” Teacher B recounted the online Social Studies curriculum as including ready-made Powerpoints that include different visual and links for the students. Teacher C identified the online staff “hub” as one of her most useful resources when it comes to planning and described it as the housing area for curriculum, lesson plans, resources, grading, and attendance programs. Seemingly the school district in which these teachers are employed offers a variety of useful
technology resources, yet content remains the first consideration when teaching. Content is viewed as the starting point and while technology resources are plentiful, technology is selected based on how well it aligns with the content as well as availability.

*Connecting Content to Technology and Pedagogy*

The teachers’ inclusion of technology as it relates to content and pedagogy was found to be based on three factors including availability of resources, convenience of integration, and access to technology resources. In this particular school district, teachers have access to a wide variety of technological resources including personal laptops, projectors, and document cameras in their classroom. Other available resources that the participants described are online textbooks, online manipulatives, digital microscopes, subscriptions to educational video streaming services, content-related wikis, Google docs, a set of ten iPads, two mobile carts of laptops, software programs to track attendance and grades, and access to two different computer labs with 30 Mac computers in each located in the school building. Despite all of these resources, technology integration was found to be dependent on accessibility and logistics. For example, Teacher A recounted her frustration when trying to rent out the mobile cart of laptops when teaching a science lesson only to find out that the cart was unavailable when she needed it. Teacher C described the process to sign out the mobile carts of laptops as difficult because teachers need to access multiple online calendars stored in two different places to sign up to use them. Maneuvering the heavy carts of laptops to the second floor of the building was also mentioned as an obstacle to technology integration because of the difficulty of the task and how much time it consumed according to Teacher C.

Teacher C also described difficulties she encountered with accessing websites with her class of students and changing passwords when teaching a language arts lesson. She stated,
The kids aren’t allowed to just do a Google search for a website. So my responsibility is to put a website in a word document and then put that in my hand out folder. And the kids have to be able to find my name in the handout folder, click to open it, and then they’ll click on the document in order to pull up the website. So that’s the way we ensure they aren’t looking at anything else. That’s the only way we have to do it. Then it’s a word document with a website on it and they click on the website and it opens. And from there, each one of them had to log in. They had a username that was given to them and a password that was given to them. It’s a default password, and I had to teach them how to change their password, which is challenging.

Teacher C recalled that this process of getting students to a particular website with the appropriate log in credentials was time consuming, yet necessary before the actual technology integration could even occur.

Teacher B explained another accessibility-related obstacle she faces on a continuous basis. She described the different types of computers that the faculty and students are supposed to know and pointed out the different user interfaces between the PC’s and Macs. While the students receive weekly instruction for 45 minutes in the computer lab using the Mac computers, they are also expected to know how to use Dell netbooks. Teacher B described herself as “oblivious to the fact that the kids did not know how to use both sets of computers. And then it dawned on me. It’s because they’re not practicing and learning on both kinds regularly.” Before she can feasibly integrate technology into her lessons, she has to assess the students’ ability to use the computers and their comfort levels working in different interfaces. This, at times, hinders her ability to integrate technology. The previously mentioned technology-related difficulties and obstacles contribute to the participants’ unanimous consideration of content first
when designing lessons plans and utilizing technology and pedagogy as supportive of the content.

TPACK Framework

The Technological Pedagogical Content Knowledge (TPACK) framework used to guide this research provides valuable insights into the knowledge teachers must possess to teach effectively with technology. The TPACK framework identifies the knowledge that teachers need to effectively teach with technology and divides this knowledge into three main areas: technological knowledge, which refers to both simple and complex digital tools, pedagogical knowledge, which refers to the method and practice of teaching, and content knowledge, which refers to subject matter being taught and learned (Koehler & Mishra, 2009). When asked to recall their knowledge of and exposure to the TPACK framework as part of their teacher education program, only one of the participants was able to accurately reflect on the framework and her exposure to it. Teacher A stated, “really just the idea behind it is that the technology that you choose to use for your lesson should be appropriately related to the content of the lesson and the pedagogy meaning how you’re going to teach the lesson.” She recalled reflecting on the TPACK framework when completing a digital portfolio as part of her coursework and also considering it when creating lesson plans and assessment pieces. Teachers B and C did not recall learning about the TPACK framework as part of their teacher education.

Despite every participant not remembering the TPACK framework as presented in the teacher education program, all of the participants have a strong understanding of how to create lesson plans that balance content, technology, and pedagogy. Content knowledge was unanimously considered first when teaching a lesson of any subject and it was supported by technology and pedagogy. All of the participants noted how their own integration of technology
is dependent on accessibility and logistics and they also shared how a variety of pedagogies are used in their classrooms based on student need. Additionally, the wealth of technology resources provided by the school district relative to the content the teachers are required to teach aided their selection of which technology to use, but still left content as their main consideration.

**Benefits of Technology Integration**

The third theme that emerged in this study is the benefits of using technology in the classroom with students. Not only did the participants reflect highly on the technology instruction they received as part of their teacher education program, but all of them also recognized technology integration as being greatly beneficial to their current teaching practices. The participants reported numerous benefits to using technology in their classrooms including increased student motivation and engagement, more organized classrooms, an improved ability to monitor individual student progress and practice for upcoming statewide assessments, the creation of improved final products, and improved communication with parents. All of the participants reflected positively on technology integration measures, despite obstacles.

*Increased Student Motivation and Engagement*

All of the participants reported how the integration of technology positively affected their students’ motivation and engagement. Teacher A spoke about how “technology always makes it [my lesson] more interesting. I know that I can take a lesson that’s kind of boring at times and include some technology that will make it much more engaging.” A lesson plan submitted by Teacher B described a technology-rich lesson plan in which students researched state symbols using approved online web resources and then created a booklet using publishing software that included multiple symbols with a written explanation of each one. The published booklets are printed in color and then displayed in the hallway. During an interview, Teacher B noted how
students are much more engaged in this social studies project now that it includes technology. In previous years, a similar lesson was taught that relied on textbooks as the reference material and students created the booklet with construction paper and markers. Now that technology has been integrated into this lesson, “the students are much more engaged and they really like looking through the websites to choose their symbols.” Teacher B also reported that students’ retention of facts about these state symbols has increased, as has their motivation to complete the project.

*Improved Classroom Organization*

Teacher A lauded technology as the main reason her classroom has been more organized this year. This year she began using an online program called ClassDojo. ClassDojo is a behavior management system that creates a profile and avatar for each student in the class and the teacher uses it to assign positive and negative points throughout the day. Teacher A has successfully used this program to increase and recognize her students’ positive behavior, manage completion of assignments, and communicate with parents. She displays the ClassDojo log in on her iPad near the door to the classroom and recalled,

“It’s always set up over there and they [the students] come in and they do their morning work. And they sign in to Dojo. It tracks if they’ve done all their homework assignments, if they’ve completed their morning work, if their desks are clean. They use it to check in every day. And their parents have the codes too so that they can check on if their child is doing their homework and if they are doing their work at school. It has been a really great motivator for homework completion and we use it for rewards too. If the kids have at the end of the month at least an 80% on their Dojo, they get some type of reward. Homework completion and even keeping their desks clean and organized has
been a whole lot better this year. This is the first year I’ve used Dojo and the students like it a lot.

Teacher A expressed that the successes in her classroom were noted by other teachers, who then started integrating this specific technology into their own classrooms.

*Improved Ability to Monitor Individual Student Progress*

Another specific benefit of technology integration mentioned by the participants relates to how technology allows them to individualize lessons and their instruction very easily. A lesson plan from Teacher C described a language arts based program purchased by the school district that she recently used. Using this program, she is able to assign reading and writing lessons to individual students who complete them on a desktop computer. Each individual lesson includes a reading passage selected for the students’ particular reading level, interactive features including read aloud and highlighting options, and opportunities for students to respond to questions in a variety of different ways including options such as selecting the correct response from multiple choices, filling in a missing word, or typing in their own response. Using this program, the teacher is able to monitor students’ individual progress, select subsequent lessons based on the students’ scores, and increase or decrease the difficulty levels as desired. In an interview, Teacher C also described how students liked this program and asked to work in it during their reading group time.

*Practice for Upcoming Statewide Assessments*

Additionally, the previously described program was also identified by Teacher C as an excellent practice tool for students who will soon be completing statewide assessment tests on the computer. By utilizing a program that allows for individualization of lessons, Teacher C is building the confidence of her students and providing them with experience reading, responding
to questions, and writing in a computer based learning environment. These experiences will ultimately aide the students’ comfort levels with upcoming statewide computer based testing.

Creation of Improved Final Products

Technology integration has also greatly contributed to the students’ ability to create final products that are more interesting and pleasing to the eye. One example is the previously described booklets about state symbols that were published and printed as part of the social studies lesson submitted by Teacher B. Teacher A described another example as she recounted the final product that students created as part of a language arts lesson plan. Students used Google docs and an online comic creator to collaboratively create an illustration that told a story about a novel previously read. Teacher A stated,

And these final products just turned out really awesome. They [the students] could use different programs, they worked together, and instead of just having them sit down and write a summary or do something boring, they were really involved in it. They were really proud of their work and then they had to present it to the class. This was a lesson that created great final products for the novels they were reading.

She recounted that the products created were of a very high level and her students were proud to share and display them. In multiple lessons, the participants shared how integrating technology at various stages of the project allowed for the ultimate creation of improved final products.

Improved Communication with Parents

A final benefit of technology integration as narrated by the participants was improved communication with parents. Teacher A remarked how the addition of ClassDojo aided parent communication in her classroom because parents are able to monitor their student’s progress, assignment completion, and behavior on a daily basis using a private log in. As a result of this,
Teacher A felt parents were well informed about their child and she also shared that ClassDojo provided her with specific examples to use in her personal communication with parents. Teacher C recounted how parent communication has improved greatly with the exchange of regular emails and monthly newsletters that are distributed electronically. The convenience and ease of such communication methods was noted.

Overall, the benefits of technology integration identified in this study were numerous. Participants found that using technology in the classroom increased student motivation and engagement, resulted in more organized classrooms with improved classroom management, improved the teacher’s ability to monitor the progress of individual students, provided practice for upcoming statewide assessments, produced improved final products that students were proud to share, and bettered communication with parents and colleagues. Despite overcoming previously mentioned obstacles related to scheduling, logistics, and availability, the participants were clear in recounting how beneficial technology integration is to their teaching on a daily basis.

**Resources Desired**

The fourth theme that developed from this study describes the resources desired by newly hired technology-competent teachers. All of the participants reflected highly on the wealth of technology resources they have available to them in their current classrooms. Yet, they also identified additional resources to which they would like to have access. Interactive white boards, additional time devoted to technology integration and collaboration, and specific suggestions for professional development are some of these desired resources.

*Interactive White Boards*

Teacher A, for example, was exposed to SMART boards and Promethean boards in the
teacher education program and her internships and found these boards to be very useful and engaging. She learned how to effectively use both types of boards as well as how to use the accompanying software programs to create interactive charts to better her lesson plans. She wished that she now had access to such boards. Teacher A recounted that she is at times “frustrated to not have computers in my classroom” because she desires to use them so regularly and often encounters difficulty with the scheduling and logistics of bringing in mobile carts or signing up to use the computer lab. While she is appreciative to have access to numerous technologies, she stated, “My comfort level using technology is pretty high. And I want more technology today.”

*Work Time Devoted to Technology and Collaboration*

Teacher B described her own technology integration as proficient, but shared that she would like to have additional time provided during her work day to better her technology integration. She stated,

> I would like to have more time to be more familiar with things. Our technology teacher does offer some tech time to get comfortable with a new technology, but it’s not really a lot of time. It’s more like 15-20 minutes in a session and to be comfortable with it, you know you really have to actually play around with it. And sometimes with a classroom of live students.

This participant also shared that she finds it difficult to remain knowledgeable about the most current technologies because there are so many new ones being added. As a member of the school’s technology committee, Participant B is often made aware of new technologies and she would like to have more time devoted to exploring them and familiarizing herself with how to best use them with her students. Participant A also noted that in addition to more time, she
would like to have more time to collaborate with her colleagues across grade levels to share and discuss how they are using technology. She stated, “when teachers share what they use in their classrooms, that is the best professional development you could have. Knowing what people are actually using and how they are using it is the most valuable.”

*Professional Development Suggestions*

Relative to professional development, the participants also identified technology-related areas of professional development in which they would like to receive training. Teacher B admitted that while most of the professional development sessions she has attended have included technology in some way, she would like to receive specific instruction about how to best use a single iPad in her classroom. When in the teacher education program, she had experience with a classroom set of iPads, but finds that now in her current environment, she has access only to one iPad on a daily basis.

Teacher C recalled how frequently she uses Google docs and identified a desire to receive professional development about additional ways to incorporate Google docs into her lessons and learn other tips and tricks for using it. Similarly, Google docs were a technology that she was exposed to in the teacher education program and while she is comfortable using Google docs, she would like specific and additional suggestions for how to work with such a program with her students. She also wondered about how Google docs could be better used among faculty in the school. Lastly, Teacher C stated she would like to receive professional development about online lesson planning programs and would like to know more about what other teachers are using.

Findings of this study indicate that while graduates of the teacher education program are proficient technology users and have access to multiple technologies in their classrooms, they
still desire additional technology resources. Participants spoke of wanting interactive white
boards and more desktop computers in their classrooms, a desire for more time during the school
day to spend exploring technologies and collaborating with colleagues, and opportunities for
sharing what technologies are being used and how. All of the participants also identified
technology-related professional development as another resource they would like to receive.
Specifically, professional development sessions about how to use a single iPad with a whole
class, how to better incorporate Google docs into lesson plans, and a review of online lesson plan
writing would all be well received.

**Suggested Improvements for the Teacher Education Program**

The fifth and final theme that emerged from this study leads back to the teacher education
program. Now that participants have experience as teachers in their own classrooms, they are
able to suggest improvements for the teacher education program. While all of the participants
spoke positively of their time in the teacher education program at Bradlin University and
identified numerous positive experiences, when asked to identify potential areas for
improvement, the participants made several useful suggestions. Teacher A described a desire to
leave the program with a physical list of resources that are recommended by the faculty of the
teacher education program. While Teacher A felt that she was continuously exposed to helpful
websites and useful online resources in the teacher education program, she suggested that an
organized list of resources including specific websites or software programs would be greatly
desired by graduates of the program who are just beginning in their own classrooms. Teacher B
voiced a similar desire when she shared that one of the difficulties she faces when it comes to
technology integration is navigating all of the different resources that are available online. She
stated, “Being able to find what is needed can be overwhelming and having a starting place for high quality resources would be most helpful.”

Based on her experience in the classroom, Teacher B identified two areas in which she believes the teacher education program could make improvements. The first area is email composition. She identified writing emails as a regular task within her responsibilities as a teacher and while she wrote and received many emails during her time at the University, she did not ever receive specific instruction or training on how to compose effective and professional emails to colleagues, parents, and administrators. Teacher B suggested that teacher candidates in the teacher education program should compose professional emails as part of their coursework and engage in discussions about the professionalism of email and other types of communication methods. The other area in which she suggested the teacher education program expand their offerings relates to the balance of classroom management and technology integration. When she began teaching in her own classroom, Teacher B described the difficulties she had with managing student behavior and monitoring computer work for all students simultaneously.

While Teacher B felt well prepared to manage the students in a classroom after graduating from Bradlin University, she soon realized that integrating technology in the form of computer time for the whole class brought with it unforeseen complications and difficulties with classroom management. For example, teaching a lesson when there are obstacles like computers that don’t work, programs that crash, and differing levels of student experience and knowledge made it difficult to successfully complete a lesson. Teacher B felt strongly that some instruction in how to balance classroom management and technology integration would be very useful.

A final specific suggestion made by Teacher C relates to the comfort level of trying new technologies. This participant indicated that because of the constantly changing and updating
technologies available, she would like to see recent graduates of the teacher education program be skilled and comfortable technology users who can adapt to any new technology. In order to do this, she suggests that the teacher education program continue to expose teacher candidates to new technologies and allow them time and experience with exploring new technologies. She states, “Any technology that they [teacher candidates] are exposed to and can practice using is going to be helpful no matter what it is.” Doing so will aide their level of comfort with the process so that when they are teaching in their own classroom, they are not overwhelmed or uncomfortable with the idea of integrating a new technology. They will, in a sense, already have learned how to try something new and will be comfortable doing so.

Overall, the participants described their experiences with technology in the teacher education program as positive. Now that they have had time to reflect on what skills and technologies they need and use on a daily basis in their own classrooms, they are able to better articulate possible improvements to the teacher education program. Findings of this study indicate that the teacher education program could be improved by providing its graduates with a faculty-approved extensive list of the “best” resources, the addition of training and discussion about email composition and professionalism of communication methods, and the incorporation of instruction about balancing classroom management and technology integration. These useful suggestions are proof that graduates of the teacher education program remain skilled learners and teachers as they reflect on suggestions for improvement of a program they highly valued.

**Chapter Summary**

This chapter summarized the themes that emerged from analyses of multiple interviews and documents collected from three recent graduates of the same teacher education program. The teacher education program was described in detail, as were the goals of the Elementary
Education program and the mission statement of the College of Education. The five phases of the program were detailed and the technology-based coursework required for all teacher candidates was explained. Lastly, a review of the numerous digital resources available to students and faculty in the classrooms and labs was provided. Taking into account this contextual information, the following five findings emerged in the coding and analysis of interviews and documents: the successes of the teacher education program, content knowledge as the first consideration when lesson planning, the benefits of technology in the classroom, resources desired by newly hired technology-competent teachers, and suggested improvements for the teacher education program as identified by its graduates.

The data showed that the successes of the teacher education program include successful, faculty modeling of technology integration, teacher candidates’ exposure to and experience with a variety of digital tools, and reports from participants of feeling well prepared and comfortable to engage in self-teaching of new technology tools in their own classrooms. Secondly, the data indicated that content knowledge was identified consistently as the main consideration when creating lesson plans. This was found to be supported by technology, depending on accessibility and logistics, and pedagogy, which varied based on student need. Next, data showed that the participants in this study believed in numerous benefits to technology integration. These benefits include increases in student motivation and organization, improved classroom organization, improvements in the teacher’s ability to monitor individual student progress, the creation of more interesting final products by students, allowances for practice testing in computer-based environments, and increases in the ease of communication with parents and faculty. All of the participants shared positive feelings and experiences about technology integration despite obstacles. Fourth, the resources desired by newly-hired technology competent teachers surfaced.
Data showed that these teachers would like to have interactive white boards and more computers in their classrooms, work time devoted to exploring technologies and collaborating with colleagues about their technology integration, and specific professional development sessions about using iPads, Google docs, and online lesson planning programs. Lastly, the data showed that the participants thoughtfully reflected on their experiences in the teacher education program and in their current classrooms. These reflections resulted in some suggested improvements to the teacher education program including graduates exiting the program with a faculty approved list of “best” digital tools and resources, coursework and collaboration about composing emails and professionalism as it relates to communication, and more instruction about balancing classroom management and technology integration.

The first major finding, these numerous successes of the teacher education program, is closely connected to all of the other findings. The successes of the teacher education program are the foundation of the participants’ later successes as documented in this research. Participants’ exposure to faculty modeling of technology integration, along with a modeled enthusiasm and willingness to try new technologies resulted in graduates who were comfortable with self-teaching new technologies and who desired additional resources, time, collaboration opportunities, and technology related professional development. Participants’ familiarity and background experience in a technology-rich teacher education program greatly affected their current technology integration practices. Not only did the participants easily recognize the benefits of technology integration in their classroom, but also they collectively expressed a desire to improve their own technology skills, no doubt another reflection of the strength of the technology component of their teacher education program. The participants’ technology successes, which range from the recognition of how technology integration benefits their
students and includes their ability to identify and explain additional technology resources desired as well as reflect on how teacher education can be improved, can be attributed to the technology-rich foundation of their learning experiences at the University. Data from this study render the teacher education program at the University as a positive and substantial influence on the technology integration practices of its graduates.
Chapter Five: Discussion of Research

Introduction

This case study examined how newly hired teachers reflect on the technology integration practices of their teacher education program. As described in Chapter Three, three research questions were developed to guide this research. The first question focused on the most useful technology-related components of the participants’ teacher education program. The second research question focused on how teachers’ knowledge of content and pedagogy facilitates their inclusion of technology. The third and final research question addressed the technology-related components that newly hired teachers identify as lacking in their teacher education programs.

In Chapter Four, the findings from multiple interviews with recent graduates from the teacher education program along with their coursework documents and current technology-rich lessons plans were examined. Answers to the three research questions were revealed in the themes of (1) successes of the teacher education program, (2) content knowledge as the central consideration when creating lessons, (3) the benefits of technology integration, (4) technology resources desired by teachers, and (5) suggested improvements to the teacher education program. This chapter will explore the significance of these findings, make connections to the literature, provide suggestions for improving the technology component of the teacher education program, and identify areas for future research as well as limitations of this study.

Themes

Successes of the Teacher Education Program

All of the participants explained how the faculty modeled the use of a variety of technologies while teaching various courses that were part of the teacher education program. Similarly, participants recalled that faculty articulated their high expectations for technology
integration, required it when writing lesson plans, utilized a variety of technologies on a daily basis, expressed enthusiasm about such technologies, and demonstrated a willingness to try new technologies. This was evident in interview responses and in the documents submitted by participants. Such modeling resulted in teacher candidates who were exposed to a variety of digital tools and technologies as part of their teacher education program and later resulted in teachers who felt comfortable experimenting with technology integration in their own classrooms. Participants of this study also reported a willingness to explore new technologies and being comfortable with this type of self-teaching.

The successes reported in this study support the research that identifies high quality teacher education programs as those that (1) include exposing teacher candidates to high quality samples of technology integration in a timely fashion (Polly & Brantley-Dias, 2009), (2) expose teacher candidates to technology integration throughout multiple courses (Shih-Hsiung, 2012), and (3) immerse them in technology-rich environments (Shin et al., 2009). Additionally, the effective faculty modeling of instructional technology was found to be essential to the preparation of technology proficient educators in numerous studies (Duran et al., 2006; Graham et al., 2012; Popham & Rocque, 2004; Hernandez-Ramos, 2005). Throughout the literature, studies reported the importance of high quality faculty modeling of technology integration. Similarly, in this study, participants relayed positive experiences with such modeling. Allowing students to learn from adept, high quality faculty who are experienced and enthusiastic technology integrators is essential to a successful teacher education program. This research study further promotes the need for teacher education programs to be taught by faculty who are experienced, enthusiastic, and willing to integrate technology.
Content Knowledge as the First Consideration

In this study, data showed that all participants considered content knowledge first when planning a lesson. Technological knowledge and pedagogical knowledge, the other two components of the Technological Pedagogical Content Knowledge (TPACK) framework, were secondary. Unanimously, the participants began planning lessons by first identifying and reviewing the content to be taught, checking its alignment with state curriculum, and writing objectives. For all of the participants, content knowledge was found to be the main consideration. As recounted in the literature, content knowledge, which addresses the subject matter being taught and learned (Koehler & Mishra, 2009) has become the central focus of the foundation of effective teachers (Grant and Gillette, 2006). In part due to the current national emphasis on student achievement often addressed by legislation, this focus on content knowledge is becoming more widespread and was evident in the findings of this research. The research does indicate, however, that sufficient understanding and application of content knowledge alone is not enough to make an effective teacher (Grant & Gillette, 2006).

Technological knowledge and obstacles. Technological knowledge, which refers to both simple and complex digital tools (Koehler & Mishra, 2009), was considered and utilized by participants, but only after first focusing on content. As recalled by the participants, technology integration was dependent on availability of resources, convenience, and access to resources. Participants identified numerous obstacles to technology integration including availability of labs and equipment, differing interfaces, and lack of time. These noted obstacles are in alignment with research literature that addresses similarly associated obstacles of technology integration (Glazewski et al., 2002). While all participants spoke eagerly of technology integration measures and a desire to incorporate it into their lessons, they also described these obstacles as
contributing to their unwillingness to make the technology component their first consideration when writing lessons. The literature about technological knowledge identifies the importance of providing teacher candidates with experience delivering and instructing technology-based lessons as part of their coursework (Dexter & Riedel, 2003). In accordance with the literature, this type of experience was provided to the participants, yet the obstacles they currently face surrounding technology integration were deemed too difficult to make technological knowledge anything more than supportive of the content.

*Pedagogical knowledge.* In this research, participants recounted content knowledge as the starting point of lesson planning and writing, followed by technological knowledge and pedagogical knowledge. This final type of knowledge, pedagogical, refers to the method and practice of teaching (Koehler & Mishra, 2009). Participants recounted pedagogical knowledge as dependent on content and technology, as well as the needs of their students. The literature shows that a lack of pedagogical experience and knowledge hinders the technology integration practices of teacher candidates (Pamuk, 2012), yet in this research, the participants did not possess a lack of pedagogical experience and knowledge. Their responses in the interviews as well as their coursework documents and current lesson plans demonstrated an understanding of different pedagogies and intentional selection of appropriate pedagogies. What this research does show is that the participants selected the pedagogy after determining the content and technology, thereby attempting to provide a balanced approach. This finding exemplifies the importance of the TPACK framework by showing how the selection of any one of the areas must be balanced by the utilization of the other two. Participants of this study were able to demonstrate their understanding of how content, technology, pedagogy, and the relationships between them, must be purposeful. This is in alignment with Mishra and Koehler’s (2006)
research which values the importance of teachers knowing and understanding the relationships between content, pedagogy, and technology and possessing an organized understanding of each component singly and wholly.

*The Benefits of Technology Integration*

The next theme that was revealed in the data relates to the numerous benefits of technology integration as recounted by the participants. Benefits of technology integration as identified by the participants included increased student motivation and engagement, improved classroom organization, improved ability to monitor individual student progress, provision of practice for upcoming statewide assessments, creation of better final products, and improved communication with parents. All of these benefits can be attributed to the thoughtful and purposeful ways in which the participants utilized technology, which is related not only to their understanding of content, technology, and pedagogy, but to their experiences with technology integration from their teacher education program.

*Increased student motivation and engagement.* Throughout the literature, studies reported increased levels of engagement and motivation among students when utilizing technology. Dietrich and Balli (2014) found that elementary school students were most engaged in classroom learning when a technology was involved. Similarly, incorporating technology into lessons was found to improve scaffolding and increase student engagement (Annetta, Mangrum, Holmes, Collazo, & Cheng, 2009). Horgan-Shadoyan (2014) found that elementary students preferred the integration of educational technologies and that such integration not only aided student engagement, but also students’ interest in the content. Likewise in this study, participants shared their beliefs and evidence that students’ motivation and engagement increased when technology was used, and recounted specific instances when this occurred.
Improved classroom organization, ability to monitor individual student progress, and communication with parents. Integrating technology into daily classroom activity through the use of an app designed specifically to monitor student progress and behavior resulted in improved classroom organization as recounted by Teacher A. Teachers B and C described how technology integration measures have allowed them to monitor the progress of individual students and then provide lessons and work that meets their needs. Teachers A and C also shared how technology integration has improved the quality, frequency, and ways in which they communicate with parents. Similar findings of how utilizing technology can improve organization in the classroom, allow for individualization measures, and better parent communication were found in the research. For example, research shows how common technologies found in today’s classrooms can improve every day management of classes by increasing efficiency and effectiveness (Sang Hyun, Holmes, & Mims, 2005; Yuen & Yuen, 2003). Such devices were found to be useful with organization and management of teaching materials, communication measures, and providing more attention to individual students (Sang Hyun et al., 2005; Yuen & Yuen, 2003). In this study, utilizing technology in various ways allowed the participants to improve upon their organization, better monitor progress of their students, and enhance their communication with parents. All participants favorably remarked on these benefits.

 Provision of practice for upcoming statewide assessments. Additionally, in this study, the data showed that integrating technology, specifically in the form of a software program, provided students with the welcome experience of computer based learning and assessment. As Teacher C noted, elementary students will soon be taking statewide assessments on the computer, and lessons in which she is able to replicate a similar experience will no doubt be
beneficial to the students. While the literature does not offer findings related to this, likely because of its currency, experiences like these in which students are able to practice taking online tests and interacting with the software in a familiar environment without the pressure of high stakes testing are useful. Teacher C shared that this type of technology integration practice is of great value to her as a teacher because her professional ratings and proficiency are connected to the performance of her students on such computer-based tests.

Creation of improved final products. Finally, results of this research show that with the implementation of various technologies, students are able to create final products of a high quality. This was evident in participants’ recollection of lesson plans previously taught as well as in their interview responses describing how various technologies were used and what their students produced. This finding is in accordance with research by ChanLin (2008) who found that incorporating technology into learning activities resulted in greater learning outcomes as well as more organized final products. Similarly, Isbell (2005) found that technology integration measures that allow for the creation and publication of final projects enhance students’ organizational skills, connect them with a larger audience, and foster their understanding of the technology. This benefit of bettering final products utilizing technology is an important one because it is related to improving the academic achievement of students in a way that appeals to them. The participants of this research were able to recognize how important the successes of their students are as a factor of technology integration.

Technology Resources Desired by Teachers

The fourth theme that emerged from this research identifies some of the specific technology resources desired by teachers in an elementary school setting. Results of this study show that teachers would like more technology available to them, including interactive white
boards, and more time to devote to improving their technology integration and collaboration opportunities with other teachers. All of the participants indicated that they would like to receive additional technology-related professional development and this finding supports research by Williams and Kingham (2003) who found that technology-related professional development is often lacking despite it being a priority for many teachers. Teachers A, B, and C voiced aspirations for continuous professional development relative to technology integration which supports the value of sustaining professional development (Burbank & Kauchak, 2003; Garet, Porter, Desimone, Birman, & Yoon, 2001; Putnam & Borko, 2000). Specific suggestions as offered by participants of this research include the provision of professional development sessions focusing on how to use a single iPad with a full class of students, how to use Google docs in a variety of ways with elementary school students, and how to use online lesson plan writing programs.

**Suggested Improvements to Teacher Education Program**

Finally, in this study, the data showed that there are improvements to be made to the teacher education program. Despite feeling well-prepared and comfortable with technology integration measures upon graduation from the teacher education program, the participants identified several suggested improvements. These suggestions for improvement are based on the knowledge they now possess as classroom teachers and personal reflection on their experiences in the teacher education program. Findings from this research study show that from the perception of its graduates, who are now employed in local elementary schools, the teacher education program could be improved by (1) providing its graduates with an extensive list of “best of” web resources based on faculty recommendation and usage in coursework, (2) including instruction in coursework about composing professional emails to parents, colleagues,
and administrators, (3) providing exposure to and experience with balancing whole class computer use with classroom management strategies, and (4) providing continued exposure to new technologies. As previously identified, research by Hassan et al. (2010) found that despite teacher candidates’ feeling well prepared to integrate technology as a result of their teacher education program, the program could be improved with more instruction related to communication skills. Additionally, Berlin and White (2012) found that teachers and teacher candidates value technology integration, yet need more access to technology resources. These findings compliment the data of this research study showing that even highly regarded successful teacher education programs can be improved.

**Recommendations for Practice**

*Implication Related to Successes of the Teacher Education Program*

The expectations for the technology instruction of teacher education programs are immense. Instruction about multiple technology components must be included (Glazewski et al., 2002; Polly & Brantley-Dias, 2009; Duran et al., 2006) and courses must be taught by high quality faculty (Graham et al., 2012; Duran et al., 2006). This research study identified numerous successes of its teacher education program ranging from high quality faculty modeling of technology integration to exposure to a variety of digital tools and technologies. The implication of this is that the quality of the teacher education program, including components of coursework, exposure to and experience with technology tools, and of great importance, the quality of the faculty, is related to the later successes of its graduates. Data from this research study proved the graduates of the teacher education program were comfortable and confident technology integrators capable of effectively integrating technology into their lesson plans, a finding that connects the later capabilities of the teacher to their technology experience in the
Institutions seeking to improve the technology integration practices of their teacher education program should do so by examining the daily practices of the faculty, observing the technological and digital tools students and faculty are being exposed to and using, and providing support measures and professional development to faculty in technology related areas. By valuing such technology integration efforts, the students within the teacher education program will know it should be a priority within their own efforts as well.

*Implication Related to Content Knowledge As First Consideration*

Many teacher education programs include the TPACK framework as a way to improve the technology component of the program because the understanding of this framework allows teachers to successfully plan and implement technology enriched lessons (Brantley-Dias & Ertmer, 2013; Koehler, Shin, & Mishra, 2011). In this research study, the participants’ knowledge of TPACK from their teacher education program varied, yet their responses in interviews and analyses of written documents including coursework and lesson plans showed the successful incorporation of the components of TPACK in their teaching and lesson planning. While data showed that all participants were most considerate of content, technology and pedagogy were factored into the lesson planning at a lesser degree.

Technology integration was reported at times to be hindered by obstacles related to accessibility. Consequently, content was consistently named the first consideration when designing lessons. Teachers A, B, and C did not identify specific pedagogical training as a component of their teacher education program, yet all three of them described their own styles of teaching that took into account their methods and styles of teaching. As recounted by the participants, consideration of pedagogy occurred after deliberate decisions were made about content and technology and the pedagogy often changed based on the selected content and
technology. This implies that the teacher education program needs to focus more on the
purposeful and intentional pedagogical training of their students and provide experience with
pedagogic methods. Because we can’t know what technology resources will be available to
graduates of any teacher education program in the schools in which they will be hired and
technology integration practices can be hindered by various obstacles, as occurred in this
research study, more exposure to the pedagogical component of the TPACK framework will aide
in the strategic alignment of content, technology, and pedagogy when designing lessons.
Research indicates that pedagogy-focused instruction should be forefront in teacher education
programs (Young et al., 2013) and that a lack of pedagogical knowledge hinders technology
integration (Pamuk, 2012), thereby reinforcing the implication of this research that pedagogical
knowledge and experiences must be central to teacher education programs.

*Implication Related to the Benefits of Technology Integration*

The benefits of technology integration as determined by this research were numerous.
Data showed increased student motivation and engagement, improved classroom organization,
an improvement in the teachers’ ability to monitor individual student progress, the provision of
computer-based practice assessments, improved final products created by students, and improved
communication measures with parents and colleagues. Previously identified research (Dietrich
and Balli, 2014; Annetta et al., 2009; Horgan-Shadoyan, 2014; Sang Hyun et al., 2005; Yuen &
Yuen, 2003; ChanLin, 2008; Isbell, 2005) coincides with these findings that technology
integration offers multiple benefits to students and teachers. The use of technology as a learning
tool positively affects motivation, engagement, organization, achievement, and interactions
among students and teachers. This implies that the benefits of technology integration do not
happen just because technology has been provided or applied to a lesson, but rather because the
teachers are knowledgeable about the technology itself and how to use it to meaningfully meet educational and professional goals. This implication is in alignment with the TPACK framework, which asserts the importance of selecting which technology to use while simultaneously considering the content and pedagogy of the lesson as well. Participants of this research demonstrated a deep understanding of the technology component as implied by the benefits of technology integration that were identified throughout the study.

*Implication Related to Technology Resources Desired by Teachers*

As discovered in this research, the participants were adept at technology integration and consequently, desired more technology-related resources. Interactive white boards, work time devoted to technology and collaboration, and professional development related to specific technologies including iPads, Google docs, and online lesson plan writing programs were identified as desired resources. This implies that technology-related professional development must become more of a focus in elementary schools. The responses of teachers in this study indicate the need for sustained and meaningful professional development that will provide them with the time, skills, and knowledge to advance their technology integration practices. The motivation and desire from the teachers to do so was evident in the data, and in order to capitalize on this, professional development and technology tools and resources must be offered to them as possible. This particular finding was most unexpected because the current assumption of teachers’ overwhelming workloads predicates that they will not be interested in devoting time and energy to learning about new technologies and how to integrate them into their lessons.

With a high volume of demands, including teaching a curriculum most recently updated as a result of Common Core State Standards, it is a refreshing discovery to have learned that despite other numerous tasks requiring their attention, graduates of the teacher education program
maintain an interest and desire in technology integration and yearn to bring more of it to their classrooms. This could be related to the interests and needs of their students, who are apt to be more motivated and engaged when technology is being used as reinforced in this research study, and these teachers have come to understand this. Improving their own technology integration skills is one way to better connect with their students and this desire to do so speaks highly of them as educators.

**Implication Related to Suggested Improvements to Teacher Education Program**

The final theme emerging from this research centered on improvements to the teacher education program as suggested by graduates of the program itself. Despite reflecting positively on the knowledge learned and their experiences in the program, the participants thoughtfully identified a few suggestions as to how the program could be improved. These suggestions included providing graduates with a researched and faculty approved list of best resources, including instruction about professionalism and email composition, providing instruction about classroom management as it applies to technology integration practices, and continued exposure to new technologies. This implies that even successful teacher education programs can be improved and an effective way to do so is by asking its graduates to reflect on their experiences. The specific suggestions provided by the participants of this research portray a willingness to improve an already effective program, and an ability to constructively reflect on their experiences, a valued skill for any learner.

**Overall Implication**

The implications of this research range from identifying the quality of the faculty of the teacher education program as a factor in the later success of its graduates to a need for more pedagogical training of teacher candidates to a commitment to focusing on technology-related
professional development in elementary schools. Overall, the key implication and key message which has emerged from this study is that we need to strengthen the use of TPACK as being a foundational framework introduced in the teacher education program and extending through the professional development offered to current teachers so that it becomes a widely used model of technology integration. While the TPACK framework has been recognized as an effective model pertaining to successful technology integration (Harris & Hofer, 2009; Harris, Mishra, & Koehler, 2009; Koehler & Mishra, 2008), its implementation as the model to use from the earliest courses in teacher education through more advanced professional development would ensure a consistent application and address some of the findings of this research. Doing so would further the successes of the teacher education program, provide more exposure to pedagogy versus the already discovered main focus on content, allow for continued benefits of technology integration in the classroom, and allow for more meaningful technology focused professional development, themes which all emerged in this research study. Relative to the three components of the TPACK framework, content knowledge and technological knowledge were found to be strongly understood and considered in this research, and the teachers’ understanding of and experience with pedagogical knowledge was noted as the weakest. More thoroughly implementing the TPACK framework into instruction beginning with the earliest courses in the teacher education program and continuing its implementation through the professional development sessions offered to currently practicing teachers would create a collaborative environment in which TPACK becomes the central focus.

The only foreseeable weakness of such a consistent implementation of the TPACK framework beginning in teacher education programs and continuing through professional development lies in the difficulty of being able to accurately measure technology integration.
Graham (2011) criticizes the TPACK framework because there is no standard way to measure technology integration, however, Hofer, Grandgenett, Harris, and Swan (2011) have recently developed two evaluation instruments to describe and score technology integration. The Technology Integration Assessment Instrument and the Technology Integration Observer Instrument offer means in which to gauge if and how well a teacher is integrating technology into the lesson (Hofer et al., 2011). Used in conjunction with the TPACK framework for assessing technology knowledge, these evaluation instruments may overcome this issue of how to accurately measure technology integration.

**Recommendations for Future Research**

Because this study focused on three teacher participants from the same elementary track of the teacher education program, it is recommended that future studies investigate technology integration practices used by teachers from the middle school and secondary tracks of the teacher education program. A similar study in nature would be appropriate, but selecting participants who now practice in an environment with older students would allow the successes and weaknesses of the teacher education program as well as perceived understandings of the TPACK framework to be shared from another perspective.

Findings from this study indicated that the participants possessed a strong knowledge of content and were comfortable with technological knowledge, although they faced several obstacles related to accessibility and organization of technological resources. A second possibility for future research should investigate how elementary schools overcome such obstacles when the teachers are skilled technology integrators. Research by Strudler (1995) and Miranda and Russell (2012) explores obstacles to technology integration, yet research that explores how technologically proficient teachers overcome such obstacles would be useful.
The third and final possibility for future research would be to investigate how TPACK, which includes intersecting multiple constructs, is best introduced to non-experienced teachers as part of their early coursework in the teacher education program or how it can be effectively introduced to experienced teachers who are not familiar with it. The key implication of this research called for strengthening the use of TPACK as being a foundational framework introduced in the teacher education program and extending through the professional development offered to current teachers so that it becomes a widely used model of technology integration. Yet without knowledge of how to introduce it effectively to teachers at different stages in their careers, this will be a difficult and daunting task. Analyzing how other institutions and school districts introduce, explain, and apply this complex construct to learning would be beneficial to all involved.

**Action Plan**

This instrumental case study examined the perceptions and reflections of newly hired teachers about the instruction they received regarding technology integration in their teacher education program and how it applied to their instruction in the classroom once hired. This research study utilized interviews and document analyses from three teacher participants, all of whom were graduates of the same teacher education program and currently teaching in an elementary school in an eastern state. Multiple data sources provided a clear picture of the technology-related components of their teacher education program that these teachers found to be most useful for classroom technology integration, how teachers’ knowledge of content and pedagogy facilitated their inclusion of technology, and the technology-related components that these teachers identified as lacking in their teacher education programs.

The results of this study suggest that the TPACK framework and various instructional
technologies have the potential to significantly improve the learning experiences of teacher candidates, currently practicing teachers, and consequently, elementary school students. By providing a framework that enables teacher candidates to begin thinking about the content knowledge, pedagogical knowledge, and technological knowledge that they need to balance to teach a successful lesson, the TPACK framework is a significant teaching tool. With this in mind, the following are recommendations to improve the teacher education program:

1. Faculty from the College of Education should engage in collaborative efforts to ensure that the TPACK framework is applied to coursework throughout the teacher education program. Introducing this framework in basic level courses and continuing its application through mid and advanced level courses, including the required technology course, would ensure a consistent utilization and ample exposure to the framework. While some of the courses currently utilize the TPACK framework, a more constant exploration would be beneficial. Referring to the TPACK framework in conjunction with references to the state technology standards addressed in all courses would be a meaningful way to do this.

2. Coursework within the required technology course for all teacher candidates should include the creation of a student-centered and faculty-approved compilation of “best” technology resources. Allowing students to identify, explore, and apply these technologies as teacher candidates will provide them with experience and result in a tangible list that they can add to and revise throughout the rest of their coursework. Doing so would also provide them with practice utilizing technological knowledge and balancing it with content knowledge and pedagogical knowledge. Storing such a list in public cloud storage, such as the students’ Google drive, would allow the students to edit
and access the list as needed over an extended period of time. It would also allow them to have access to this list of resources beyond graduation from the teacher education program.

3. Faculty from the College of Education should take a leadership role in the technology-related professional development of local teachers through the creation of a partnership. As part of their job requirements, faculty is required to spend ten percent of their time in service-related work. If faculty were provided the opportunity to complete this service requirement in local schools, either leading technology-related professional development sessions, or working with teachers on an individual or small group basis, both groups would benefit greatly. This type of collaborative partnership would ensure that the TPACK model is a shared framework between faculty and teachers and one that extends beyond the teacher education program.

4. The technology-related professional development of elementary schools should be revised to include instruction about and applications of the TPACK framework. Such professional development should include more meaningful sessions in which teachers can share their best technology practices and collaborate with each other in an on-going and purposeful way. The professional development should provide teachers with knowledge and experience about how to balance content, technology, and pedagogy in their lessons. Through this TPACK-focused training, teachers could improve their technology integration practices and develop solutions to overcoming the technology-related obstacles that they are facing. Because all of the participants in this research voiced a desire for more technology-related professional development and more time to devote to technology endeavors, this remains an area in need of improvement. Basic technology
professional development as well as more advanced level professional development should be offered, and the suggestions and desires of what technology tools, resources, and applications the teachers would like to explore should be solicited so that the sessions are relevant to them. In accordance with the previously stated recommendation, faculty from the College of Education would be prime leaders for such sessions.

These recommendations will be presented to the College of Education as part of the mid-semester workshop for faculty occurring in the spring. I will work with the faculty to gather initial feedback, encourage discussion, and initiate planning for their implementation.

Limitations

This instrumental case study was limited to three participants in one eastern state who were all graduates of the same teacher education program. The data collected from interviews and document analyses revealed the perspectives and opinions of only these three elementary school teachers. Therefore, the results cannot be generalized to all teachers who graduated from the program or who teach in the surrounding area. Many factors influence technology integration including personal motivation, the support of administrators and faculty, the type and quantity of technology available, the resources available, and the infrastructure of the environment. The participants of this study were selected because of their regular technology integration, yet their perceptions, beliefs, and technology integration practices cannot be generalized to all teachers or all graduates of the teacher education program.

Conclusion

Teacher education programs face a variety of challenges including constantly changing technologies, new standards, and a current spotlight on developing students’ 21st century skills. The main focus of many teacher education programs is technology integration and the ways in
which the programs instruct their teacher candidates are varied. The TPACK framework and results of this research study show that technology integration benefits from a careful alignment of content, pedagogy, and the technology itself. While not all participants of this research identified the TPACK framework explicitly as they recalled their experiences in the teacher education program and shared their thought making processes for lesson design and instruction, the information shared by all participants applies directly to the TPACK framework and its intention of creating balanced lessons. Thoughtfully implementing the TPACK framework consistently in the teacher education program is one way teacher education programs can monitor, measure, and improve instruction related to technology integration. Continuing the dialogue about this framework by making it a focus of professional development for currently practicing teachers will add to its value. The initial problem of practice explored in this research study addresses the difficulties facing the technology integration instruction provided in teacher education programs and highlights the need to provide instruction to teacher candidates about how to best integrate constantly changing technologies and updated standards. Findings of this research study indicate that the teacher education program is successful in many ones, yet could be further improved by focusing on the pedagogical training of teachers, valuing the reflections of its graduates by taking into account their suggestions for improvement and making changes to coursework, and improving the technology-related professional development of currently practicing teachers.
References


Horgan-Shadoyan, T. A. (2014). Graphic organizers and technology unite for lots of learning! 


doi:10.1111/j.1467-8535.2011.01228.x  

framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.  
doi:10.1111/j.1467-9620.2006.00684.x  

http://www.bradlin.edu/missionstatement.asp  


National Council for Accreditation of Teacher Education. (2013). *Frequently asked  
questions about standards*. Retrieved from  
http://www.ncate.org/Standards/UnitStandards/FAQAboutStandards/  

learned from a PT3 project. *Computers In The Schools, 23*(3/4), 93-104.  
doi:10.1300/J025v23n0306  

Ottenbreit-Leftwich, A. T., Brush, T. A., Strycker, J., Gronseth, S., Roman, T., Abaci, S., & ...  
Plucker, J. (2012). Preparation versus practice: How do teacher education programs and  
practicing teachers align in their use of technology to support teaching and learning?.  
*Computers & Education, 59*(2), 399-411. doi:10.1016/j.compedu.2012.01.014

doi:10.1111/j.1365-2729.2011.00447.x


doi:10.1300/J025v21n0109


Appendices

Appendix A: Questionnaire for Potential Participants

Frequency of Technology Use

Please indicate how frequently the following technologies are part of your classroom instructional practices.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Every Day</th>
<th>At least once per week</th>
<th>1-3 times per month</th>
<th>Less than 1 per month/Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Interactive white board (ex. Smartboard or Promethean)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Projector(s) to display digital media from a computer/laptop</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Document projector(s) to display papers or other hard copies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Handheld devices (smartphones, clickers)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Tablets or electronic readers (iPads, kindles, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Students use Laptops/Desktops beyond word processing (visit websites, complete readings/ quizzes, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Students use hardware (cameras, microphones, video cameras, etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. A computer based program for course management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Teachers wanted!

You are invited to participate in a research study. The purpose of this study is to gain a better understanding of what teachers need to know about technology as they begin their teaching career.

We are seeking participants who:

1. Graduated as Elementary Education majors from the College of Education at Bradlin University between 2010-2013.
2. Are currently teaching in a public elementary school in Maryland.
3. Incorporate technology into daily instruction.

If you choose to participate, we would like to interview you two times and collect a few lesson plans and documents that show how you use technology. Your time commitment would be no greater than 90 minutes at a location of your choice. Participants will receive a $25 gift card. For more information about this research study, please contact Kelly Keane at Northeastern University, College of Professional Studies at xxxxxxxx.
Appendix C: Script for Introducing Study to Potential Participants

Good evening. Thank you to your professor for allowing me a few minutes to talk to you tonight about a research study. My name is Kelly Keane and I am conducting a study involving teachers and their classroom technology integration. The purpose of this study is to gain a better understanding of what teachers need to know about technology as they begin their teaching career and to ultimately improve the technology instruction in teacher education programs. I am looking for participants with specific qualifications and I invite you to contact me if you meet the following characteristics:

1. You graduated as an Elementary Education major from Bradlin University between 2010-2013.
2. You are currently teaching in a public elementary school in Maryland.
3. You incorporate technology into daily instruction.

Selected participants would be asked to participate in 2 interviews, each lasting about 45 minutes, at the location of their choice. One interview would be about your current technology use in the classroom and the other interview would be about your technology-related experiences as part of the teacher education program. I would also like to collect a few documents from the chosen participants including no more than 3 pieces of coursework from your teacher education classes and no more than 3 lesson plans that show currently how you are using technology. I invite you to contact me at this email or phone number [display on board] if you are interested or have questions. Thank you very much.
Appendix D: Initial Email to Participants

Dear [Name],

Thank you for completing the short questionnaire about your technology integration habits. At this time I invite you to participate in this research study and to review the attached Statement of Consent Form, which provides details about this research study and your role. As you may recall, the purpose of this study is to gain a better understanding of what teachers need to know about technology integration as they begin their career and to ultimately improve the technology instruction in teacher education programs. By interviewing recent graduates of the teacher education program about their current experiences with technology integration and their experiences in the teacher education program, I hope to produce practical and applicable suggestions for improvements to the technology component of the teacher education program.

As a participant of this research study, you will be asked to engage in 2 one-on-one interviews with me and to submit a few documents. You will be compensated with a $25 gift card at the completion of your involvement.

Please contact me to set up a time to meet at your convenience. At our initial meeting, we will review and sign the Statement of Consent. I look forward to working with you.

Kindly,

Kelly Keane

cell: XXX.XXX.XXXX
Appendix E: Statement of Consent Form

Statement of Consent

<table>
<thead>
<tr>
<th>Northeastern University, College of Professional Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Investigators: Corliss Brown, Kelly Keane</td>
</tr>
<tr>
<td>Title of Project: Reflecting on Technology Integration in Teacher Education Programs and in the Classroom</td>
</tr>
</tbody>
</table>

Informed Consent to Participate in a Research Study
We are inviting you to take part in a research study. This form will tell you about the study, but the researcher will explain it to you first. You may ask this person any questions you have. When you are ready to make a decision, you may tell the researcher if you want to participate or not. You do not have to participate if you do not want to. If you decide to participate, the researcher will ask you to sign this statement and will give you a copy to keep.

Why am I being asked to take part in this research study?
We are asking you to be in this study because you have recently graduated from a teacher education program that included instruction about technology integration and you are a teacher that currently uses technology in your classroom on a regular basis.

Why is this research study being done?
The purpose of this research study is to improve the technology instruction in teacher education programs.

What will I be asked to do?
You will be privately interviewed two different times. In the first interview, you will be asked to discuss and expand upon your current technology practices in the classroom. In the second interview, you will be asked to discuss and expand upon the technology-related instruction you received as part of your teacher education program. You will also be asked to submit up to 3 pieces of your coursework from your teacher training program as well as no more than 3 lesson plans you recently used that integrate technology. The researcher will copy these documents and return the originals to you.

Where will this take place and how much of my time will it take?
You will be interviewed at a place and time that is convenient for you. The interviews will take place approximately 2 weeks apart and each will last approximately 45 minutes. You will also be asked to locate and submit some of your teacher education coursework and some of your current lesson plans.

Will there be any risk or discomfort to me?
There are no foreseeable risks or discomfort to you. Your participation and contributions to this research study will in no way affect your employment or your relationship with the College of Education.

**Will I benefit by being in this research?**
There will be no direct benefit to you for taking part in this study. However, the information learned from this study may be used to improve the technology integration instruction that pre-service teachers receive.

**Who will see the information about me?**
Your part in this study will be confidential. Only the researchers of this study will see the information about you specifically. No reports or publications will use information that can identify you in any way or any individual or institution as being part of this project. Pseudonyms will be used for names and any other identifying information collected during the interviews. Research materials will be stored in a locked cabinet and on a password-protected computer.

**What will happen if I suffer any harm from this research?**
There are no foreseeable reasons for you to suffer any harm. No special arrangements will be made for compensation or for payment for treatment solely because of participation in this study.

**Can I stop my participation in this study?**
Your participation in this study is completely voluntary. You do not have to participate if you do not want to and you can refuse to answer any question. Even if you begin the study, you may quit at any time. If you do not participate or if you decide to quit, you will not lose any rights, services, or benefits that you otherwise have.

**Who can I contact if I have questions or problems?**
If you have any questions about this study, please feel free to contact Kelly Keane at XXX-XXX-XXXX, the person mainly responsible for the research. You can also contact the Principal Investigator, Dr. Corliss Brown at 617-637-6702.

**Who can I contact about my rights as a participant?**
If you have questions about your rights in this research, you may contact the Institutional Review Board Coordinator at Northeastern University, Kate Skophammer at 617-373-6659. You may call anonymously if you wish.

**Will I be paid for my participation?**
You will be given a $25 gift card to a book store as soon as you complete the interview and follow up.

**Will it cost me anything to participate?**
No, it will not cost you anything to participate.
I agree to take part in this research.

<table>
<thead>
<tr>
<th>Signature of person agreeing to take part</th>
<th>Date</th>
</tr>
</thead>
</table>

Printed name of person above

<table>
<thead>
<tr>
<th>Signature of person who explained the study to the participant above and obtained consent</th>
<th>Date</th>
</tr>
</thead>
</table>

Printed name of person above
Appendix F: Interview Protocol

Title of Project: Reflecting on Technology Integration in Teacher Education Programs and in the Classroom

Time of Interview:

Date:

Place:

Interviewer:

Interviewee:

Preparing preservice teachers to effectively utilize technology in teaching and learning is essential to their subsequent success as teachers. The purpose of this research study is to improve the technology instruction in teacher education programs. To do this, we are interviewing and collecting documents from newly hired elementary school teachers in this area. Your part in this study will be confidential. Only the researchers of this study will see the information about you. Names and any other identifying information collected during the interview will be eliminated from written transcripts. This interview should take no longer than one hour. Do I have your permission to record this interview?

[Read, review, and sign consent form.]

[Turn on recording device.]

Interview Questions for Session #1

1. What is your current position? (Including subjects taught.)

2. How long have you been teaching?

3. Describe the digital tools and resources you use during the instructional day (Graham et al., 2009; Harris & Hofer, 2009)
4. How do you use the technology integration skills that you acquired as part of your teacher education program? (Sandholtz, 1997; Judson, 2006)

5. As you begin to write a lesson plan, what is your thinking process and what factors affect the type of technology you include? (Harris & Hofer, 2009; Koehler & Mishra, 2009)

6. How has technology use influenced your instructional methods? (Koehler & Mishra, 2009)

7. How has technology use influenced the content you teach? (Koehler & Mishra, 2009)

8. What new technologies or technology skills did you have to learn when you began teaching in this classroom? (Halverson & Smith, 2009)

9. What obstacles have you faced that make it hard for you to use technology in your classroom? (Brzycki & Dudt, 2005; Chen, 2008)

10. What do you wish you had learned more about - relative to technology – in your teacher education classes? (Brzycki & Dudt, 2005)

11. You may have been introduced to a framework called TPACK, which stands for the knowledge you have about technology, pedagogy, and content. What is your recollection or experience with this framework? (Koehler & Mishra, 2009)

12. What types of technology professional development have you had? How have they shaped your teaching practice? (Bos, 2011; Brock, 2009)

13. Please describe the lesson plans you brought with you today. How did you learn to create lesson plans such as this? How did you learn to integrate technology into your teaching?

**Interview Questions for Session #2:**

1. What is your educational background prior to enrolling in the teacher education program?

2. Why did you choose to attend this University?
3. What technology tools or resources do you remember using or being exposed to in your teacher education program? (Ottenbreit-Leftwich et al., 2012; Lei, 2009). How were the tools used?

4. When you were in your teacher education classes, describe any projects you completed or lesson plans that you wrote that utilized technology. (Glazewski et al., 2002; Graham, Borup, & Smith, 2012)

5. What role did technology play in the instruction you received in your teacher education classes? (McRobbie, Ginns, & Stein, 2000; Madson, Melchert, & Whipp, 2004)

6. How were the Maryland Technology Standards for Teachers addressed in your teacher education classes? (Glazewski et al., 2002; Ball & McDiarmid, 2008) [Provide copy of these standards if necessary.]

7. Describe a technology, technology tool, or website that you learned about as part of your teacher education classes (Han, Eom, & Shin, 2013; Graham et al., 2012)

8. What role did technology play in your student teacher in experience? (Greenberg et al., 2011) What technology tools did you observe being used? What technology tools did you incorporate into the lessons you taught?

9. When did you graduate from the teacher education program?

10. Thinking back on all the different technology components in your teacher education program that you just described, how did it prepare you for the technology integration you do in your classroom today?

11. Please explain to me the projects/coursework that you brought with you today. How did these projects relate to/prepare you for your current teaching practice?
12. Is there anything else you would like to share about your teacher education program and technology?
Appendix G: Major Findings and Notable Quotations

Finding #1: Successes of the Teacher Education Program

- “Most of my teachers were trying to figure out what was the newest piece of technology, how it could be included in the lesson, and how it could be used to motivate everyone.”
- “I feel like they [the faculty] definitely positively trained us how to properly incorporate technology as much as possible by using it with us.”
- “I definitely had exposure to different ways technology can be used in the classroom.”
- “I had to use different parts of technology for lesson plans and it was expected in my student teaching and in my coursework that we were using technology in our lesson plans and that it was regularly incorporated.”
- “As far as using smartboards, iPads, and different Internet programs, all of that, I was used to it through [Bradlin]. And using Blackboard and different Internet sites like that, I was very used to it.”
- “He [my professor] gave examples of all different ways to include technology in social studies because it was his passion to make social studies interesting to kids. And it made me want to teach that way.”
- “I knew that [Bradlin] was a really good teaching school. I knew that they had a very high success rate of their teachers getting hired.”
- “I had to have a clicker for one of my science classes and we used it to check in every day. The Active vote and the little clickers – we used in class every day.”
- “We would come up with different videos or sound bytes or podcasts and then we would use those with our classes.”
- “In my education classes most of my teachers were trying to figure out what was the newest piece of technology, how could you get use it to get the kids motivated, and different ways to get into the computer lab.”
- “I had a few education teachers who would always start the class with a video or a Brainpop video or just some type of motivational movie - just to start off class.”
- “I included flip charts and a lesson on transformations in math. I had a Promethean flipchart that we went through and that included a video and a song to make it interactive for the kids. And that’s a lesson that I included in my portfolio that utilized technology.”
- “The teachers were always modeling a little bit of the technology.”
• “After leaving [Bradlin] I did feel prepared, especially when you get to the level of the program when you’re actually in the classroom and working with the teachers.”

Finding #2: Content Knowledge As Central

• “I mean I always start with XXXXXXXX curriculum and the different Common Core Standards and then go from there.”

• “I always start with the XXXXXXXX curriculum.”

• “So I felt prepared going into teaching, using technology, I was comfortable with it.”

• “The first thing I look at is what I need to teach. What is the objective? And then I think of what resources I have to meet that.”

• “Really just the idea behind it [TPACK] is that the technology that you choose to use for your lesson should be appropriately related to the content of the lesson and the pedagogy meaning how you’re going to teach the lesson.”

• “I focus on the lesson first and then if I can apply technology, if it’s applicable to what I am doing, then I pull it in.”

• “They [the pedagogy and technology] kind of really depend on the content.”

Finding #3: Benefits of Technology in the Classroom

• “Technology always makes it [my lesson] more interesting. I know that I can take a lesson that’s kind of boring at times and include some technology that will make it much more engaging.”

• “The students are much more engaged and they really like looking through the websites to choose their symbols.”

• “And these final products just turned out really awesome. They [the students] could use different programs, they worked together, and instead of just having them sit down and write a summary or do something boring, they were really involved in it. They were really proud of their work and then they had to present it to the class. This was a lesson that created great final products.”

• “Their parents have their codes to that so they can check on if their kid is doing their homework and if they are doing their work at school. That has been a really great motivator for homework completion.”
• “Homework completion and even keeping their desks clean and organized has been a whole lot better this year with this app.”

• “My students love to use technology.”

Finding #4: Resources Desired

• “I’m frustrated to not have computers in my classroom.”

• “My comfort level using technology is pretty high. And I want more technology today.”

• “I would like to have more time to be more familiar with things. Our technology teacher does offer some tech time to get comfortable with a new technology, but it’s not really a lot of time.”

• “When teachers share what they use in their classrooms, that is the best professional development you could have. Knowing what people are actually using and how they are using it is the most valuable.”

• “It’s a little bit frustrating to not have computers in our rooms. It’d be really nice to have computers in our rooms.”

• “I wish we had more training on what online sites or tools are recommended.”

• “I wish that in my classroom today we had a Promethean. They’re so awesome. It was really fun to use it when I was a student at [Bradlin].”

• “We do have a little bit of technology professional development. I guess a big thing for me is, I would just like more time. Just to be able to play around with it more. I could definitely use more time to play around with it and get more comfortable.”

Finding #5: Suggested Improvements to the Teacher Education Program

• “Being able to find what is needed can be overwhelming and having a starting place for high quality resources would be most helpful.”

• “I wish that coming out of school I had more typed up lists or you know, these are the best resources that we recommend - just more lists of resources to use and start with.”

• “I wish I learned how just to write an effective email. It’s more professionalism and communication. And that should be for everybody. Because of the whole texting world, it’s not appropriate for teachers to text or use text speak in their emails.”

• “Somewhere along the line, someone should mention this is what’s appropriate and this is not and show them [teacher candidates] how to best communicate with parents.”
• “I wish I had experience integrating technology and somehow classroom management with it. With older kids, you can experiment, but I’m not going to experiment with a group of first graders if I’m not comfortable with it. Trying it [a new technology] for the first time can be very daunting if you aren’t in control.”

• “Any technology that they [teacher candidates] are exposed to and can practice using is going to be helpful no matter what it is.”