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# Teaching and learning with technology: how the best teacher education programs are preparing preservice teachers

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# TEACHING AND LEARNING WITH TECHNOLOGY: HOW THE BEST TEACHER EDUCATION PROGRAMS ARE PREPARING PRESERVICE TEACHERS

by

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This is dedicated to the memory of my late grandfather, Edward J. Connolley, who instilled in me a thirst for knowledge and love for learning and literacy at a very young age.

**TEACHING AND LEARNING WITH TECHNOLOGY:**

**HOW THE BEST TEACHER EDUCATION PROGRAMS ARE**

**PREPARING PRESERVICE TEACHERS**

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ABSTRACT

This study explored the utilization of best practices surrounding content and delivery strategies for educational technology preparation of undergraduate preservice teachers within some of the top public U. S. institutions of higher education (IHEs). This study was needed due to the changing nature of technology, a critical need to better prepare preservice teachers, and mixed opinions on what should be included in their preparation.

The respondents were representatives from 11 *NCATE*-accredited, public IHEs. The 54 participants included deans, teacher educators, librarians, instructional technology staff, and department heads. Data were collected through semi-structured interviews, surveys with selection and open-ended questions, and course syllabi related to technology. Data were analyzed using content analysis to review and code the documents, interview data, and survey data, which included constructing categories. The constant comparative method was used to determine emerging themes.

Results revealed that the responding IHEs are preparing undergraduate preservice teachers to implement technology in their future classrooms both within and beyond

required educational technology courses and that they are using many best practices and strategies as presented in the research literature and standards. However, only one of the 11 IHEs reported preservice teachers were required to take a technology course concurrently with a methods course, considered to be an important practice. Technology sandboxes were reported to be an effective way for preservice teachers to explore and learn about emerging digital tools, and meeting the challenge of the ever-changing nature of technology.

Respondents reported challenges surrounding technology integration including a deadline to meet revised accreditation standards in spring 2016 as IHEs transition from NCATE to CAEP standards (CAEP, 2013). This study found IHEs are still facing historical challenges, such as varying technology dispositions among teacher educators, inservice teachers, preservice teachers, and institutional constraints. Some of the solutions to these challenges included the use of consultants to work with teacher educators and inservice teachers and preparation using digital tools outside of the required technology course.

Implications of the results are discussed relative to the reported solutions of the IHEs, despite past and new challenges surrounding undergraduate technology preparation.

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## LIST OF ABBREVIATIONS

CAEP.....Council for the Accreditation of Educator Preparation

IHE .....Institution of Higher Education

ISTE..... International Society for Technology in Education

NBPTS..... National Board for Professional Teaching Standards

NCATE.....National Council for Accreditation of Teacher Education

NETS ..... National Educational Technology Standards

P21 .....The Partnership for 21st Century Learning

TEAC..... Teacher Education Accreditation Council

USDOE..... U. S. Department of Education

## GLOSSARY

*Educational technology:* The "study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources" (Association for Educational Communications and Technology, 2008, p. 1).

*Effective technology integration:* "Curriculum integration with the use of technology involves the infusion of technology as a tool to enhance the learning in a content area or multidisciplinary setting. Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally. The technology should become an integral part of how the classroom functions—as accessible as all other classroom tools" (ISTE, 2000, p. 6).

*Field experiences:* Preservice teachers' observations or student teaching with inservice teachers in a K–12 school.

*Generic course:* Undergraduate course for preservice teachers that is not identified as a technology course.

*Inservice teacher:* An employed teacher in grades kindergarten (K) through 12$^{th}$ grade who works with preservice teachers in their field experiences.

*Preservice teacher:* An undergraduate student who is enrolled at the school or college of education and majoring in elementary or secondary education, intending to work with students in grades K–12.

*Required undergraduate technology course:* A course that is required for all undergraduate preservice teachers in order to meet certification requirements before graduating from the teacher preparation program.

*Teacher educator:* A professor or instructor at the institution of higher education (IHE) who closely works with or teaches undergraduate preservice teachers.

# Chapter 1

## Introduction

With the increased availability of technology (Purcell, Heaps, Buchanan, & Friedrich, 2013) and its cited benefits for learning (Bransford, Brown, & Cocking, 2000; Robinson & Hullinger, 2008; Sivin-Kachala & Bialo, 2000; United Kingdom Department for Children, Schools, and Families, 2009), administrators expect teachers to know how to use current technologies in their teaching, as well as prepare their students for today's global information society (Project Tomorrow, 2013). To prepare teachers for these demands, institutions of higher education (IHEs) must implement technology training methods into preservice teacher programs (U.S. Department of Education, 2010), along with adhering to standards, licensure requirements, and accreditation policies at the national, state, and professional levels. Although researchers have identified theoretical frameworks for the best models and practices for technology use (e.g., Bullock, 2004; Hofer, 2005; Kay, 2005; Tondeur et al., 2012), teacher preparation programs are faced with challenges that prevent them from fully integrating these frameworks.

*National Board for Professional Teaching Standards (NBPTS)* defined the knowledge and expertise that teachers should use to guide their pedagogy in the classroom across various subject areas, both in K–12 schools and teacher preparation programs in IHEs. *The U.S. National Educational Technology Plan* (2010) and the *National Educational Technology Standards (NETS)* (2008) stress the need for teachers and students to utilize digital tools to improve learning outcomes. These technology-rich frameworks are designed to encourage the development of a curriculum that provides

students with opportunities to build knowledge within their current cultural context (USDE, 2010). Similar national efforts, such as *Preparing Tomorrow's Teachers to Use Technology (PT3) (2000),* focused on developing guidelines to be followed for preparing faculty in higher education institutions on how to effectively integrate and model technology during instruction. Moreover, since the passing of the legislation, *No Child Left Behind* (2001), national and state educational stakeholders have set the goal of improving the quality of the requirements surrounding educating new teachers entering the profession, and examining the quality of teacher preparation programs and how they prepare future educators to incorporate technology into the 21st century classroom (Collins & Halverson, 2009; Kay, 2006; Tondeur et. al, 2012).

An organization that has had an impact on technology training strategies and topics required in quality, accredited teacher preparation programs is the *National Council for Accreditation of Teacher Education (NCATE*). Due to its partnership with the *International Society for Technology in Education* (*ISTE)*, multiple *NCATE* standards "require future educators to integrate technology into instruction to facilitate student learning and support teaching," making technology as a critical component of a quality teacher preparation program (Lever-Duffy & McDonald, 2015, p. 5). As the *National Council for Accreditation of Teacher Education (NCATE*) is merging with the *Teacher Education Accreditation Council (TEAC)* to form the *Council for the Accreditation of Educator Preparation (CAEP),* schools of education are beginning to prepare for meeting *CAEP*'s (2013) newly drafted standards. Although there are similarities and differences between *NCATE* and *CAEP*'s standards (Tomei, 2014), both sets of standards recognize

that educational technology in teacher preparation programs is essential. The new *CAEP* standards (Appendix A) integrate technology and diversity as two cross-cutting themes (CAEP, 2013), placing emphasis on implementing technology experiences and modeling of effective uses throughout the curriculum.

In addition to national policies and standards, each state's department of education determines the standards, procedures, and requirements preservice teachers must adhere to when applying for licensure to practice in the field (Lever-Duffy & McDonald, 2015). "Although the state licensing requirements may differ among states, teachers must fulfill basic requirements including specific technology requirements that are often met through an undergraduate course in educational technology" (Lever-Duffy & McDonald, 2015, p. 8). The professional organization, *International Society for Technology in Education (ISTE),* developed standards for best practices which focus on the preparation of preservice teachers: *National Education Technology Standards for Teachers: Preparing Teachers to Use Technology (NETS) (2008).* The standards currently serve as a framework for schools of education to aid in teaching effective technology integration skills in order to meet subject area standards.

Even though numerous research studies indicate that teachers have a favorable attitude toward using technology in their teaching (e.g., Al-Zaidiyeen, Mei, & Fook, 2010; Lei, 2009; Public Broadcasting Service, 2013; Strudler & Wetzel, 1999; U. S. Department of Education [USDOE], 2010), many teachers are still not fully integrating technology in their classrooms (Dawson, 2008; Henning, Robinson, Herring & McDonald, 2006; Polly, Mims, Shepherd & Inan, 2010; CDW Government LLC, 2010;

Chen, 2008; Hoel, 2005; International Society for Technology in Education [ISTE], 2008; Wang, 2002). According to the *National Center for Education Statistics* (2010), only 25% of all teachers felt that their undergraduate teacher education program prepared them to "make effective use of educational technology for instruction" (Gray, Thomas & Lewis, 2010, p. 17). Since the early 1990s, a popular strategy in many teacher education programs has been an introductory, stand-alone educational technology course for preservice teachers (Andersson, 2006; Gronseth et al., 2010; Kleiner, Thomas, & Lewis, 2007); however, preservice teachers developed teacher-centered technological skills in these courses (Gronseth et al., 2010; Polly & Shepherd, 2007), that do not aid effective implementation of technology to impact student learning (Hoel, 2005; Johnson et al., 2013; Niess, 2012; Ruggiero & Mong, 2013). Teacher-centered uses of technology occur when the "teacher is at the center of instruction and the students are in a passive recipient role" (Breen, 2014, p. 77). Without other experiences using and observing technology in non-technology courses and field placements (Bahr, Shaha, Farnsworth, Lewis, & Benson, 2004; Glazer, 2004; Tondeur et al., 2012), preservice teachers enter the field with ineffective skills (Glazer, 2004) and few strategies surrounding technology implementation (Andersson, 2006; Wang, 2002).

Moreover, research studies have reported a gap in what topics are taught in teacher education programs and what inservice teachers perceive as critical abilities (Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013). Reported challenges for establishing common topics addressed across teacher preparation programs include:

a) maintaining a level of authenticity of technology experiences (Barab, Squire,

& Dueber, 2000),

b) teacher educators struggling to keep up with the best practices with ever-changing technology (Brush et al., 2003; Pellegrino, Goldman, Bertenthal, & Lawless, 2007),

c) teacher educators' lack of familiarity of best practices, technical skill, resources, and time (Butler & Selborn, 2002; Kleiner, Thomas, & Lewis, 2007),

d) inservice teachers' varying skill levels and ineffective uses of technology (Lim & Khine, 2006; Project Tomorrow, 2011; National Education Association, 2008),

e) accessibility of technology varies at field placement sites (Becker, 2001; Graham, Tripp, & Wentworth, 2009), and

f) absence of a shared vision across the teacher preparation program and with the field placement schools (Goktas, Yildirim, Yildirim, 2009; Tondeur et al., 2012).

In response, researchers identified that quality preservice teacher technology experiences and training provided in teacher preparation programs is a critical factor for influencing the use of educational technology in their future classroom (Agyei & Voogt, 2011; Drent & Meelissen, 2008; Stobaugh & Tassell, 2011; Tondeur et al., 2012). This need calls for teacher preparation programs to train preservice teachers with technology skills through evidence-based training aligned with national, state, and professional standards. However, with so many organizations influencing the expectations of teacher preparation

programs, a consensus on what to teach and how it should be taught is difficult.

**Problem Statement**

Due to the ever-changing nature of technology (Straub, 2009) and the mixed opinions on what topics should be included (Goktas, Yildirim & Yildirim, 2008; Hew & Brush, 2007; Lawless & Pellegrino, 2007), there is a lack of consensus on how educational technology is taught in teacher education programs with various combinations of content and delivery strategies (Angeli & Valanides, 2009; Dawson & Dana, 2007; Goktas, Yildirim, & Yildirim, 2008; Gronseth et al., 2010; Iverson, Lewis, & Talbot, 2008; Kay, 2006; Niess, 2005; Ottenbreit-Leftwich et al., 2012). Although researchers have begun to identify the best models, practices, and technology topics to include in undergraduate preparation programs to prepare preservice teachers (e.g., Glazer, 2004; Hofer, 2005; Kay, 2006; Lawless & Pellegrino, 2007; McCoy, 1999; Tondeur et al., 2012), "the jury is still out on which strategies work best" (Kay, 2006, p. 395).

**Purpose**

The purpose of this study was to explore how undergraduate teacher preparation programs are instructing preservice teachers to use educational technology. The current research literature includes studies that examine the effectiveness of content and delivery strategies used to prepare preservice teachers to use technology (Kay, 2006; Polly, Mims, Shepherd, & Inan, 2010; Tondeur et al., 2012), as well as the examination of exemplary teacher preparation programs (Hofer, 2005; Mergendoller, 1994). However, in addition to an absence of cross-institutional studies (Pellegrino, Goldman, Bertenthal & Lawless,

2007), there are few "recent studies that investigate the actual topics or uses of technology that preservice teachers are likely to use in their future classrooms" (Ottenbreit-Leftwich et al., 2012, p. 400). Additional research is needed on the technology content and topics that are addressed across teacher education preparation institutions (Hew & Brush, 2007; Lawless & Pellegrino, 2007; Ottenbreit-Leftwich et al., 2012). As Gronseth et al. (2010) concluded: "…gaining an understanding of the content of instruction from other teacher preparation programs may provide teacher educators with insights for use in the redesign and development of technology experiences in their own institution" (p. 34).

To address the need for cross-institutional research, this study was designed to explore how the top undergraduate teacher preparation programs are preparing preservice teachers to use technology and to compare this to the technology integration strategies suggested in the research literature and to the state, national, and professional standards for preparing preservice teachers to use educational technology. In doing so, the actual practices of the top rated public IHEs can be described to show how best practices are implemented and where the challenges in teacher technology preparation remain. This study is particularly timely due to the changing nature of technology (Polly, 2012; Straub, 2009), a critical need to better prepare preservice teachers (Collins & Halverson, 2009), and mixed opinions on what technology topics and strategies should be included (Angeli & Valanides, 2009; Goktas, Yildirim & Yildirim, 2008; Hew & Brush, 2007; Iverson, Lewis, & Talbot, 2008; Kay, 2006; Lawless & Pellegrino, 2007; Niess, 2005; Ottenbreit-Leftwich et al., 2012; West & Graham, 2007), teacher preparation programs are met with

new and lingering challenges. Furthermore, *NCATE* accredited IHEs are facing a deadline for change to meet revised standards in spring 2016 with this recent merge (CAEP, 2013). This includes the need to address "…increased splintering of roles, contingency of status, workload demand, and what faculty and institutions are doing to creatively and thoughtfully respond in the face of change and conflict" (Association of American Colleges and Universities, 2009). Therefore, the goal of this study was to provide teacher preparation programs with a description of the current models and the contemporary realities of technology preparation to better understand what is actually taking place within top public IHEs during this time of change. It is hoped that the findings of this study will shed light the utilized strategies for technology preparation, as well as the continued challenges that even the best IHEs are faced with as they transition to meet these new *CAEP* standards (2013).

**Context**

The study focuses on technology integration strategies and topics for undergraduate preservice teachers within eleven top institutions across the United States. The population pool was *NCATE* accredited, public institutions of higher education (IHEs) that offered an undergraduate, elementary major for preservice teachers. Informants in this study included educational technology instructors, curriculum and teaching/instruction instructors, instructional or informational technology staff, administrators, library staff and department heads. For each of the IHEs, data were collected on: (a) teacher preparation program's structure, (b) curriculum framework, (c) required technology course content, (d) availability of technology in the school or college

of education, (e) usage of technology among faculty members, (f) technology professional development opportunities for teacher educators, and (g) overall technology preparation and experiences of preservice teachers, as it relates to recommended content and delivery methods reported in the literature (Kay 2006; Tondeur et al., 2012).

**Research Question**

The research question that guided this study was: What do top public schools of education offer undergraduate preservice teachers to prepare them to integrate technology into their future classrooms and to what extent does this match best practices as articulated in the literature and professional standards?

# Chapter 2

## Literature Review

This review of the literature provides an introduction to major themes related to the role and use of technology in teaching and learning situations, as well as an examination of current best practices for preparing preservice teachers to effectively use technology in their future teaching situations. The review is separated into four major sections which outline the following: (1) the role and use of educational technology in teaching and learning, (2) the changing set of standards for teacher education programs, (3) the challenges surrounding overall technology preparation of preservice teachers, and (4) the best practices and strategies for preparing preservice teachers to use technology.

### The Role and Use of Educational Technology

With the emergence of a wide variety of technologies since the early twentieth century, there have been revolutionary promises of change in the field of education, followed by repeated failures to effectively integrate it in the classroom (Cuban, 2001). Although the technologies are powerful and flexible tools that can enhance teaching and learning in innumerable ways, historically, they have not been used in ways that significantly enhance student-centered learning processes (Partnership for 21st Century Skills, 2004). When one examines this history, it is quite clear that patterns have emerged which could be considered valuable "lessons learned" for present and future directions in the field of educational technology. One of these lessons has been an identified need to properly prepare educators on ways to use the technology in teaching situations, rather than relying on the tool itself (Cuban, 1986; Hew & Brush, 2007). The

following sections discuss the role and use of educational technology in the research literature as it pertains to: (a) history of the field of educational technology, (b) emerging technologies in the Information Age, (c) research on teaching and learning with educational technology, and (d) improving the quality of education in K–12 schools.

**History of the field of educational technology.** In the past, numerous revolutions were expected to change the course of education with the advent of each new technology. In the 1930s, educational radio was promised to be the "assistant teacher" (Darrow, 1932). In the 1950s and 1960s, experiments with instructional television promised the ability to replace the teacher (Cuban, 1986). By integrating teaching machines in classrooms in the 1960s, the process of education was to be improved (Ross, Morrison, & O'Dell, 1989). Claims for a classroom revolution and the search for greater classroom productivity arose again in the 1980s with the introduction of the personal computer. In order to become efficient with time, computers came with the promise of quick, individualized instruction of students, with prompt feedback from drill and practice exercises. Warnings made educators and administrators alike feel that if computers and other technological communication systems were not adopted, schooling would become extinct (Cuban, 1986). Although computers were purchased and placed in classrooms across the country, the National Education Association (1982) reported 'limited use' of the computers by teachers due to inaccessibility of the hardware and software, flaws in the process of implementation, the amount of time a teacher needs to learn the technology, and a teacher's innate 'cautionary attitude' toward change (Cuban, 1986).

With the emergence of each new tool, enthusiastic reformers and administrators welcomed the predictions of extraordinary changes in the classrooms (Cuban, 1986); however, once research was conducted, it was reported that "the mechanical or electronic device proved as effective as a teacher in conveying information to students" (Cuban, 1986, p. 5). With repeated frustrations over the lack of effectiveness, teachers often cast aside the computers, leading to "teacher bashing" (Cuban, 1986). Although reformers insisted that teachers resist change, Cuban (1986) posed the idea of "situationally constrained choice" (p. 63) and argued that teachers do change over time while maintaining stability in practice: "Teachers will alter classroom behavior selectively to the degree that certain technologies help them solve problems they define as important and avoid eroding their classroom authority" (p. 70). Moreover, when researching schools with an abundance of technology resources, Cuban (2001) reported that teachers who adopted technology in the classroom used it to support existing, teacher-centered practices of productivity, research, and communication tasks, rather than changing their pedagogical beliefs surrounding technology integration.

**Emerging technologies in the information age.** Technologies are rapidly developing with new promises of improving education. Twenty-first century technologies have not only altered the ways educators use digital tools in the classroom, but also transformed communications among students, teachers, and parents (Angeli & Valanides, 2009). The latest digital tools, referred to as an emerging educational paradigm called "Web 2.0," promote collaboration in our society (Anderson, 2012) and place students at the center of the learning process. Advantages of incorporating Web 2.0

tools in the classroom include promotion of student-centered learning, increased creativity during problem solving, enhancement of collaborative opportunities, and creation of an engaging learning environment (McLoughlin & Lee, 2010).

**Research on teaching and learning with educational technology.** With the rapid expansion of technology, students are pushed to use technology tools in both their personal and academic endeavors. Today's students are often called "digital natives," as they are readily adopting technologies in order to improve their learning processes (Prensky, 2006/2007). They "expect more from their teachers than in decades past" (Downes & Bishop, 2012, p. 155) to use technology during learning. Moreover, when used to support the curriculum, technology can lead to positive impacts on student learning (Hitlin & Rainie, 2005; Lazarus, Wainer, & Lipper, 2005) and promote the development of students' "new literacy" (Leu, Kinzer, Coiro, & Cammack, 2004) that requires skills of thinking, reasoning, collaboration, and using technology (21st Century Workforce Commission, 2000). Specific benefits of technology use for learning purposes include higher-order thinking skills, self-confidence in learning, improved student attitudes toward learning, and increased student motivation (Bransford, Brown, & Cocking, 2000; Sivin-Kachala & Bialo, 2000). In addition to increasing student motivation (Russell, Bebell, & Higgins, 2004), technology also allows for all students' voices to be heard in the classroom, the enhancement of collaboration and communication skills, reaching the varying styles of learning among students, student choice in achieving tasks, and authentic learning through a global community of learners (Kara-Soteriou, 2009).

Instructional technologies can be "powerful pedagogical tools – not just rich sources of information, but also extensions of human capabilities and contexts for social interactions supporting learning" (Bransford, Brown & Cocking, 2000, p. 230). One of the underlying rationales for using educational technologies in the classroom is that it forces students to become designers of their own knowledge because they are "teaching the computer" (p. 30) and actively participating in the environment in ways that are intended to help them construct their own knowledge (Jonassen, 1998). Brooks & Brooks (1999), building on the work of educational psychologists Piaget (1970), Vygotsky (1978), and Papert & Harel (1991), supported this view of learning and described it as an opportunity for students to make or construct their own meaning, rather than memorize the given information from the teacher. In this learning approach, students are asked to explore their own thoughts to contribute to discussion, debate, and inquiry in the classroom with their peers (Anderson & Piazza, 1996). Educational technology is most effective when it is used to support active engagement through student-centered practices (Bickford, Tharp, McFarling & Beglau, 2002; Kozma, 1994; Morrison & Lowther, 2005).

**Improving the quality of education in K–12 schools.** In the past several decades, educational stakeholders in the United States reported a sense of urgency to improve the quality of education. In 1999, "The CEO Forum on Education and Technology" was created to improve student achievement with technology use and support teachers through technology implementation strategies. These include: a) *alignment*: curriculum, technology use, and assessment should work together to support

objectives and standards; b) *assessment*: all educators must be equipped to use technology as a tool to achieve high academic standards and measure higher order thinking skills; c) *accountability*: all stakeholders in the school should use technology to monitor students' progress by collecting and analyzing data; d) *access*: all students must have equitable access to educational technology; and e) *analysis*: continued research on best practices on educational technology implementation strategies should be accessible.

Moreover, there has also been an identified need to better prepare inservice and preservice teachers who can facilitate learning and creativity through effective uses of digital tools (Collins & Halverson, 2009). *Preparing Tomorrow's Teachers to Use Technology* (PT3), the U. S. Department of Education's grant (1999), was designed to train teacher educators on effective technology integration strategies, focus on how technology interacts with content and pedagogy, and develop curriculum appropriate materials to support technology use (Polly, Mims, Shepherd, & Inan, 2010). The passing of the legislation, *No Child Left Behind* (NCLB) in 2001, addressed the need for the revision of what skills students need in a technological society (Apte, Karmarkar, & Nath, 2008), as K–12 schools are responsible for preparing students to be successful in a new digital society (Warschauer & Matuchniak, 2010). *The National Educational Technology Plan* (2010) included a goal of preparing of preservice teachers to use technology effectively: "Provide preservice and inservice educators with professional learning experiences empowered by technology to increase their digital literacy and enable them to create compelling assignments for students that improve learning, assessment, and instructional practices" (U. S. Department of Education Office of

Educational Technology, 2010, p. xviii). Another effort was made to reach this goal in 2013 when President Obama announced the *ConnectED* initiative. Monetary resources were allocated to not only provide schools with technology access, but also to improve "the skills of teachers, ensuring that every educator receives support and training to use technology to help improve student outcomes" (USDOE, 2013, p. 1).

## The Changing Set of Standards for Teacher Education Programs

"Every educator needs to master essential technology skills not only to accomplish his or her administrative and instructional tasks, but also more importantly, to prepare students for contemporary life" (Lever-Duffy & McDonald, 2015, p. 3). In an effort to guide educators in both K–12 schools and teacher preparation programs, multiple sets of standards have been developed to inform proficient technology skills and illustrate the qualities of effective technology integration by supporting curricular goals (Lawless & Pellegrino, 2007). The following section discusses not only standards that every teacher preparation program must meet in order to license teachers in their states, but also technology standards and the evolving best practices created by professional and national organizations.

**State certification licensing requirements.** Licensing requirements differ by state and each state approves teacher education institutions that meet their guidelines. When a student completes the requirements at an institution authorized by the state, the teacher candidate becomes certified to teach in that state. According to Roth & Swail (2000), even though licensure and certification vary from state to state, most professionals agree that teacher candidates should a) earn a bachelor's degree, b)

complete an approved, accredited education program, c) earn a major or minor in education, d) have a major in the subject area in which they plan to teach (for middle or high school levels), e) have a strong liberal arts foundation, and f) pass a state test or another exam. An additional aspect to attaining licensure or graduating from many teacher preparation programs at IHEs includes the completion of a technology-related requirement or requirements (American Association of Colleges for Teacher Education [AACTE], 2013). Each state's Department of Education determines the procedures preservice teachers must adhere to when applying for licensure to practice in the profession, but the teaching profession determines the skills, knowledge, and dispositions of an accomplished practitioner in the field (National Council for Accreditation of Teacher Education, 2008). This requirement is primarily met through an introductory educational technology course (Gronseth et al., 2010; Lever-Duffy & McDonald, 2015).

**National certification and educational technology.** *The National Board*, a non-profit organization committed to advancing the quality of teachers across the nation, claims, "strengthen the profession of teaching and thereby raise the quality of education…to establish high and rigorous standards for what accomplished teachers should know and be able to do" (Roth & Swail, 2000, p. 34). At the national level, the *National Board for Professional Teaching Standards (NBPTS)* defines the knowledge and expertise that teachers should use to guide their pedagogy in the classroom across various subject areas. These standards are created and revised by a committee of noteworthy educators in the field (NBPTS, 2013). Not only do school districts in the K–12 arena utilize these standards as part of an ongoing development and improvement of

their professionals, but higher education institutions (IHEs) also incorporate them into their teacher preparation programs. *The National Board* characterized *Five Core Propositions* that are included in the foundation for the characteristics of *National Board Certified Teachers (NBCTs)* within all grade levels and subject areas in the profession (Appendix B). Although *NBPTS* does not directly incorporate technology standards, the use of media for diverse teaching methodologies and assessment strategies are considered components of evaluation. Proposition 2, [Element 2] states: "Teachers command specialized knowledge of how to convey a subject to students. Professional teachers' commitment to learning about new materials includes keeping oneself informed of technology developments and digital tools that support learners in the classroom" (NBPTS, 2013, para. 1). Moreover, in addition to considering all learners, teachers have to demonstrate competency in using digital tools and technologies to enhance their own teaching.

**Technology standards for 21st century teaching and learning.** The *International Society for Technology in Education (ISTE)* has developed standards for teaching (Appendix C), learning (Appendix D), and leading in the digital age, which are widely recognized and adopted worldwide (Thomas & Knezek, 2008). The organization developed the standards surrounding a set of criteria for best practices to guide educators in improving their teaching with technology in the classroom (ISTE, 2008). In 2008, *ISTE* released *National Education Technology Standards for Teachers: Preparing Teachers to Use Technology (NETS),* a set of standards that specifically focus on the preparation of preservice teachers and has influenced states in the development of their

standards (Lever-Duffy & McDonald, 2015, p. 4). Moreover, the standards currently serve as a framework for many schools of education to aid in teaching effective technology integration skills in order to meet content area standards, as well as evaluating educators' knowledge and skills surrounding technology use.

**The partnership for 21st century learning and common core standards.** "The Framework for 21st Century Learning" developed by *The Partnership for 21st Century Learning (P21)* addresses the need for students to acquire technology literacy skills for future success, in particular those surrounding information, media, and technology. "The *P21* Framework mandates that professional educators become qualified to prepare their students only when the educators' own level of technology literacy includes these key skills" (Lever-Duffy & McDonald, 2015, p. 4). The elements of the framework include a) core subject knowledge and 21st century content for success in the workplace, b) learning and thinking skills to make effective choices, c) information and communications literacy in order to use technology, and d) life and career skills.

The *Common Core Standards,* a national initiative led by professional organizations, including *National Council of Teachers of Mathematics* and *National Council of Teachers of English*, have placed emphasis on the use of new technologies in core subject matter areas in an effort to prepare K–12 students for the workforce, continued academic career, and life in a continually-changing technological society (Common Core State Standards Initiative, 2010; Lever-Duffy & McDonald, 2015, p. 4). According to Lever-Duffy & McDonald (2015),

Given the *NETS-T* standards, the imperative defined by the Partnership for 21st

> Century Learning, and the inclusion of technology in *Common Core Standards*, most national, state, and local organizations and districts recognize educational technology literacy as a core competency for educators. (p. 4)

**Teacher preparation accreditation.** Another organization that currently impacts some teacher preparation programs is the *National Council for Accreditation of Teacher Education (NCATE)*. Due to its partnership with *ISTE*, multiple *NCATE* standards "require future educators to integrate technology into instruction to facilitate student learning and support teaching," making technology as a critical component of a quality teacher preparation program (Lever-Duffy & McDonald, 2015, p. 5). As one of the first steps of achieving *NCATE* accreditation, the educator preparation provider must meet and report on their status as related to six preconditions. Precondition #4 states: "the unit has a well developed conceptual framework that establishes the shared vision for a unit's efforts in preparing educators to work in P–12 schools and provides direction for programs, courses, teaching, candidate performance, scholarship, service, and unit accountability" (NCATE, 2014, para. 1). Documentation to support Precondition #4 includes an overview of the conceptual framework, the vision and mission of both the institution and unit, and the unit's philosophy, purposes, and goals/organizational standards support its conceptual framework (NCATE, 2008). According to *NCATE* (2005):

> The conceptual framework establishes the shared vision for a unit's efforts in preparing educators to work effectively in P–12 schools. It provides direction for programs, courses, teaching, candidate performance, scholarship, service, and unit

> accountability. The conceptual framework is knowledge based, articulated, shared, coherent, consistent with the unit and institutional mission, and continuously evaluated.

In 2013, *NCATE* and the *Teacher Education Accreditation Council (TEAC*) merged into one new accrediting agency for teacher preparation programs, the *Council for the Accreditation of Educator Preparation (CAEP).* Schools of education are now charged with planning and preparing to meet *CAEP*'s newly drafted standards, based on best practices and recommendations from the research literature (CAEP, 2013). Although there are similarities and differences between *NCATE* and *CAEP*'s standards (Tomei, 2014), both sets of standards recognize that technology in teacher preparation is essential. These new *CAEP* standards (Appendix A) integrate technology and diversity as two cross-cutting themes (CAEP, 2013), placing emphasis on integrating technology experiences and modeling of effectives uses throughout the curriculum. Moreover, *CAEP* (2013) standard 1.4 states an expectation that teachers "use technology to enhance their teaching, classroom management, communications with families and assessment of student learning" as they engage in "reasoning and collaborative problem solving related to authentic local, state, national, and global issues, incorporating new technologies and instructional tools appropriate to such tasks." The *CAEP* standards differ from the previous *NCATE* standards with re-envisioned dispositions, an emphasis on partnerships and stakeholder involvement, an increased focus on benchmarking and impact, and higher expectations surrounding the quality of evidence (Tomei, 2014).

**Historical Challenges Surrounding Overall Teacher Technology Preparation**

*The American Association of Colleges for Teacher Education* (*AACTE*) (2013) reported that 98% of teacher preparation programs within IHEs said they prepared their preservice teachers to integrate technology into their future teaching situations, with 62% requiring a technology-based performance requirement needed to exit the program. A 2011 study reported the most commonly taught types of technology for preservice teachers in teacher preparation programs were word processing and database software (71%), multimedia presentations (64%), and interactive whiteboards (55%) (Project Tomorrow). "These technology tools may be considered low-level technology as teachers present information without altering the way they teach" (Breen, 2014, p. 77), which does not effectively prepare them to integrate technology in their future classrooms (Cuban, 2001).

With this, according to the *National Center for Education Statistics Institute of Education Sciences* (2010), only 25% of teachers felt that their undergraduate teacher education program had prepared them "to a moderate of major extent" to "make effective use of educational technology for instruction" (p.17). While preservice teachers noted the heavy use of productivity tools used in their methods classes, principals have a "different set of expectations about the experiences with technology that they want to see in potential teacher candidates" (Project Tomorrow, 2013, p. 5). They want new teachers to possess skills and knowledge of authentic, problem-based integration techniques of digital tools, such as mobile devices, social media, online learning, and digital content into daily instruction (Project Tomorrow, 2013). There is a disconnect between the

expectations of K–12 principals and content taught in current teacher preparation programs; school administrators have higher aspirations for the next generation of teachers' skills. Moreover, even though preservice teachers are exposed to various technology experiences throughout their preparation program, it does necessarily mean that they are equipped with adequate skills to integrate technology on their own (So & Kim, 2009).

**Teacher educators' technology dispositions.** Many teacher preparation programs have moved toward integrating technology across the curriculum (Kleiner, Thomas, & Lewis, 2007); however, it was reported that teacher educators continue to use technology to support already existing, teacher-centered practices, such as information presentation and personal organization (Gronseth et al., 2010; Pellegrino, Goldman, Bertenthal, & Lawless, 2007). As preservice teachers place high value on their observations of professors' technology use (Project Tomorrow, 2011), there is a need to model student-centered uses of digital tools "through a constructivist lens to create an interdisciplinary approach to instruction" (Breen, 2014, p. 77). Barriers preventing teacher educators from modeling student-centered technology experiences in their courses include underdeveloped technology skills (Hadley, Eisenwine, Hakes, & Hines, 2002), low digital self-efficacy (Wetzel, Wilhelm, & Williams, 2004) and a lack of time to learn a new tool (Butler & Selborn, 2002; Mergendoller, 1994).

**Inservice teachers' technology dispositions.** Even when technology is available, teachers typically use technologies to support existing teaching practices (Cuban, 2001; Zhao, Pugh, Sheldon, & Byers, 2002) and teacher-centered practices

already in use (e.g., Hutchison & Reinking, 2011; Peck, Cuban, & Kirkpatrick, 2002; Smarkola, 2007; Zhao, Pugh, Sheldon, & Byers, 2002), which does not contribute to high levels of active learning in the classroom (Warschauer & Matuchniak, 2010). Although there has been an increase in technology use by inservice teachers (Franklin, Sexton, Lu, & Ma, 2007; Project Tomorrow, 2008), many are not using it to promote student-centered (ISTE, 2008; Partnership for the 21st Century Learning, 2004) and constructivist approaches of learning (Becker & Riel, 1999; Cuban, Kirkpatrick & Peck, 2001). Franklin, Sexton, Lu, & Ma (2007) reported that inservice teachers "used computers primarily in four ways: (a) locating and gathering materials, (b) communication, (c) posting information, and (d) writing lessons" (p. 275). Similar findings were reported in a 2012 study (Ottenbreit-Leftwich et al.), in which, inservice teachers reported heavy use of technology for personal productivity, information presentation, and to access and use electronic resources. A continually noted barrier by educators to using technology during instruction has been a lack of time (Hew & Brush, 2007; Seels, Campbell & Talsma, 2003).

Teachers decide when and how to use technology; moreover, it is their knowledge, optimistic attitudes, beliefs, and a high digital self-efficacy that contribute to successful technology integration (Cassidy & Eachus, 2002; Zhao, Pugh, Sheldon, & Byers, 2002). One of the predictors of technology use is teachers' confidence in achieving instructional goals with technology (Wozney, Venkatesh, & Abrami, 2006). Teachers must self-identify a level of comfort with using digital tools (Franklin, Sexton, Lu, & Ma, 2007) and understand how effective technology integration impacts student

learning in order to regularly use technology in their classrooms (Ottenbreit-Leftwich, Glazewski, & Newby, 2010). Discomfort surrounding their technology skill set will dissipate when teachers begin to move away from teacher-centered teaching (Kim, Kim, Lee, Spector, & DeMeester, 2013), promoting effective modeling for new teachers entering the profession (Ertmer & Ottenbreit-Leftwich, 2010).

**Preservice teachers' technology dispositions.** Preservice teachers reported their willingness to use and integrate technology in the classroom is related to a high digital self-efficacy (Bullock, 2004; Cassidy & Eachus, 2002) and an optimistic attitude regarding the use of educational technologies (Brinkerhoff, 2006; Lei, 2009; Strudler & Wetzel, 1999). "The decision of whether and how to use technology for instruction ultimately depends on the teachers themselves and the beliefs they hold about technology" (Ertmer, 2005, p. 5). Preservice teachers who are fearful toward technology use reported low levels of intention to use technology in their future classrooms (Teo, 2008). However**,** "expressing a positive attitudes toward technology does not automatically ensure the use of a specific technology" (Shoffner, 2009, p. 158). In addition to a lack of knowledge about subject-specific technologies (Lei, 2009), preservice teachers are not fully prepared to use technology in teaching and learning situations in ways that surpass the purposes of productivity and presenting information (Cheon, Song, Jones, & Nam, 2010). Lei (2009) stated:

> Although digital natives as preservice teachers use technology extensively, their use of technology has been mainly focused on and related to their socio-communication activities and their learning activities as students. As preservice

> teachers, they lack the knowledge, skills, and experiences to integrate technology into classrooms to help them teach and to help their students learn, even though they fully recognize the importance of doing so. (p.92)

**Institutional barriers.** Since the mid-1990s, researchers have examined barriers preventing effective technology integration within teacher preparation programs (e.g. Cuban, 2001; Hew & Brush, 2007; Thomas, Larson, Clift, & Levin, 1996). These barriers include: lack of resources (Butler & Selborn, 2002; Duhaney, 2001; Thomas, Larson, Clift, & Levin, 1996), lack of ongoing training to develop skills (Duhaney, 2001; Hsu & Sharma, 2010; Thomas, Larson, Clift, & Levin, 1996; Tondeur et al., 2012), and an absence of a shared vision across the program and with the field placement schools (Goktas et al., 2009; Lavonen, Lattu, Juuti, Meisalo, 2006; Thompson, Schmidt, Davis, 2003; Tondeur et al., 2012).

As technologies continue to be ever-changing (Sims 2014), insufficient access to technology is a barrier for use in the classroom (e.g., Butler & Selborn, 2002; Hew & Brush, 2007; Thomas, Larson, Clift, & Levin, 1996). "The problem is not necessarily lack of funds, but lack of adequate training and lack of understanding how computers can be used to enrich the learning experience" (U.S. Department of Education, 2004, p. 22). Although institutions recognize the need to provide basic technology training (Mulkeen, 2003), an identified problem is the workshop model for staff development that is has been that is often used in that it "rarely offers the practice and follow-up required if teachers are to learn the skills and discover new ways to implement them" (Seels, Campbell & Talsma, 2003, p. 91). Moreover, without a shared technology vision among

all stakeholders in teacher preparation programs, technology implementation may have a small impact (Hofer, 2005; Sergiovanni, 2000).

There have been "significant differences" among training institutions in how they approach technology planning and leadership strategies (Tondeur et al., 2012, p. 140), with the specific challenge among institutions to develop common technology experiences for preservice teachers (Ertmer & Ottenbreit-Leftwich, 2010; Ottenbreit-Leftwich et al., 2012). In the research literature, there is a lack of agreement between teacher educators and K–12 inservice teachers surrounding the most important technology topics and uses (Ottenbreit-Leftwich, Ertmer, & Tondeur, 2015). Therefore, with limited available research on the actual technology topics that are taught to preservice teachers in teacher preparation programs (Lawless & Pellegrino, 2007; Ottenbreit-Leftwich et al., 2012), "future efforts are needed to provide our future teachers with the skills and knowledge they need to be effective technology-using teachers" (Ottenbreit-Leftwich, Ertmer, & Tondeur, 2015, p. 1261).

**Identified Best Practices For Preparing Preservice Teachers to Use Technology**

Despite the reported benefits of using educational technology (Bransford, Brown, & Cocking, 2000), preservice teachers do not possess the innate knowledge of effective technology integration practices and must be exposed to positive learning opportunities and practice technology skills within their teacher preparation programs (Gronseth et al., 2010; Hofer, 2005) to acquire the needed knowledge and skills. However, these programs differ in their method of delivery for technology integration (Gronseth et al., 2010; Kay, 2006). "To date, there is no consolidated picture on how to effectively

introduce technology to preservice teachers " (Kay, 2006). Upon re-examining the technology topics in teacher preparation programs, Ottenbreit-Leftwich, Ertmer & Tondeur (2015) concluded:

> Although teacher educators are addressing a wide variety of topics in their programs, are not completely aligned with the types of topics or uses that classroom teachers most value, as indicated by the technology they incorporate into their classrooms on a regular basis. (p. 1261)

Researchers have reported several strategies as best practices surrounding the integration of technology in teacher these preparation programs (Kay, 2006; Tondeur et al., 2012) from exemplary programs (Hofer, 2005; Mergendoller, 1994). In the following sections are a discussion of best practices as they relate to: (a) undergraduate curriculum framework, (b) technology skills and topics in courses, and (c) planning within the teacher preparation program and the field placement schools.

**Recommendations for curriculum framework.** Kay (2006) reviewed sixty-eight journal articles and reported ten main models for teaching technologies to preservice teachers: (1) integrating technology in all courses; (2) using multimedia; (3) focusing on the education faculty; (4) a single technology course; (5) modeling of effective technology use throughout the program; (6) collaboration among preservice teacher, mentor teachers, and faculty; (7) practicing technology in the field; (8) offering mini-workshops; (9) improving access to software, hardware, and support; and (10) focusing on mentor teachers. Since Kay's (2006) study, researchers have contributed to the initial findings of the strategies. These are explained below by describing their

characteristics, as well as reported affordances and constraints.

In the **integrated** strategy, preservice teachers are introduced to technology instruction throughout the entire teacher preparation program (Hofer, 2005; Kay, 2006). "A major strength of the integrated approach was the opportunity it provided preservice teachers to design, enact, and reflect upon the implementation of a technology-integrated lesson in a real classroom" (Mouza, Karchmer-Klein, Nandakumar, Yilmaz, Hu, 2014, p. 219). Researchers have noted that although this strategy improves confidence in one's technology skills (Albee, 2002), some preservice teachers have found it difficult to transfer what is learned to their field experiences (Brush et al., 2003). In order to make technology integration more successful, faculty, preservice, and inservice teachers should spend more time helping each other with technology (Thompson, Schmidt, & Davis, 2003) in a "formal coordination of efforts" (Hofer, 2005, p. 10).

The **multimedia** approach provides preservice teachers with an opportunity to experience various types of technologies, such as online courses, e-portfolios, and technology case studies (Kay, 2006). Researchers reported a need for incorporating modern technologies into 21st century teacher preparation programs in order to encourage preservice teachers to reflect on use of digital tools in their future teaching situations (Coutinho, 2007). Moreover, analyzing technology use in case studies aids preservice teachers in developing knowledge and skills surrounding technology integration and its alignment with content knowledge (Brantley-Dias, Kinuthia, Shoffner, de Castro, & Rigole, 2007).

The **education faculty** model encourages all members in the teacher preparation

program to improve their skill and use of digital tools to effectively instruct (Hofer, 2005; Kay, 2006) and model the process of teaching with technology (Kajder, 2005) in their courses. The advantage of this approach is that the entire program works together to improve overall technology use (Davis & Falba, 2002), including both teacher educators at IHEs and inservice teachers at K–12 field placement schools who are "exemplary users of technology" (Abbot & Faris, 2000, p. 31). Stobaugh & Tassell (2011) further reported that if preservice teachers do not observe "comprehensive" and quality modeling, they "will not be aware of the possibilities of the extent to which technology can be used when in the field" (p. 155). Preservice teachers expressed the desire to see more **modeling** of "subject matter-appropriate technology" in methods courses (Wetzel, Buss, Foulger & Lindsay, 2014, p. 100), to provide authentic examples of technology use in the classroom (Bullock, 2004; Howland & Wedman, 2004; Stobaugh & Tassell, 2011).

Many teacher preparation programs continue to require a **single technology course** (Gronseth et al., 2010) which is project-based, content-based, or process-based. Although such courses can improve preservice teachers' self-efficacy (Albion, 2001), preservice teachers will not necessarily transfer their new technology knowledge to the field (Hsu & Hargrave, 2000). Researchers who have examined technology courses have found the central focus surrounds the use of hardware, software and productivity tools, rather than effective technology integration practices and pedagogy (Graham et al., 2009; Gronseth et al., 2010; Hughes, Gonzalez-Dholakia, Wen, & Yoon, 2012). However, other researchers (e.g., Kay, 2006) have reported that this course can "provide a strong foundation of technology skills and a good overview of the use of technology in

teaching" (Mouza et al., 2014, p. 219). Moreover, when coupling this course with field experiences from required methodology courses, preservice teachers can practice new technology knowledge and skills in an authentic environment (Brush & Appleman, 2003).

The **collaboration** approach involves developing a relationship between the university and K–12 school to create common technology-infused learning experiences for preservice teachers (Kay, 2006). This approach not only provides preservice teachers the opportunity to collaboratively work with inservice teachers to create technology-rich activities, but also become comfortable with the tools (Dawson & Norris, 2000; Thompson et al., 2003). In order for this approach to be effective, all stakeholders must be motivated to effectively use technology in learning and teaching experiences (Hofer, 2005). An additional collaboration theme in the literature includes collaboration among peers. Preservice teachers acknowledged the benefits of discussing and sharing concerns with their peers as the "most successful part of the lesson" (Brush et al., 2003, p. 66) and an opportunity to gain confidence in using technology (Coley, Cradler, & Engel, 1997).

The **field-based** approach actively supports "the production and delivery of technology-based lessons by preservice teachers" (Kay, 2006, p. 391). By participating in this approach, preservice teachers learn technology integration strategies by working with and observing technology use of inservice teachers and students (Abbot & Faris, 2000), practice technology (Basham, Palla, & Pianfetti, 2005), apply technology in a content-specific lesson plan with learners (Niess, 2012), and reflect on how students learn in a technology-infused classroom (Brush et al., 2003). Some researchers have linked

this approach to "authentic experiences" to expose preservice teachers to real-world problems with technology use that they might encounter in their own classroom (Bird & Rosaen, 2005), allowing them to strategize their reactions to these problems (Weisner & Salkeld, 2004).

The **workshop** approach is implemented as a stand-alone strategy or in combination with other strategies (Kay, 2006). Technology-based seminars are presented and offered to faculty members and preservice teachers to create artifacts for portfolios or create specific teaching activities with technology. In order for this model to be effective, researchers have reported a need to provide one-on-one support in the workshop for university faculty, inservice teachers, and preservice teachers (Thompson et al., 2003), along with subsequent practice and follow-up to "learn the skills and discover new ways to implement them" (Seels, Campbell & Talsma, 2003, p. 91).

When programs incorporate the **access** strategy, the university typically provides preservice teachers and teacher educators with resources, such as hardware and software, along with technological support (Gulbahar, 2008; Hofer, 2005; Wetzel, Buss, Foulger & Lindsay, 2014) and "careful investments" for long-range access (Gulbahar, 2008, p. 6). This strategy is typically incorporated with other strategies in a teacher education program in order to use technology in a meaningful way. Moreover, inservice and preservice teachers should be able to access technologies to help them plan technology-infused activities, along with flexible scheduling during the school day to learn how to use the tools (Honey & McMillan, 1996). Additionally, "teachers should be encouraged to use computers at home, to learn at their own pace, pursue their own interests, and gain

an understanding of the range of technology applications that can be used in the classroom" (Cradler, Freeman, Cradler, & McNabb, 2002, p. 52). With the demand to stay current with changing technologies, Stobaugh, & Tassell (2011) recommended "universities and schools [should] continually update their technology resources" (p. 144).

The **mentor teachers** approach is typically a collaborative effort (Kay, 2006), as inservice teachers guide preservice teachers in producing meaningful uses of technology (Bullock, 2004). Preservice and inservice teachers benefit from observing and working with mentors who are experienced using technology in a standards-based curriculum (Abbot & Farris, 2000; Stobaugh & Tassell, 2011). Preservice teachers acknowledged the importance of applying their knowledge of educational technology in authentic teaching experiences, in that, "watching" technology is not a substitute for "doing" (Tearle & Golder, 2008, p. 63). Moreover, necessary scaffolds implemented by mentor teachers, such as support during planning and preparation of technology-infused lesson plans and activities, are also important to preservice teachers during this learning process (Brush et al., 2003; Tondeur et al., 2012).

**Recommendations for technology skills and topics in courses.** Technology topics and skills that should be taught in courses include: (1) linking theory to practice (Ageyi & Voogt, 2011; Tondeur et al., 2012); (2) asking preservice teachers to reflect on their technology attitudes and beliefs (Bullock, 2004; Ertmer & Ottenbreit-Leftwich, 2010; Tondeur et al., 2012); and (3) building preservice teachers' confidence in using technology for teaching (Tondeur et al., 2012; Wozney, Venkatesh & Abrami, 2006).

***Linking theory to practice.*** In order to increase teachers' technology knowledge and promote successful integration in the classroom, Mishra & Koehler (2006) extended the work of Shulman (1986) and developed the *Technological Pedagogical Content Knowledge (TPACK)* framework. *TPACK* (Figure 1) helps educators understand the interconnections and flexible relationships among technology (T), pedagogy (P), and content knowledge (CK), as they are influenced by the rapid changes in technology (Cox & Graham, 2009). Technology integration occurs when a teacher effectively connects these three components in a learning experience for students (Koehler & Mishra, 2009). When teachers learn how to use technology in their specific content areas, they can transfer that knowledge to their own classrooms; therefore, these experiences should be connected to content learning goals (Hughes, 2005). Therefore, teachers emphasize these skills in method courses and field experiences (Ottenbreit-Leftwich et al., 2010; Polly et al., 2010) by training preservice teachers on using technologies before they apply techniques in the field (Cheng & Zhan, 2012). *TPACK* can help preservice teachers develop the critical knowledge and skills, while understanding the relatedness of all components (Ageyi & Voogt, 2011; Koehler & Mishra, 2009; Mouza et al., 2014; Niess, 2012; Sang, Valcke, Braak, & Tondeur, 2010; Schmidt, Baran, Thompson, Mishra, Koehler, 2009).

***Preservice teachers' reflection on technology attitudes and beliefs***. Teacher beliefs are formed from past schooling experiences and how they were taught in their teacher education programs before entering the profession (Windschitl & Sahl, 2002). Lortie (1975) argued that preservice teachers have already developed beliefs surrounding

technology use when they enter a teacher preparation program. Therefore, it is critical that teacher preparatory programs address these beliefs when preservice teachers enter programs (Bullock, 2004; Ertmer & Ottenbreit-Leftwich, 2010; Tondeur et al., 2012).

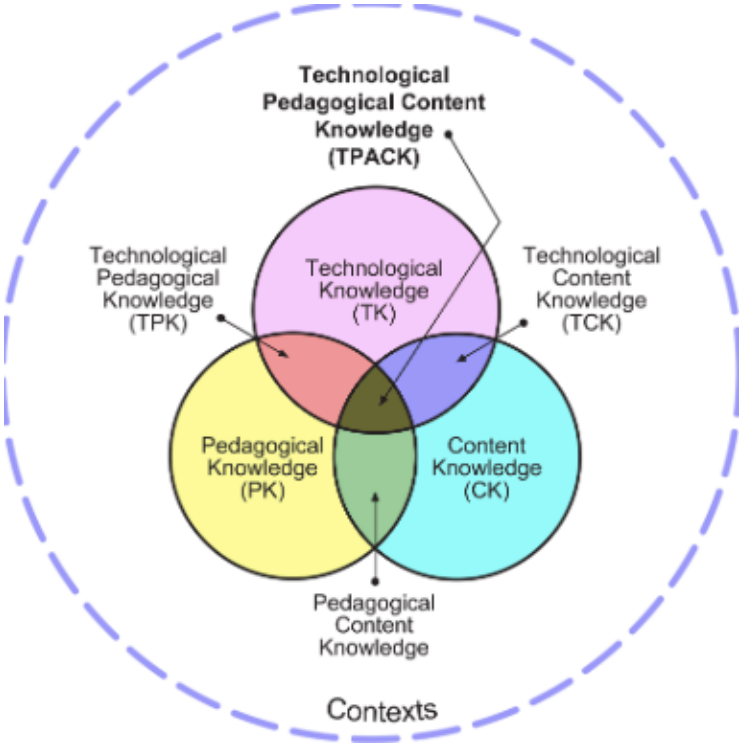


*Figure 1*: Framework of technological pedagogical and content knowledge (Koehler, M. J., & Mishra, P., 2008). Reprinted under Creative Commons.

By asking preservice teachers to reflect on their attitudes about the role of technology, engagement levels are reported to increase, as well as "the development of preservice students' positive attitudes toward technology" (Tondeur et al., 2012, p. 6). Discussion groups, observations, and e-portfolios have been commonly used in teacher preparation programs in order for preservice teachers to reflect on and develop their attitudes (Britten, Mullen, & Stuve, 2003; Tearle & Golder, 2008). An additional suggestion for programs is to increase the number and types of technologies preservice teachers encounter

throughout the program (McCoy, 1999).

***Preservice teachers' digital self-efficacy.*** Research surrounding preservice teachers' future uses of technology identified the need to focus on their digital self-efficacy (Wozney, Venkatesh & Abrami, 2006). Teacher preparation programs should support "beginning users with achieving a base comfort level in technology functions, in addition to making the connection between curriculum and instructional strategies" (Fisher, 2000, p. 118) and focus on how a teacher supports curricular goals while integrating the technology, rather than using it simply for teacher-centered practices (Ertmer & Ottenbreit-Leftwich, 2012). If preservice teachers are given a positive experience in the classroom with technology knowledge and with mentor teachers, their anxiety using technology will decrease, they will develop collaboration more positive attitudes toward technology (Bullock, 2004; Gunter, Gunter, & Wiens, 1998), and be more likely to use it in their future classroom (Bullock, 2004; Cassidy & Eachus, 2002). Recommended strategies to increase preservice teachers' self-efficacy include:

(1) small, incremental successful integration experiences (Mueller, Wood, Willoughby, Ross & Specht, 2008; Schunk, 2000),

(2) witnessing the positive effect on student achievement due to technology integration (Ottenbreit-Leftwich, 2007),

(3) practicing or playing with technology (Hew & Brush, 2007; Somekh, 2008),

(4) working with their peers (Ertmer, Ottenbreit-Leftwich & York, 2006; Tondeur et al., 2012) and,

(5) participating in a professional learning community (Putnam & Borko,

2000).

**Planning within teacher preparation programs and field placement schools.** In order for preservice teachers to effectively practice new technology knowledge and skills in an authentic environment, collaborative efforts should be made between teacher preparation programs within IHEs and partnering K–12 field placement schools (Goktas et al., 2008; Lavonen et al., 2006; Tondeur et al., 2012). Recommendations related to (a) planning within the institution and (b) planning with the field placement schools include: (1) the development of a technology plan (Goktas et al., 2009) and a shared vision for technology use and integration (Ertmer & Ottenbreit-Leftwich, 2010; Hofer, 2005), (2) co-operative technology strategy planning (Lavonen et al., 2006) with top management (Gillespie, 1998; Haydn & Barton, 2007; Hofer, 2005), (3) staff development to support teacher educators' use of technology through workshops, consultants, and sharing information (Ertmer & Ottenbreit-Leftwich, 2010; Stobaugh & Tassell, 2011), (4) regular meetings to monitor progress in technology professional development (Ertmer & Ottenbreit-Leftwich, 2010), and (5) addressing access to resources (Goktas et al., 2008; Hofer, 2005; Seels et al., 2003; Wetzel, Buss, Foulger, Lindsey, 2014).

***Planning within the institution.*** In order to facilitate effective modeling, researchers reported a need for leadership (Hofer, 2005; Mergendoller, 1996) to provide a shared vision in the teacher preparation program, opportunities for teacher educators to develop skills and knowledge, and a supportive culture for technology use. Ertmer & Ottenbreit-Leftwich (2010) explained a shared vision "should place emphasis on including technology as part of the definition of good teaching" (p. 275). Faculty

members and staff serve as a key factor in developing a shared vision of utilizing technologies within the teacher preparatory program (Lavonen, Lattu, Juuti, & Meisalo, 2006), and supporting technology modeling throughout the curriculum (Foulger & Williams, 2007).

When planning preservice teachers' technology experiences, researchers recommended several other key elements, including the development of a technology plan as an important step to achieving a shared vision (Goktas et al., 2008). This plan should be developed by all stakeholders, supported and updated regularly by a specific committee, and focused on both the technical and instructional purposes of educational technology for teaching and learning (Goktas et al., 2008; Tondeur et al., 2012) to facilitate the implementation of technology. Moreover, certain individual participants of this planning and implementation process are critical and include: top management (e.g., Hofer, 2005; Mergendoller, 1994), specifically with the help of deans (Trufant, 2007), department heads (Haydn & Barton, 2007), technology coordinators (Haydn & Barton, 2007) and other key persons who support technology integration (Hsu & Sharma, 2010). Furthermore, these participants should engage in learning communities to create and sustain collaboration among a program's stakeholders (Hsu & Sharma, 2010).

Training for both inservice teachers and teacher educators is a necessity to provide new technology skills and knowledge (Fishman & Pinkard, 2001; Hsu & Sharma, 2010; Privateer, 1999), change or develop their attitudes and beliefs surrounding educational technology (Shaunessy, 2005), and learn best practices so preservice teachers can observe "seamless integration" (Stobaugh & Tassell, 2011, p. 154) of technologies in their subject

domain (Gomez, Sherin, Griesdorn & Finn, 2008). These professional development opportunities should be provided through workshops, consultants, and sharing of information among colleagues (Clift, Mullen, Levin, & Larson, 2001) during meetings and other scheduled time (Seels, Campbell, & Talsma, 2003). Teacher educators who already use educational technology in teacher preparation programs should lead others by example, create and support learning communities among colleagues, and share successes of technology use in their instructional experiences (Seels, Campbell, & Talsma, 2003; Wetzel, Buss, Foulger, & Lindsay, 2014). Recommended activities for professional development include those that focus on using technology to promote active engagement, learning how to model of effective technology uses, and situating teaching and learning with technology in a *TPACK* framework (Wetzel, Buss, Foulger, & Lindsay, 2014) in an effort to help "teachers understand how student-centered practices, supported by technology, affect student learning outcomes" (Ertmer & Ottenbreit-Leftwich, 2010, p. 278). After completion of activities, follow-up should include: a reunion in which participants who previously participated in faculty development opportunities help to contribute to future professional development events, a post-event to share experiences with colleagues, tracking their ongoing development, documenting their teaching techniques with technology, and implementing a college-wide technology needs assessment (Trufant, 2007).

***Planning with the field placement schools.*** Because preservice teachers need authentic experiences observing effective uses of technology in K–12 classrooms (e.g. Angeli & Valanides, 2009; Bullock, 2004; Fleming, Motamedi & May, 2007; Kay, 2006;

Tondeur et al., 2012), researchers reported the benefits surrounding quality partnerships and planning of common experiences between teacher training programs and inservice teachers in local K–12 schools to incorporate technology into instruction (Bullock, 2004; Ertmer & Ottenbreit-Leftwich, 2010; Goktas et al., 2008; Ottenbreit-Leftwich et al., 2012; Tondeur et al., 2012). The result of co-operative planning provides preservice teachers an "opportunity to link theoretical knowledge with practice in authentic environments" (Goktas et al., 2008, p. 177) by integrating technology into lessons that facilitate student learning (Ertmer & Ottenbreit-Leftwich, 2010), and providing "successful technology integration trainings" for preservice teachers to transfer skills to their future teaching situations (Tondeur et al., 2012, p. 140). As a result, "teacher education programs must engage in more concerted efforts in identifying field placements rich in technology resources and models that integrate technology, content, and pedagogy" (Mouza et al., 2014, p. 221), alongside mentors who encourage technology use (Childress, 2014).

**Implications on Further Research**

In a recent synthesis of evidence-based interventions used to prepare preservice teachers with technology in teacher preparation programs, the *SQD model* (Tondeur et al., 2012) emphasizes the significance of all stakeholders working together (Figure 2). "It was clear that effective preparation of preservice teachers for technology integration required attention to not only the separate key themes in the model, but the relationship between each of the key themes" (Tondeur et al., 2012, p. 141). With the merge of major accrediting bodies in the profession, researchers should examine the macro level factors

of technology standards, as well as “the influence of cultural and contextual factors on the development of preservice teachers’ capacity to apply technology in daily classroom practices” (Tondeur et al., 2012, p. 143). Researchers have also identified a need to examine the stand-alone technology course and its methods in which teacher educators make efforts to build preservice teachers’ pedagogy, content, and technology skills and knowledge (Mouza & Karchmer-Klein, 2015), as well as moving beyond the use of presentation technologies and digital content alone (Mouza et al., 2014). In the future, efforts should be placed on the methods for aiding preservice teachers to create uses of various technologies and digital tools, beyond ‘written descriptions’ (Mouza & Karchmer-Klein, 2015, p. 135), with an overall emphasis on providing our future teachers “with the skills and knowledge they need to be effective technology-using teachers” (Ottenbreit-Leftwich, Ertmer, & Tondeur, 2015, p. 1261).


*Figure 2.* SQD Model to Prepare Preservice Teachers for Technology Use. Reprinted from "Preparing Pre-service Teachers to Integrate Technology in Education: A Synthesis of Qualitative Evidence," by Tondeur et al., 2012, *Computers & Education*, *59*(1), 134–144. Reprinted with permission.

## Summary

When reflecting on the history of educational technology, it is undeniable that with the emergence of new technologies, revolutionary change was promised. However, there have been multiple repeated failures to adopt the new tools when these technologies were introduced to teachers. This review of the literature includes the recommended strategies for preparing preservice teachers to use technology and highlights the presence of repeated challenges that teacher preparation programs continue to face, as well as best practices that should be considered during the implementation process at the micro and macro levels. Even though technology is used in many teacher preparation programs,

barriers still prevent effective integration. Researchers acknowledge that the single, stand-alone technology course does not alone sufficiently prepare preservice teachers to enter the profession. As the standards outline, technology knowledge and skills must be integrated throughout the entire program and situated with authentic experiences in order for preservice teachers to build competencies surrounding pedagogy and their content area. With the lack of agreement on the best method to teach educators how to effectively integrate technology, it remains a challenging task. However, it is clear from the literature that teacher education programs and K–12 schools must develop a clear vision for expectations for educators entering the field. Technologies will continue to change over time, but it is the continued responsibility of teacher preparation programs to best prepare our students to enter the profession equipped with appropriate technology knowledge and skills.

**Gaps in the Research Literature**

While there have been many studies that examine the effectiveness of content and delivery strategies used to prepare preservice teachers to use educational technology (e.g., Kay 2006; Tondeur et al., 2012), there are few cross-institutional studies (Pellegrino, Goldman, Bertenthal & Lawless, 2007), and those that "investigate the actual topics or uses of technology that preservice teachers are likely to use in their future classrooms" (Ottenbreit-Leftwich et al., 2012, p. 400). Additional research is needed on the actual technology content and topics that are addressed across teacher preparation programs in IHEs (Gronseth et al., 2010; Hew & Brush, 2007; Lawless & Pellegrino, 2007; Ottenbreit-Leftwich et al., 2012).

This study fills a gap in the research literature by looking at the actual practices of the top rated public IHEs in order to show how they are being implemented and where the challenges in teacher preparation with technology remain. Furthermore, an important factor of this study is its timeliness, not only with the dynamic nature of technology use (Polly, 2012; Straub, 2009), and a critical need to better prepare preservice teachers (Collins & Halverson, 2009), but also with the upcoming changes in standards due to the merge of accreditation organizations. Therefore, the goal of this study was to provide teacher preparation programs with the current models and the contemporary realities of technology preparation to better understand what is actually taking place within top public IHEs during this time of change.

# Chapter 3

Methodology

As research has shown that teachers are not effectively integrating technology in their classrooms, teacher preparation programs are charged with preparing new teachers with a skill set to meet expectations of all educational stakeholders. Because researchers report the need for multiple strategies of preparation within programs at IHEs, schools of education are struggling to define a common vision for best preparing preservice teachers with technology skills. The purpose of this study was to explore how the eleven undergraduate teacher preparation programs in public universities are preparing preservice teachers to use technology. This chapter presents the methodology of the study.

## Research Question

The research question that guided this study was: What do top public schools of education offer undergraduate preservice teachers to prepare them to integrate technology into their future classrooms and to what extent does this match best practices as articulated in the literature and professional standards?

## Preliminary Action

**Determination of best practices.** I conducted an exhaustive search of the literature addressing commonly implemented best practices for preparing preservice teachers to use technology in IHEs. I primarily focused on the findings of Kay (2006), who conducted a synthesis of preservice teachers' technology training within teacher preparation programs, and Tondeur et al. (2012), who conducted a similar updated study

and generated key themes for "content and delivery methods that prepare preservice teachers to integrate technology into their future classrooms" (p. 138). At both the macro and micro levels of teacher preparation programs, these findings incorporated the following best practices for technology integration:

(a) at the *institutional level*: training staff, cooperation between institutions, technology planning and leadership, and access to resources;

(b) at the *course level*: feedback, role models, reflection, instructional design, collaboration, and authentic experiences; and

(c) in *both levels*: linking theory to practice and change efforts. (Tondeur et al., 2012)

They reported, "in order to successfully train pre-service teachers to use technology, teacher education programmes need to address all these key variables thoughtfully" (Tondeur et al., 2012, p. 141). Appendix E provides a more detailed explanation of characteristics for the recommended content and delivery methods described by Kay (2006) and Tondeur et al. (2012), as well as those reported by other researchers who have added insights and recommendations.

**Population.** A method of purposeful sampling was used to include the top, public IHEs in this study. There were three criteria used to determine the sample for this study, taken in the following order. First, the initial population pool consisted of the top, public institutions in the United States, as determined by the most recent *2015 U.S. News and World Report (USNWR)* on the Top Public Schools (2014). *USNWR* is the best source for the initial population in this study as it remains the most popular ranking

publication in the U. S. (Hazelkorn, 2011) and has been heralded as an important source of information for and about colleges and universities (Webster, 2001). Because this study aimed to uncover the practices of the best IHEs, *USNWR* served as an optimal source for this initial population. I chose to include only public IHEs for the sample because they continue to be a major source of beginning teachers. Compared to private IHEs (40%), 60% of individuals enrolled in a teacher preparation program attended a public IHE (U.S. Department of Education, Office of Postsecondary Education, 2013).

Second, I only included IHEs that have approval from the *National Council for Accreditation of Teacher Education (NCATE)*. *NCATE* is currently one of the two professional organizations in the U. S. that accredits teacher education programs and is the "profession's mechanism to help establish high quality teacher preparation" (NCATE, 2014, para. 2) by providing standards of knowledge that each preservice teacher should attain upon graduating the program. Including IHEs that are *NCATE* accredited, assured that the IHEs in the sample have met national standards and have received the profession's "seal of approval" (NCATE, 2014).

Third, only IHEs that offer an undergraduate elementary major were contacted and invited to participate. The elementary education major remains a popular choice by undergraduate preservice teachers in IHEs with over 1.7 million elementary school teachers entering the profession upon graduation in 2010 (The National Center for Education Statistics). Nationally, 89% of all four-year IHEs offered elementary education programs to undergraduates (Kleiner et al., 2007). Moreover, experiences in this popular major provide preservice teachers with an exposure to multiple subjects and

a broad range of knowledge and skills "…necessary to enter the professional field of teaching" (Simpson University, 2011, para. 1). These IHEs became part of this study's sample to provide insight into preparing preservice teachers in a common major that focuses on teaching multiple subjects and not necessarily on the educational technology. Of the top 100 IHEs from *USNWR's 2015 Top Public Schools (2014),* thirty-six met the three criteria and served as the initial sample. List of all potential recruits can be viewed in Appendix F.

**Development of interview questions and follow-up survey questions.** Interview and follow-up survey questions were constructed to reflect the key content and delivery strategies on what teacher preparation programs should do in order to properly prepare preservice teachers with knowledge and skills needed to effectively integrate technology into their future classroom (Kay, 2006; Tondeur et al., 2012). Appendix G provides the sources from the research literature for each of the interview questions with deans, Appendix H provides the sources for each of the interview questions with department heads, and Appendix I provides the survey questions and answer choices for informants.

***Interview questions.*** In addition to best practices, I also constructed interview questions related to meeting standards in order to address the research question. Depending on the informant's position at the IHE, I chose from the following list of interview questions during the semi-structured interviews. The semi-structured interviews allowed topics to be discussed in an open-ended format and encouraged informants to report what was most important to them. The interview questions

constructed for administrators or department heads at IHEs were:

- What are the expectations or requirements of faculty members to use technology in your school?
    - What types of technology are available at your school?
    - What types of technology do the faculty members use?

- How does your school meet state standards in order to license teachers?

- How does your school meet your stated learning outcomes/goals?

- What are the technology requirements for preservice teachers?

- How does your school prepare preservice teachers to teach with technology?

- Does your school work with the National Board for Professional Teaching Standards (NBPTS) to equip preservice teachers with the skills as outlined by the NBPTS? If so, how?

- Does your school meet the National Educational Technology Standards (NETS), as outlined by the International Society for Technology in Education (ISTE)? If so, how?

- Since you took your position as program director or department head, what have you changed in regards to technology use for teaching and learning?

- In your opinion, what is the most important technology-related topic or experience that preservice teachers need before graduating (Gronseth et al., 2010; Ottenbreit-Leftwich et al., 2012)?

The interview questions constructed for teacher educators and instructional technology staff members at IHEs were:

- Does your school have a technology plan?

- To what degree do the faculty members use technology for instruction?
    - What types of technology do the faculty members use?
    - How do they use technology?

- Are the faculty offered training or workshops to aid them in teaching with technology?

- Is there any technology strategy planning among your colleagues at your school?

- Please describe some of the experiences for preservice teachers in their methods classes.

- How do you choose placement schools for the preservice teachers?
    - Do you consider the level of technology use in the school? Or of the inservice teachers?
    - Do you discuss and collaborate on common technology experiences between your school and the placement school?

- Does your teacher preparation program strive to link theory and practice for the preservice teachers?

- In your opinion, what is the most important technology-related topic or experience that preservice teachers need before graduating (Gronseth et al., 2010; Ottenbreit-Leftwich et al., 2012)?

***Survey questions***. Because there is an additional need in the literature for exploring the value of various technology topics (Lawless & Pellegrino, 2007) and digital tools (Project Tomorrow, 2013) addressed in courses, questions were constructed from the results of recent, previous studies (e.g., Gronseth et al., 2010; Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013). The open and closed-ended survey questions were constructed for: (a) teacher educators who currently teach or have taught undergraduate preservice teachers at the IHEs and (b) informants who participated in the interviews. The related sources from the research literature used to construct the survey questions can be found in Appendix J. If further clarification was needed after the interviews, a follow-up survey was sent to informants.

**Field test and revisions of interview questions and survey questions.** Before the study began**,** a field test was conducted with three informants to assess the validity and clarity of the interview and follow-up survey questions (Kim, 2011). The three field

test informants included: (a) a current department head and instructor of curriculum and instruction, (b) a current department head and instructor of educational technology, and (c) a post-doctoral student who currently researches the best practices of survey creation. Because the test informants provided recommendations on how to improve these questions, I made revisions before the semi-structured interviews were conducted and the follow-up surveys were distributed.

**Recruitment.** From this initial sample, I first collected relevant contact information from the each of the first ten IHEs' websites. This included published e-mail addresses for the following people who were knowledgeable about educational technology at their IHE (if applicable): deans, the department heads of curriculum and instruction, the department heads of educational technology, instructors of the required educational technology courses, instructional technology staff, and library staff.

First, deans of the schools or colleges of education at each IHE were contacted through e-mail with the purpose, scope, and description of the study, along with a request to participate in a 30-minute interview (Appendix K). If interested in participating, these individuals were asked to reply to my email to indicate his or her willingness, as well as giving consent to participate in the study. If the dean did not respond to the e-mail in seven days, a follow-up email was sent as a reminder. If I did not receive a response fourteen days after the initial e-mail was sent, no additional contact was made with that informant. Additionally, if a follow-up attempt was unsuccessful, I searched the IHE's web site for an associate dean or administrator(s) in charge of the teacher education preparation and contacted him or her by email with information about the purpose of the

study and consent form (Appendix K).

Next, I contacted department heads of both curriculum and instruction and educational technology (if applicable) departments through e-mail (Appendix L). In the e-mail, department heads were also provided the purpose, scope, and description of the study, along with a request to participate in a 30-minute interview. If interested in participating, these individuals replied to my email to indicate his or her willingness, and gave consent to participate in the study. If they did not respond to the e-mail in seven days, a follow-up email was sent as a reminder. If I did not receive a response fourteen days after the initial e-mail was sent, no additional contact was made with that informant. When a dean, associate dean or department head agreed to participate in the study, that IHE became part of the sample for this study. Moreover, the same process was repeated when I contacted instructors of the required educational technology courses at IHEs. After scheduling the interview, all participants were sent a copy of the questions at least one week before the scheduled interview.

**IHEs in study.** The recruitment process was repeated until I attained a final sample of 11 IHEs who agreed to participate in the study. A total of fifty-four informants from these 11 IHEs agreed to participate in a mixture of both semi-structured interviews and surveys. The IHEs that met the previously described selection criteria had varying sizes of total student enrollment in the school or college of education. Table 1 shows the total student enrollment reported (2014) at each IHE, which included part- and full-time status for both undergraduate and graduate students. Four of the IHEs enrolled less than 499 students, three of the IHEs enrolled between 500 and 599 students, and four IHEs

enrolled more than 1,000 students.

Table 1

*IHE Demographics*

| IHE # | Enrollment # | # Full-Time Faculty |
|---|---|---|
| 1 | 1756 | 125 |
| 2 | 306 | 40 |
| 3 | 1101 | 61 |
| 4 | 419 | 38 |
| 5 | 952 | 95 |
| 6 | 450 | 66 |
| 7 | 840 | 87 |
| 8 | 1384 | 73 |
| 9 | 921 | 77 |
| 10 | 321 | 36 |
| 11 | 1102 | 76 |
| Mean | 868 | 70 |

*Note*. Data were extracted from *2015 U.S. News and World Report (USNWR)* (2014).

The total number of informants (see Table 2) was 54, and the number from each IHE ranged from one to nine, with the mean number of informants as five. One IHE was represented by only one informant, the rest had two and more. Informants included educational technology faculty, curriculum and teaching/instruction instructors, instructional or informational technology staff, administrators, library staff, and department heads (Table 2).

Table 2

*Informant Demographics*

| IHE # | # of Informants | Role | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Dean | C & I Head | C & I Dept | Ed Tech Head | Ed Tech Dept | Tech Staff | Librarian |
| 1 | 3 | | | 1 | | 1 | 1 | |
| 2 | 5 | 1 | 1 | 2 | | | 1 | |
| 3 | 8 | 1 | | 1 | 1 | 3 | 1 | 1 |
| 4 | 3 | 1 | | 1 | | 1 | | |
| 5 | 7 | 1 | | | | 5 | 1 | |
| 6 | 3 | | | | | 2 | | 1 |
| 7 | 6 | | 1 | | | 2 | 3 | |
| 8 | 4 | 1 | | 1 | | 1 | | 1 |
| 9 | 9 | 1 | | 4 | | 2 | 2 | |
| 10 | 1 | | | | | 1 | | |
| 11 | 5 | | 1 | 3 | | | 1 | |
| Total | 54 | 6 | 3 | 13 | 1 | 18 | 10 | 3 |

**Data Collection**

For each of the IHEs, data were collected on:

(a) teacher preparation program's structure,

(b) curriculum framework and standards,

(c) required technology course content,

(d) availability of technology in the school or college of education,

(e) usage of technology among faculty members,

(f) technology professional development opportunities for teacher educators, and

(g) overall technology preparation and experiences of preservice teachers, as they

relate to recommended content and delivery methods reported in the literature (Kay 2006; Tondeur et al., 2012).

Data were collected from multiple sources at each IHE. The tools used to collect data included: (a) semi-structured interviews with administration, faculty, and staff, (b) open and closed-ended surveys, and (c) the evidence found in documents related to technology integration.

**Interview participants.** Data from semi-structured interviews were gathered from a total of 38 of the 54 informants among the 11 IHEs (see Table 3). I conducted all interviews either over the phone or using Skype, lasted approximately 30–45 minutes, and were audio-recorded and transcribed. The semi-structured interviews allowed me to not only ask the pre-determined questions, but also encouraged the informants to determine the direction of the conversation. For all interviews, I used a self-created checklist of the questions, along with the sources of best practices and recommendations cited in the literature (Appendix G and Appendix H). The sources of these interviews are described below.

***Deans.*** The first set of interviews with deans or associate deans were conducted to gain insight on the macro of teacher preparation programs at the institutional level (Tondeur et al., 2012). Questions were asked regarding the IHE's preparation goals, curriculum framework and standards, technology usage of teacher educators, and infrastructure of these teacher education programs (Appendix G).

***Department heads***. The next set of interviews with department heads were conducted to gain additional information and insights on each IHE's technology

preparation and experiences of preservice teachers, both within method courses and fieldwork experiences (Appendix H). These interviews also helped to clarify information not gathered during the previous round of interviews with deans. The department heads of curriculum and teaching and educational technology (if applicable) were considered the best source for these questions, as they are directly involved with creating field placements, curriculum in the IHE's methods courses, and overall technology experiences in other courses at the IHEs.

***Instructors of the required educational technology courses.*** During the interviews with instructors of the required educational technology courses, I asked questions regarding the course structure, requirements, placement of the course in the curriculum, activities and skills taught, availability of technology resources within the school or college of education, technology professional development opportunities for teacher educators, and other technology-related tasks for undergraduate preservice teachers at that IHE.

***Other***. During interviews, if and when the informant mentioned the name of a colleague, I contacted him or her and requested participation in this study by: (a) responding to a three-question survey; (b) sending a copy of his or her syllabus or syllabi for the courses in which undergraduate preservice teachers are enrolled (if applicable); and/or (c) participating in a follow-up interview. Nine informants agreed to take the follow-up survey and send their syllabi, but declined participating in a follow-up interview. Only two informants also agreed to participate in a 15-minute follow-up interview.

Table 3

*Data Sources at Each IHE*

| IHE | Total number of informants | Number of interviews | Completed follow-up surveys after interviews | Completed survey sent by administrator and no interview | Completed survey only sent by researcher and no interview | Completed survey, and follow-up interview |
|---|---|---|---|---|---|---|
| 1 | 3 | 3 | 2 | 0 | 0 | 0 |
| 2 | 5 | 5 | 3 | 0 | 0 | 0 |
| 3 | 8 | 5 | 2 | 0 | 2 | 1 |
| 4 | 3 | 3 | 2 | 0 | 0 | 0 |
| 5 | 7 | 3 | 2 | 0 | 3 | 1 |
| 6 | 3 | 3 | 3 | 0 | 0 | 0 |
| 7 | 6 | 6 | 1 | 0 | 0 | 0 |
| 8 | 4 | 2 | 1 | 0 | 2 | 0 |
| 9 | 9 | 4 | 2 | 3 | 1 | 1 |
| 10 | 1 | 1 | 1 | 0 | 0 | 0 |
| 11 | 5 | 3 | 4 | 0 | 1 | 1 |
| Total | 54 | 38 | 23 | 3 | 9 | 4 |

**Surveys.** Surveys used in this study took two forms: (a) follow-up surveys after semi-structured interviews were conducted and (b) faculty surveys sent by the dean at IHEs. These are discussed below.

***Follow-up surveys.*** If clarification was needed on the data gathered during the interviews, a follow up, closed-ended survey of two to four questions was sent to informants. 23 of the 40 informants who participated in the semi-structured interviews also completed a follow-up closed-ended survey.

***Faculty surveys.*** At the conclusion of their interviews, informants who were in administrative roles were asked to distribute a 19-question open and closed-ended survey (Appendix I) to faculty members who teach preservice teachers at their school or college of education. The questions were modified from previous findings in the literature, and aimed to understand the teacher educators' technology experiences at IHEs, as well as topics taught in preservice teachers' coursework. The content of technology experiences can vary, "including instruction on activities that teachers perform regularly, engage students in the classroom, incorporate reflection, involve professional practice knowledge, and work to further shape the profession" (Iverson et al., 2008, p. 291). Because many researchers have suggested that technology skills should be integrated throughout the teacher education curriculum (e.g., Ottenbreit-Leftwich et al., 2010; Niess, 2005), a web link to the survey was sent to all faculty members who teach undergraduate preservice teachers at the school or college of education at each IHE. The survey link led faculty members to a page that included an informed consent and description of the study, along with an explanation of expectations regarding commitment expectations and protocol to support confidentiality.

At the end of the survey, faculty members were asked to provide their course syllabi and contact information if they were willing to participate in a possible follow-up interview. Administrative informants at three (IHE 4, IHE 5, IHE 9) of the 11 IHEs agreed to distribute the survey. I received one response from IHE 5 and three responses from IHE 9. There were no survey responses from IHE 4. From these surveys, only one informant from IHE 5 and one informant from IHE 9 agreed to participate in a 15-minute

follow-up interview.

**Document collection.** Documents related to technology integration were collected both from (a) IHEs' websites and (b) individuals who participated in the interviews.

***Websites***. Information was gathered from the IHEs' web sites and was used to triangulate data gained from other sources. Before conducting the interviews, I focused on the structure and curriculum of the teacher education program of each IHE, and collected the following information (if available) via on-line searches of the IHEs' web sites:

- Number of students
- Number of faculty
- Structure of the school/college of education
- Offered majors and minors
- Learning outcomes of the IHE and school/college of education
- Requirements for graduation
- Requirements for the school's state licensure/certification
- Pre-practicum programs and placement requirements
- Outline of required and elective courses and their modes of instruction
- Course syllabi
- Sample assignments
- Potential contact information for additional informants involved with educational technology (e.g., instructors of required, educational technology

courses; staff development offices, etc.)

***Documents.*** During the interviews, I requested any relevant documents that related to their IHE's technology plan, syllabi of technology or methods courses for undergraduate preservice teachers, and any relevant documentation on technology-related assignments, tasks, or assessments that undergraduate preservice teachers must complete in their coursework or fieldwork.

**Data Analysis**

Data analysis was conducted at two levels. First, documents, interview data, and survey data from all the IHEs were organized and analyzed as related to the research question. Content analysis was used to review and code the documents, interview data, and survey data, which included constructing categories for each IHE in relation to the research question. The next level of analysis involved generating additional codes for both (a) content that did not fit into the pre-determined best practices and (b) content that supported the pre-determined best practices as supportive details. I used the constant comparative method to determine emerging themes across all data sources for all IHEs to present in relation to the research question. In order to increase the reliability of the results, I recruited a peer reviewer to critically review the coded data and provide recommendations for re-coding of specific phrases, statements, or concepts.

# Chapter 4

## Findings

The purpose of this study was to explore how undergraduate teacher preparation programs from public universities are preparing preservice teachers to use technology. This chapter presents the findings of the study. The research question that guided this study was: What do top public schools of education offer undergraduate preservice teachers to prepare them to integrate technology into their future classrooms and to what extent does this match best practices as articulated in the literature and professional standards?

Teacher preparation programs at IHEs are challenged to meet several sets of standards in order to license their preservice teachers. In order to provide preservice teachers with licensure upon graduation, most informants (1, 2, 4, 5, 6, 7, 8, and 9) reported they responded to the requirement by providing a single, stand-alone required technology course for at least one of the teacher preparation programs at their IHE. In addition, nearly all IHEs (1, 2, 3, 4, 5, 6, 8, 9, and 10) that require at least one technology course for preservice teachers reported that the *ISTE-NETS* standards are addressed in this course through various activities, experiences, and modeling best practices of effective technology use by instructors. However, only three informants (2, 4, and 5) reported the incorporation of *ISTE-NETS* standards outside of the required undergraduate technology course: (1) as part of regular discussions surrounding curriculum planning with administration, technology committees, and learning goals (IHE 2) and (2) in the summative portfolio for preservice teachers to graduate and receive licensure (IHE 4 and

5). One informant (IHE 4) explained: "They have one page dedicated to educational technology and they go to each of the standards and have to list the five *ISTE-NETS* standards for teachers. For each standard, they have to share an artifact that shows they have done something related to this."

As the IHEs in this study are transitioning to meet the new CAEP standards, several informants (2, 5, 7, 9, and 11) reported that programs at their IHE incorporate or are in the process of incorporating standards developed by Specialized Professional Associations (SPAs), while several informants (1, 5, 8, and 10), not all of the IHEs above, reported that their teacher preparation programs are moving away from a portfolio assessment and are focusing efforts on adopting the *edTPA* as a performance assessment for an exit requirement for preservice teachers. The most commonly reported SPAs included *National Science Teachers Association*, *National Council for English Teachers*, and *National Association of Math Teachers*. One informant (IHE 5) explained: "Our state re-wrote its standards a few years ago and modeled them after *Interstate Teacher Assessment and Support Consortium (InTASC)*, so our faculty have focused on their professional association, more than worried about our state standards."

In the study, I found that new challenges have arisen from the transition between *NCATE* and *CAEP*. In addition, nearly all educational technology implementation challenges reported over the past three decades (e.g., Betrus, 2012; Cuban, 1986; Ertmer, 2005; Hew & Brush, 2007) still largely persist in IHEs as stakeholders attempt to implement best practices of technology integration. In the next section I present information about these and describe some of the steps taken by top rated IHEs to meet

the needs of all stakeholders in current teacher preparation programs. These are discussed as they relate to the best practices and recommendations described in the literature.

**New Challenges Responding to a Period of Transition**

With the merge of the *National Council for Accreditation of Teacher Education (NCATE)* and the *Teacher Education Accreditation Council (TEAC)* into the *Council for the Accreditation of Educator Preparation (CAEP)*, there are notable differences between the old *NCATE* standards and the new *CAEP* standards including re-envisioned dispositions for teacher educators and preservice teachers, integration of diversity, partnerships and involvement with field placement schools, and an increased focus on documentation of evidence on preparation (Tomei, 2014). Due to this, many informants (1, 2, 3, 4, 6, 8, and 10) reported that although they are aware of the best practices of the use of technology set forth in the new standards, there are two that are challenging for them to meet: (a) infusing technology standards throughout the curriculum and (b) planning for preservice teachers' field work experiences with technology. Each of these is discussed below in the following sections.

**Infusing technology standards throughout the curriculum.** Many informants reported a lack of consistent use of educational technology in generic undergraduate courses (those that are not identified as 'technology focused' for preservice teachers) and the absence of a technology plan at their IHE. Infusing technology throughout was a challenge for many of the IHEs (1, 2, 3, 4, 5, 7, 8, 9, 10, and 11). While there is a need to meet *CAEP*'s cross-cutting theme of technology and diversity beginning in 2016, only

one informant (IHE 8) reported the presence of specific planning efforts toward meeting this standard designed to ensure teacher educators are applying technology standards and are modeling new technologies throughout preservice teachers' coursework. This informant (IHE 8) pointed out the positive impact of having to address the standard: "It's been really helpful to get our faculty on board with our core courses and technology plan because we have to have it."

**Planning for preservice teachers' fieldwork experiences with technology.** When planning for preservice teachers' field work experiences with technology, nearly all informants (1, 2, 3, 4, 5, 7, 9, 10, and 11) reported that current field placements schools for their preservice teachers continue to be a challenge, leading to concerns surrounding different levels of experiences with technology. These challenges include: (a) the level of technology resources in field placement schools varies, (b) the level of inservice teachers' technology use and skills varies, and (c) placement of required undergraduate technology course is not taken concurrently with methods course during field placements.

Although technology availability has increased (Bausell & Klemick, 2007), nearly all informants (1, 3, 4, 5, 7, 9, 10, and 11) reported varying levels of access and technology support at field placement schools for preservice teachers. Some preservice teachers were placed at schools with one-on-one computing initiatives with laptops or mobile devices; others, from the same IHEs, were with inservice teachers that only have one computer available and it is on the teacher's desk. One informant (IHE 1) explained:

There are some schools where not everyone has a Smart Board, some don't have

> great technical support. Others have oodles of technology. We have some [schools] that have a lot, and some that schools don't emphasize it and don't have any interest and they don't do it [technology], which is acceptable in some schools.

The most commonly reported technology at field placement schools were Smart Boards, followed by Chromebooks and iPads. Limited funding for technology in field placement schools was reported to not only restrict preservice teachers' opportunities to observe technology use, but also as preventing them to use and practice with technology. Several informants (2, 4, 5, 7, and 11) reported frustration due to high levels of difficulty preparing their preservice teachers for classroom technology use when they are not observing regular technology use during experiences in field placements.

Several informants (2, 4, 5, and 11) also reported concerns that some inservice teachers do not regularly use technology and others use technology with varying levels of comfort. They reported this as concerning as those teachers were supposed to be the models for preservice teachers. One informant (IHE 2) explained: "[Some] Teachers are more comfortable with technology and/or willing to take risks and others are not." In particular, although they are widely available now in K–12 schools, several informants (1, 3, 6, 7, 9, and 11) expressed specific concern about the current uses of interactive whiteboards as "expensive chalkboards" and not being used to support student-centered practices to engage learners in the classroom.

Despite the recommendations in the literature that technology classes be taken at the same time that methods courses are taken, among IHEs that reported that they require a technology course for preservice teachers, there were vast differences in when those

schools require preservice teachers to enroll in these courses. Just over half of the IHEs (2, 3, 5, 6, 8, and 9), require the technology course prior to junior year, whereas several other IHEs (1, 4, and 7), require preservice teachers enroll in the course in their junior and senior year, before taking methods coursework. The placement of the required undergraduate technology course is a continued area of challenge for many teacher preparation programs, as one informant in an educational technology department indicated: "The challenge with the educational technology courses [across teacher preparation programs] is that schools [IHEs] offer [the course or courses] at different times." When placed too early in a preservice teachers' curriculum, they will not have gained knowledge in the areas of planning and pedagogy. Another informant (IHE 10) explained:

> There are definitely differences depending on when the course is offered. If it is offered early on, they [preservice teachers] do not have experiences with planning, going out in the schools…a lot of the stuff they think about are based on their own experiences as learners in K–12, and not thinking with the teacher mindset.

With a majority of informants (1, 2, 3, 4, 5, 6, 7, 8, and 9) reporting that the required undergraduate technology course at their IHE does not require concurrent fieldwork or to be taken concurrent with fieldwork courses, instructors are challenged to create authentic experiences for preservice teachers to link theory to practice with educational technology.

**Continued Challenges Faced by IHEs During Implementation of Best Practices**

Schools reported three areas of continued challenges facing their teacher preparation programs: (1) staying current with educational technology, (2) responding to a wide range of technology dispositions, and (3) institutional constraints.

**Staying current with educational technology.** Despite acknowledging efforts to address significant challenges, many informants reported the difficulty in implementing change, specifically as it related to (a) keeping current with the ever-changing technology and practices in the K–12 schools and (b) updating content within the required undergraduate technology courses for preservice teachers. For example, IHE 7, 9, and 11 reported the challenge of staying up-to-date with the technology trends and providing the most current digital tools for preservice teachers at their IHEs. One informant (IHE 11) explained: "We simply can't keep up with the technology that's going on in the K–12 arena...that's one of the reasons we want them [preservice teachers] to share what they are doing out there." Regarding updating the course, even more informants (1, 2, 3, 5, 8, 9, and 10) described the need to change from how to use the equipment and stand-alone applications in the required undergraduate technology course to helping preservice teachers focus on the process and skills needed for effective technology implementation. Well-stated by one informant (IHE 10):

> As new technologies come out, you can't just be doing the same old stuff…so we keep the format of the course the same, but the nature of the tools is definitely changing…if not every semester, definitely every other semester, there's something new to be added.

Outdated topics and tools had to be removed from these courses, such as 'how to' uses of computer software and devices like overhead projectors. One informant (IHE 5) explained: "I see us moving towards web based uses, applications, mobile devices and tablets, as opposed to stand alone applications."

**Responding to a wide range of technology dispositions.** With varying levels of technology knowledge, skills, and attitudes among their teacher educators, most schools (1, 2, 3, 4, 5, 7, 8, 9, 10, and 11) reported a lack of consistent use of technology in generic courses. As one informant (IHE 5) explained, "It just depends on the level, the instructor, whether or not they bought into this, or they see a need, so it's kind of all over the place." In addition, these same IHEs reported that with inservice and preservice teachers' attitudes and beliefs toward educational technology, there is a wide range of needs present in many teacher preparation programs at the IHEs who participated in this study. Some teachers do not regularly use technology and others use technology with varying levels of comfort because they are often less experienced with the tools than are preservice teachers. One informant (IHE 9) commented, "Faculty members here are like deer in the headlights and don't know quite what to do with it. They have not kept their technology and instructional skills paced with how quickly the schools have moved."

Finally, they reported that preservice teachers have a varying level of technology interest, knowledge and skills and they expressed some difficulty in addressing these in the required undergraduate technology course. Several informants (3, 5, 6, and 7) who were instructors of this course indicated frustrations from the challenges of meeting the wide array of subject and grade level interests of preservice teachers in the same course.

One informant (IHE 5) gave an example of this challenge when describing what happened when covering certain digital tools during class. The informant pointed out that it is easier to create examples of use for certain content areas.

> Our data analysis week worked out for science and math students with burner probes and experiment stations. I try and persuade them and say, 'Here's how you could do this with your students. It's innovative, project-based and student based.' For the social studies folk, it's really easy. Inspiration has some templates. I struggle with the English language arts and foreign language students. With the tool, Wordle, they can throw in a bunch of text and analyze it for character analysis. There are different ways you can do that, but it's not as cut and dry and useful as different subject areas; it is hard. But, that is one of the things that is critical: to come up each week with examples.

Several informants (2, 3, 4, 7, and 11) reported that preservice teachers often have high technology skill levels, considering they grew up surrounded by technology as digital natives. One informant (IHE 4) explained: "We find that preservice teachers going into the field placement schools often have more experience with technology than the inservice teachers." However, other informants (1, 2, and 3) reported low-levels of experience and knowledge surrounding technology skills even in these so-called 'digital native' students. "Our preservice teachers don't know how to even approach the technologies that are out there in the field experiences" (IHE 9). Another informant (IHE 3) explained: "My students are not very tech savvy, some don't know about PowerPoint. They are supposed to be this generation of students with technology skills." Despite this

gap in reported experiences and knowledge, several informants (1, 2, 3, 4, and 7) expressed that preservice teachers possess high-levels of technology skills for social uses. Although they are high-functioning users of technology in their personal lives, preservice teachers need help understanding the pedagogical uses of technology in the classroom to best support all learners, as well as the curriculum frameworks. One informant (IHE 3) explained: "Students are well aware of the technologies but it appears that they are attune to how those technologies function for their lives, and not with the mindset of teaching an elementary learner."

**Institutional constraints.** Informants emphasized two specific institutional constraints preventing effective technology integration with preservice teachers. Teacher educators' lack of time (3, 6, 7, 8, and 11) prevented consistent participation in professional development to update their technology skills and stay current with practices. Several IHEs (3, 5, 6, 7, 9, 11) reported that access to current technology in their school or college of education has been a recent challenge. However, not long ago, some IHEs (5, 6, 7, and 9) addressed this challenge by upgrading their technology, while others continue to utilize outdated tools (3 and 11). "Our technology here is about fifteen years behind the times. We've never been good at keeping pace, but we really need to," as one informant (IHE 11) explained. The most commonly reported technology at IHEs were Smart Boards, followed by projectors, desktops computers, digital cameras, and iPads. Although none of the IHEs reported that they prepare preservice teachers to deliver K–12 online courses, several informants (4, 5, 6, 8, and 10) indicated that with an increased emphasis on distance learning came the availability of production spaces within

their school or college of education for faculty to create audio, video, screen recordings for online and blended instruction, as well as technology-enhanced classroom activities.

**Solutions Utilized to Meet the Challenges**

Although none of the IHEs reported that their teacher preparation program has the perfect solution, they reported implementation of multiple strategies to address challenges related to technology integration and effective preparation of preservice teachers to use technology in their future teaching situations, shown in Table 4. In order to teach preservice teachers how to effectively use technology, many informants reported the utilization of several methods for delivery and instruction both within teacher preparation program courses and field placement schools. These methods, many reported as best practices in the research literature, were incorporated by most of the teacher preparation programs at IHEs in order to prepare preservice teachers with educational technology skills and experiences.

**Responding to a period of transition.** In order to respond to a period of transition, informants reported the implementation of the following strategies at their IHEs: (a) development of technology committees charged by leadership, (b) provision of professional development for inservice teachers, (c) utilization of IHE-owned devices and discussion of leveraging limited resources, and (d) development of preservice teachers' technology skills in field placements. First, within the IHEs, the use of a technology committee (2, 3, 5, 6, 7, 8, and 9), charged by administrative leadership, was reported to address and encourage technology integration and modeling in all undergraduate courses for preservice teachers, as well as developing improvement plans in the technology

infrastructure and upcoming distance education courses, supporting teacher educators' requests for technology purchases, identifying hardware needs, and planning professional development opportunities for faculty members. One informant (IHE 2) explained:

> They are charged with looking for cross-curricular opportunities, and they are rolling out a technology initiative for the first year courses. Each program sends a representative with a back up and the member reports back to each program. Their goal is to identify and act to advance strategic opportunities and technology integration is its first major initiative.

Members of these committees were commonly reported as technology coordinators, educational technology faculty members, other instructional technology staff, and administrators. Several informants (1, 2, 4, 8, and 9) explained that their dean has been a critical informant in planning and implementing technology in preservice teachers' coursework by embracing various technology initiatives, staying current with technology needs of faculty and students, and communicating to faculty members that technology is a priority for the school or college of education.

Table 4

*Strategies Used by IHEs to Address Challenges Related to Technology Integration and Effective Preparation of Preservice Teachers*

| Challenge | Solutions | Steps to the Solution |
|---|---|---|
| Responding to a Period of Transition | a. Technology committees charged by leadership | i. Technology committees<br>ii. Content tools in some generic courses<br>iii. Quality examples in required undergraduate technology courses |
| | b. Developing inservice teachers' technology knowledge and skills | i. Workshops and consultations |
| | c. Preservice teachers bring own devices to the field and discuss leveraging limited resources in technology courses | i. Bring tools to the field<br>ii. Leverage small amount of technology |
| | d. Practicing technology in field placements | i. Observation protocol |
| Staying Current with Educational Technology | a. Purchasing updated technology | i. New support roles<br>ii. New technologies |
| | b. Required undergraduate technology course | i. Teaching theory behind educational technology<br>ii. Moving towards teaching the process<br>iii. Current topics<br>iv. Staying current in the profession |
| Responding to a Wide Range of Technology Dispositions | a. Developing teacher educators' technology knowledge and skills | i. Formal staff development opportunities<br>ii. Peer sharing |
| | b. Developing preservice teachers' technology knowledge and skills | i. Sandboxes<br>ii. Workshops<br>iii. Technology enhanced lesson plans |
| | c. Content area required undergraduate technology courses | i. Multiple sections of the required undergraduate technology course for different content areas |
| | d. Opportunities for reflection | i. Integration of reflection time in required undergraduate technology courses |
| Institutional Constraints | a. Time | i. Consulting model<br>ii. Winter and summer<br>iii. Recorded workshops<br>iv. Incentives<br>v. Go-to People |
| | b. Access | i. Grants |

Along with modeling technology reported as being in all required undergraduate technology courses (1, 2, 3, 4, 5, 6, 7, 8, 9, and 10), many informants (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11) also reported some degree of integration of technology in generic courses as a best practice to prepare preservice teachers to use technology in their future teaching situations. These informants indicated higher levels of modeling and use of technology mainly in methodology courses with some content-specific digital tools at their IHEs. These subject areas included math, science, and special education. As one informant (IHE 6) explained: "It's a different world out there with all the things you can do on the Internet and we feel that it's important to see all that stuff in action, and not just in the technology classes." Quality examples of using educational technology during instruction were also modeled in required undergraduate technology courses. Many instructors of this course (1, 2, 3, 4, 5, 6, 7, 8, and 10) described the incorporation of social networking tools as an avenue for preservice teachers to interact and communicate with each other throughout the semester, modeled after what collaboration with colleagues and the process of building a personal learning network might look like when they enter the profession. One informant (IHE 1) explained: "We model the distance and the collaboration and networking that you would hopefully see in a classroom; engaging teaching and learning practices are very important and what I try to work with my students."

In order to promote effective technology implementation in field placements, several informants (1, 3, 4, 5, 6, and 9) reported that their IHE provided technology professional development experiences with technology implementation for inservice

teachers through the use of outreach opportunities, workshops, and one-on-one consultations. This time was spent on improving inservice teachers' technology skills and brainstorming ideas for technology implementation and modeling in the field placement classroom with preservice teachers. An informant (IHE 6) described this interaction between inservice teachers and the IHE's media specialist to explore new digital tools: "I will have several [inservice teachers] come in and I show them what technology we have and share some lesson plan ideas."

Due to varying access levels of technology resources in field placement schools, two commonly reported strategies were having preservice teachers bring tools or devices from their IHE to field placement schools to practice using the technology (3, 4, 9, and 10) and asking them to contemplate how to leverage a small amount of technology in his or her classroom (1, 3, and 9) by considering the context the culture of the school (3, 5, and 7). One informant (IHE 3) described this process in the classroom as getting undergraduate preservice teachers to begin "thinking like innovative teachers. Even with small amount of technology, they [teachers] can do a lot with it." Another informant (IHE 3) explained:

> We talk about what you could do in a one computer or one iPad classroom versus having students do everything…preparing them for that perfect world versus the world they [preservice teachers] might go into… How do I maximize the time when I do have the laptop cart or the computer lab?

Finally, in order to promote effective technology use and practice by preservice teachers in field placements, several educational technology faculty (3, 4, 5, 6, and 10) reported

the changes to their IHE's supervising protocol of preservice teachers. One (IHE 6) explained: "Each department has been recently asked to come up with technology requirements for student teaching…we are all responsible to developing the requirements that they want our students to come out with." Focus was moved to observing the learner, the context, the implementation of technology, and whether or not it was an effective use of technology.

**Staying current with educational technology.** There were two areas emphasized in order to stay current with educational technology. First, moving from away from solely technical support, new support roles of technology coordinators and a change in office structure (1, 2, 4, 6, and 7) provided support for teacher educators to merge pedagogical practices with appropriate technology. One informant (IHE 2) explained: "This position has evolved over time. I started as technology support and now I'm a technology integrationist position, with some technology support, too, working alongside of faculty and students with technology integration, instead of just [dealing with] technology problems." Similarly, other informants described a shift to focus more on supporting faculty with pedagogy within their teaching, actively pursuing engagement in technology work with students, assisting with technology implementation during instruction, and holding active roles on technology planning and technology committees at their IHEs: "I work with faculty; my whole team does across the college to make sure those things get integrated well into their classroom" (IHE 8). Additionally, IHEs (1, 2, 5, 6, 7, and 8) have also purchased current technology and digital tools for areas such as libraries and media centers for teacher educators and preservice teachers to remain

current with K–12 technology. One informant (IHE 7), who serves as the department chair of Curriculum and Instruction, explained:

> I've tried to look at the technology that is out at the schools that our students [preservice teachers] would have access to and try and bring those technologies here so that they can get that experience before they get out in those schools.

Another area of emphasis was updating the content in required undergraduate technology courses to highlight the ever-changing nature of technology. First, many informants (1, 2, 3, 4, 5, 6, 8, 9, and 10) reported the incorporation of theoretical models surrounding technology integration as a way to shift the course focus from 'how to' use the equipment and stand-alone applications to helping preservice teachers focus on the process and skills needed for effective technology implementation and decision making around what tool to use (1, 3, 5, 8, and 9). The most commonly reported (1, 2, 3, 4, 5, 6, 8, and 10) framework for helping undergraduate preservice teachers think about practice was *Technological Pedagogical Content Knowledge (TPACK)* (Koehler & Mishra, 2009). One informant (IHE 1) explained: "It starts with an understanding of why technology should be infused in teaching and learning." Other informants reported the use of *TPACK* in order to help them understand the choices of using technology when considering the context, the learners, and reasons behind using technology when maximizing the use of technology for all learners. One (IHE 2) explained this process as "not starting with the tool, but starting with the curriculum and learning activities; help them connect the technology to what they are teaching and how they are teaching it." Requested by K–12 principals in a national survey (Project Tomorrow, 2013), another

avenue used by nearly all informants (1, 2, 3, 4, 5, 6, 7, 8, and 10) to update the content was including the topics of social networking tools and student-owned mobile devices with modeling and incorporation in lessons and activities.

Moreover, these informants (1, 3, 4, 5, 6, 7, 8, 9, and 10) further identified "staying current with technology" as one of the most important technology topics preservice teachers need before entering the profession. As an activity in their course, several informants (1, 3, 4, 5, 7, and 9) reported exposing preservice teachers to professional development resources to help them stay current in the future. One informant (IHE 3) explained:

> We try to help them [preservice teachers] learn how to be their own professional development advocate and personalize their learning. 'How are you going to keep up with technology?' I try and expose them to the professional associations, social networks, places with free professional development, technology conferences, and what blogs to follow. This is more important than any one thing that we teach them [preservice teachers].

Another informant (IHE 4) emphasized the importance of beginning a career-long process of reflection and development: "As future professionals, students will begin a systematic process of developing their ability to effective integrate technology across the curriculum." This process included keeping informed of trends and standards affecting technology integration, reviewing new resources and technologies, and developing a library of curricular materials and refining skills in evaluating their effectiveness.

**Responding to a wide range of technology dispositions.** Efforts were made by IHEs to keep teacher educators' technology knowledge and skills current through professional development opportunities, such as regularly scheduled workshops and consultants to work one-on-one with technology integration during classes. The most frequently reported topics of faculty professional development opportunities were: (a) training of technology to promote active engagement of learners, (b) training to become role models of technology use, (c) iPads, (d) flipped teaching and learning, (e) interactive whiteboards, (f) Google applications, and (g) online assessments. Other informal professional development strategies included regularly scheduled time for teacher educators to share how they are using technology in their teaching with their colleagues during technology meet-up sessions (2, 9, and 10), faculty or department meetings (2, 6, and 8), or through the use of a blog, website, or newsletter (1, 3, 4, 5, 10, and 11). Efforts to develop technology skills and attitudes of preservice teachers were made at many IHEs, including access to technology sandboxes (1, 2, 3, 5, 6, and 8) to play with, create, collaborate, and investigate teaching and learning with emerging technologies, as well as technology workshops to offer additional practice time with digital tools (1, 5, 6, 7, 8, 9, and 10). Workshops took place outside of class and focused on building technology skills with the following tools: (a) interactive whiteboards, (b) manipulatives, (c) data probes, (d) iPads, (e) digital microscopes, (f) 3D printers, and (g) other content specific tools.

Planning efforts in the required undergraduate technology course at some IHEs (2, 4, 8, and 9) led to offering different sections for preservice teachers to enroll with their

peers in the same content or subject area or organizing one course to address all majors**.** Some informants (2, 4, and 9) reported this change as due to the presence of content specific tools in different subjects and grade levels in K–12 classrooms. One informant explained:

> We decided a few years ago that some of the technologies that are used in elementary education are a little different from what you might use with secondary and some of the strategies are a bit different. For example, Smart Boards are pretty popular now in the elementary school. (IHE 9)

Informants reported strategies to improve preservice teachers' knowledge, skills, and attitudes toward technology. These include the requirement of developing a technology enhanced lesson plan or activity and (1, 2, 3, 4, 5, 6, 7, 8, 9, and 10) opportunities to think about, reflect, and discuss their beliefs and attitudes surrounding the role of technology in education with their peers (1, 2, 3, 4, 5, 6, 7, 8, 9, and 10). Through appropriate time and support, preservice teachers were asked to utilize developmentally appropriate, learner-focused pedagogical strategies in their lesson plans and demonstrate their ability to plan for curriculum-based technology integration by choosing a tool to review and present to peers. Moreover, at various stages throughout the course, informants asked preservice teachers to reflect on their attitudes and beliefs with their peers through the use of: collaborative writing tools, video reflections, e-portfolios, teacher websites, and blogs. In order to reduce anxieties surrounding technology use, these informants also reported the use of group work to offer feedback, develop problem-solving skills, and, as an informant (IHE 2) stated, "take risks and seek out information, while being unafraid of having

something go wrong [with technology]." This allows for preservice teachers to "take the pressure off themselves [preservice teachers] as all-knowing, in relation to technology. They don't have to be an expert so their students can use it," as one informant (IHE 1) explained.

**Institutional constraints.** Due to time constraints of teacher educators, IHEs reported that they have implemented several strategies in order to meet the needs of developing their technology skills. Due to a high level of difficulty when recruiting teacher educators to attend workshops, some IHEs (6 and 8) abandoned this option and moved to a consulting model to best support individuals. For example, one (IHE 6) informant explained:

> We tried workshops and it has failed every time. Few people show up and people are busy. They don't have the time to learn or don't care to learn new technologies. We're at the point that we resist even doing that…it's a waste of time.

Additionally, some offered workshops in the summer and winter when teacher educators are not teaching (1, 9, and 10), some (1, 3, and 9) offered incentives such as iPads or a stipend to increase participation and enthusiasm, and others (7 and 11) have recorded workshops to view at a later time with streaming media, podcasts, and webcasts relevant to teaching and learning with technology. With a need for quick technology information, some informants also reported that teacher educators at their IHE seek out knowledgeable colleagues for 'quick tips' or help with their technology skills (1, 3, 4, and 6). Most commonly described as the "go to" people in their school or college of education, teacher

educators in the educational technology department receive many requests from their colleagues when they have questions about using educational technology.

In an effort to overcome limited or outdated resources, teacher educators were also reportedly supported by their IHE (1, 3, 5, 8, and 10) through campus-wide technology grants to receive new technology for their teaching. Some opportunities were organized as formal events for teacher educators to not only create the technology proposals, but also develop a collegial network for technology integration at their IHE. One informant (IHE 5) explained:

> We will offer money to the faculty for technology needs and they turn in proposals. Then, in May, we have a week of an event that the faculty gets together who are awarded and talk to each other about their project and goals and what kinds of resources they might use. This is really productive because our faculty often doesn't get very far outside their departments and it's really stimulating when they have a broader community. In the end with their final projects, they present to the whole faculty and they are awarded with the money to buy the technology equipment that they need.

# CHAPTER 5

# DISCUSSION

The purpose of this study was to explore how the top rated *NCATE* approved undergraduate teacher preparation programs are teaching preservice teachers to use educational technology. There are mixed opinions on what technology topics should be included (Angeli & Valanides, 2009; Goktas, Yildirim & Yildirim, 2008; Hew & Brush, 2007; Kay, 2006; Lawless & Pellegrino, 2007; Ottenbreit-Leftwich et al., 2012) in such programs and "the jury is still out on which strategies [to teach those topics] work best" (Kay, 2006, p. 395). Moreover, as current *NCATE*-accredited programs are facing a deadline to meet revised standards in spring 2016 (CAEP, 2013), IHEs are challenged. They are faced with "increased splintering of roles, contingency of status, workload demand, and what faculty and institutions are doing to creatively and thoughtfully respond in the face of change and conflict" (Association of American Colleges and Universities, 2008, para. 2).

The findings of this study contribute to the existing body of the literature shows that IHEs continue to utilize primarily a single standalone technology course in undergraduate teacher preparation programs to (a) meet licensure requirements for preservice teachers and (b) address ISTE-NETS standards. As previous researchers have found, although recommended best practices are incorporated into the technology courses, teacher preparation programs are also preparing preservice teachers outside of this course, by using workshops and modeling in other generic courses (Kay, 2006; Tondeur et al., 2012). With efforts to include best practices surrounding technology

integration at both micro and macro levels in the programs, this study found that IHEs still face historical challenges surrounding teacher preparation, such as a varying range of technology dispositions among teacher educators (Gronseth et al., 2010), inservice teachers (Hutchinson & Reinking, 2011), and preservice teachers (Cheon, Song, Jones, & Nam, 2010), as well as various institutional constraints (Cuban, 1986; Goktas et al., 2009) present in the research literature.

In addition to confirming prior work, this study added three new findings to the technology adoption literature. First, only one of the 11 IHEs require students to take the technology course concurrently with methods coursework, a recommended best practice in the research literature (Karchmer-Klein, 2007; Polly et al., 2010). Second, despite reports that preservice teachers leave teacher preparation programs with expired technology skills (Zhao, 2007), instructors of technology courses in this study reported otherwise, citing the use of current K–12 technology topics and emerging tools such as social networking resources and student-owned mobile devices. Finally, this study sheds light on the now prevalent use of technology sandboxes in schools of education as an avenue to develop preservice teachers' skills and attitudes toward technology outside of the required courses by playing, creating, collaborating, and investigating with emerging digital tools in a social learning space.

## Findings

### What Do These IHEs Provide Undergraduate Preservice Teachers To Prepare Them To Integrate Technology Into Their Future Classrooms?

My findings indicate that IHEs in this study continue to utilize primarily a single

standalone technology course in undergraduate teacher preparation programs to prepare preservice teachers to use current and up-to-date digital tools and technology in the K–12 field. However, they also incorporate several other recommended best practices outside of this course. The typical approach and its variations are discussed below.

**Single technology course.** IHEs have designed the single standalone technology course to accomplish three goals: (1) to meet licensing requirements, (2) address *ISTE-NETS* standards, and (3) incorporate several recommended best practices from the research literature. These practices include (a) modeling of quality examples of technology usage, (b) reflecting on attitudes and beliefs surrounding technology integration, (c) working collaboratively with peers, (d) developing a technology-enhanced lesson plan, (e) teaching the theory behind educational technology, (f) teaching the process of technology integration, (g) providing up-to-date technology topics, and (h) emphasizing the need to stay current with technology in the profession.

The modeling of technology usage was reported in all of the required undergraduate technology courses at all IHEs in this study, a critical element that continue to be recommended by researchers (Gronseth et al., 2010; Kay, 2006; Kleiner, Thomas, & Lewis, 2007). Modeling included the introduction of quality technology examples, such as, case studies video examples of teaching, activities, projects, and technology-enhanced lesson plan examples, a course structure similar to previous findings (Ottenbreit-Leftwich, Glazewski, & Newby, 2010). Activities surrounding reflection were implemented at 10 out of 11 IHEs. Preservice teachers were asked to consider the integration of educational technology in teaching and learning situations

through collaborative activities with their peers. This recommendation is consistent with those reported, in the research literature (Anderson & Maninger, 2007; Ertmer & Ottenbreit-Leftwich, 2010; Lim & Chan, 2007; Smarkola, 2008; Teo, 2009; Tondeur et al., 2012). By asking students to develop a lesson plan with appropriate considerations of the learner and context, preservice teachers at 10 out of 11 IHEs were creating and doing, rather than observing, as recommended by Tearle & Golder (2008). In this study, nine out of 11 IHEs reported they taught the theory behind educational technology such as *TPACK* (Koehler & Mishra, 2009), designed to help preservice teachers construct logic surrounding the use of educational technology (Lambert & Gong, 2010) and understand the important relationships among pedagogy, content knowledge, and technology, as identified in the research literature (Koehler & Mishra, 2009). With an acknowledged need to focus on the process of technology integration and not technology skills alone (Adamy & Boulmetis, 2006), seven out of 11 IHEs in this study reported they were pushing preservice teachers to use and create with what they learn.

When informants were asked what they believed was the most important topic preservice teachers should learn before entering the profession, most emphasized the need to stay current with emerging digital tools and technologies. Informants from nine of 11 IHEs reported that their required undergraduate technology course emphasized the need to stay current. One informant described this effort as "laying the groundwork of a career-long process of reflection and development." Informants identified efforts made to stay current by providing updated technology in the school or college of education's library, media center, or technology sandbox.

**Other best practices.** In addition to the required undergraduate technology course, this study found that many IHEs used a combination of recommended best practices in the research literature to prepare preservice teachers to teach with technology including technology modeling in generic courses, technology workshops, and technology sandboxes. This is significant because it illustrates a paradigm shift in which top IHEs have emphasized the importance to integrate best practices beyond the required undergraduate technology course in order to aid preservice teachers in building their technology attitudes and skills. Technology sandboxes reported at uses at several IHEs allowed students access to current digital tools and technologies current utilized in the K–12 schools, in a space that encouraged practice, creation, collaboration, and exploration with their peers. This was reported as encouraging students to fully utilize technology as outlined in literature (Kay, 2006; Tondeur et al., 2012). Although technology sandboxes have been used in teacher preparation programs (Gregory & Masters, 2012; Wilks & Jacka, 2013), researchers have not included its use as a recommended best strategy or practice in these programs. Preservice teachers can experience emerging technologies and gain confidence in their use in teaching and learning, as researchers recommend (Wilks & Jacka, 2013), by "exploring and learning new technologies, and supporting learning in ways that resonate with digital students" (Frydenberg, 2013, p. 50). Researchers have recommended further research in this area of collaborative learning spaces in IHEs (Syvänen, Frydenberg, Poutanen, Turunen, & Walton, 2014).

## Implementation Challenges

Many IHEs faced challenges when attempting to implement best practices,

including (a) staying current with educational technology, (b) responding to a wide range of technology dispositions among teacher educators and preservice teachers and (c) time constraints. These challenges are consistent with those found in the research literature, in that, technology continues to be ever changing (Sims, 2014), forcing teacher educators to try to keep up, a daunting task for those with low levels of interests, beliefs, and skills surrounding technology integration. Similarly, many IHE respondents in this study reported that preservice teachers also have varying levels of interests, beliefs, and skills about educational technology, presenting a barrier to effective integration as seen in prior studies (Butler & Selborn, 2002; Ertmer, Ottenbreit-Leftwich, & York, 2010; Georgina, 2007). Previous research has found that although preservice teachers are 'digital natives' (Gao, Wong, Choy, & Wu, 2010), their abilities to use technology are often over-estimated (Bennett, Maton, & Kervin, 2008; Taylor & Newton, 2011).

New challenges found in this study surrounded the necessity to adhere to new *CAEP* standards during this time of transition. The challenges can be described as falling into three areas: (a) the varying level of technology resources in field placement schools, (b) the varying level of inservice teachers' technology use and skills, and (c) the required undergraduate technology course is not taken concurrently with the methods course during field placements. These reported challenges, related to *CAEP* standards 1 and 2 (Appendix A), surround infusing technology standards throughout preservice teachers' curriculum and planning for preservice teachers' K–12 fieldwork experiences with technology. With an absence of a reported technology plan at most of the IHEs in this study, many informants indicated a lack of consistent technology use in generic courses

for undergraduate preservice teachers. Moreover, nearly all informants reported challenges they faced when planning for preservice teachers' K–12 fieldwork experiences with technology, which led to different levels of experiences with technology for the teacher candidates. Preservice teachers at these top IHEs are placed at field placement schools with varying levels of technology access, restricting their opportunities to observe and practice technology integration. Some informants reported that some inservice teachers at these schools do not regularly use technology, while others use it with varying levels of comfort. Finally, a majority of informants reported that their IHE does not require the undergraduate technology course to be taken concurrent with fieldwork experiences, thereby not facilitating consistent, authentic technology experiences for preservice teachers.

As new national standards demand (CAEP, 2013), modeling of technology across the curriculum (Donohue, 2014; Kay, 2006; Niess, 2008; Tondeur et al., 2012) has been recommend as a key strategy for technology preparation (Kay, 2006; Tondeur et al., 2012). In order to facilitate modeling, researchers recommended the development of a technology plan to encourage a shared vision and supportive culture for effective technology use (Donnelly, 2010; Hofer, 2005; Sergiovanni, 2009; Tondeur et al., 2012). However, researchers (Butler & Selborn, 2002; Cuban, 2001; Hew & Brush, 2007; Project Tomorrow, 2013) indicate that field placement schools continue to be a challenging component when planning for preservice teachers' fieldwork experiences with technology due to varying access levels and (Mouza & Karchmer-Klein, 2015; Tondeur et al., 2012) and inservice teachers' varying technology skill levels in field

placement schools (Becker, 2001; Cuban, 2001; Cuban, Kirkpatrick, & Peck, 2001; Project Tomorrow, 2013). Therefore, *CAEP* (2013) has implemented Standard 2 (Appendix A) so that these accredited IHEs place emphasis on technology-enhanced learning opportunities in clinical experiences for preservice teachers.

Finally, although researchers recommended that the required undergraduate technology course should be offered in conjunction with the methods courses and field experiences (Brush et al., 2003; Karchmer-Klein, 2007, Polly et al., 2010), only one IHE (10) in this study reported that preservice teachers are required to take this course concurrent with methods course.

**Implementation Solutions**

In order to teach preservice teachers effective technology implementation, many informants reported the utilization of several methods for delivery and instruction. Planning for the implementation of these methods occurred both within the teacher preparation programs' courses and in the K–12 field placement schools to overcome the aforementioned challenges both (a) within the IHE and (b) between the IHE and K–12 field placement schools, as discussed below.

Planning within the IHE. Informants at many IHEs in this study reported the use of technology committees, charged by the deans, as an avenue to encourage teacher educators' technology modeling in all undergraduate preservice teachers' coursework. With a reported need to update teacher educators' technology skills, several informants explained a shift in instructional support to aid teacher educators in linking pedagogy with technology, consistent with recommendations from literature (Betrus, 2012;

Georgina & Olson, 2008; Koehler & Mishra, 2009). Efforts were in place in most of the IHEs in this study to address the varying levels of teacher educators' technology dispositions (Rogers, 2000; Tondeur et al., 2012) through the use of 'peer sharing' in collaborative environments, regularly scheduled workshops (Davies & West, 2014), and consultants working one-on-one with technology integration during implementation. In order to respond to teacher educators' time constraints and varying levels of access to technology, IHEs in this study provided: workshops in the summer and winter, recorded workshops to view at a later time, incentives to increase participation and enthusiasm, consultants to work with them on an as-needed basis when trying new tools and techniques, and go-to people with educational technology questions or concerns. Also, to address their varying levels of technology resources, IHEs encouraged teacher educators to take advantage of institution-wide technology grants to support their teaching.

As reported by many informants in this study, IHEs have acknowledged and responded to preservice teachers' wide range of technology dispositions. To address "common differing levels of expertise and conceptual levels" (Lambert, Gong, & Cuper, 2008, p. 406) in a single technology course, some informants reported a change in planning efforts by offering different sections or subject areas. This finding is consistent with recommendations in the research literature that teacher preparation programs divide the course into sections in order "to eliminate the need to accommodate all types of learners in one course" (Lambert, Gong, & Cuper, 2008, p. 406).

Researchers recommend teacher educators be supported as they work to increase their integration of technology into their own teaching (Goktas et al., 2009; Hew &

Brush, 2007; Hofer, 2005). Consultants can support teacher educators by working one-on-one with them (Hinson, LaPrairie, & Heroman, 2006; Mouza & Wong, 2009; Wells, 2007). The use of sharing experiences towards technology integration among teacher educators has been reported to improve professional development outcomes (Davies & West, 2014) and result in sustained practices with technology (Cifuentes, Maxwell, & Bulu, 2011). Moreover, the use of 'go to' people has been recommended as a more sustainable form of support for teacher educators, as contrasted with scheduled workshops (Burnett & Meadmore, 2002) by serving as a key element for integrating technology across the curriculum and creating a community of users among teacher educators (Hsu & Sharma, 2010). Additionally, moving toward meeting the new *CAEP* standards, Childress (2014) recommended that these 'go to' people should serve as mentors "to help guide the understanding of technology integration" (p. 104). As an avenue to increase access and strengthen teacher support, the research literature has recommended that IHEs encourage teacher educators to take advantage of institution-wide technology grants for their own teaching (Bates & Sangra, 2011; Wachira & Keengwe, 2011).

**IHE and K–12 field placement**. Under the leadership of administration and technology committees, informants at some IHEs reported several solutions to the challenges faced in the K–12 field placements schools. First, teacher educators in the educational technology departments at IHEs promoted preservice teachers' effective technology implementation during field placements by changing the observation protocol in order for preservice teachers to learn effective technology integration. In addition, to

deal with inservice teachers' varying levels of technology knowledge and skills, informants at several IHEs reported the use of workshops and consultants to improve modeling and plan opportunities for effective technology implementation in the K–12 field placement schools. Finally, with varying levels of access in K–12 field placement schools in this study, informants at several IHEs reported the solutions of not only bringing technology from their IHE, but also discussing how an educator might leverage small amounts of technology in the required undergraduate technology courses. Because limited access to technology can deter teachers from using it altogether (Clark, 2006; Dawson, 2008; Hew & Brush, 2007), educational stakeholders must have adequate access to resources (NCATE, 2008; Wetzel, Buss, Foulger, & Lindsey, 2014).

Additional findings. Interestingly, only three IHEs (2, 8, and 10) in this study reported the incorporation of three additional best practices found in the research literature. First, only one IHE (2) reported the incorporation of *ISTE-NETS* standards during technology planning in their teacher preparation programs to raise awareness among teacher educators and create professional development opportunities to develop skills needed to meet these standards. One IHE (8) reported the development and implementation of a technology plan aligned with *CAEP's* cross-cutting theme of technology and diversity. This informant (IHE 8) pointed out the positive impact of having to address the standard: "It's been really helpful to get our faculty on board with our core courses and technology plan because we have to have it." One IHE (10) reported that preservice teachers are required to concurrently take the technology course with methods course. All of the remaining IHEs in this study reported that the required

undergraduate technology course was not connected to a methods course or required field placements or experiences.

## Limitations

Limitations are to be expected in all studies. The limitations of this study are present not only in the sample, but also the methodology for the study. First, because participants who elected to take part in this study may differ in some way to those who elected not to participate, selection bias may have occurred. This may have swayed data towards that of teacher educators within preparation programs who are more interested in technology use with preservice teachers. Further, participants may have felt obligated to respond in a way that they believe the researcher wanted them to respond. Another possible limitation is that in selecting a qualitative approach for this study, the researcher may have exhibited bias in the data analysis due to familiarity with the content and delivery strategies found in the research literature and standards. Moreover, the researcher collected data through interviews, surveys, and technology-related documents. It was outside of the scope of the project to confirm reports via classroom observation, which inherently limits the author's absolute confidence on classroom delivery of content. Finally, this study did not seek to address the effects of various techniques, but rather to evaluate the methods of technology integration.

## Future Research

Based on the findings from the top IHEs in this study, several recommendations have arisen for future research surrounding technology preparation for preservice teachers. First, similar with this study's findings, the single standalone technology course

continues to serve as the main instructional strategy (Kay, 2006) warranting continued research. This study illuminated a paradigm shift, showing the IHEs are integrating technology elsewhere such as in social learning spaces (Syvanen, Frydenberg, Poutanen, Turunen, & Walton, 2014), virtual practicum placements (Karchmer-Klein, 2007), and technology sandboxes. Future research should push this further into new methods of integration outside of the standalone course. Finally, informants at many IHEs in this study did not report the presence of a technology plan at their IHEs. Future efforts should be placed on the examination of how IHEs address both *CAEP*'s cross-cutting theme of technology and diversity and *ISTE-NETS* standards when planning for teacher educators' professional development experiences.

The findings illustrate not only the challenges, but also the importance of implementing best practices surrounding educational technology, as outlined in the new *CAEP* (2013) standards. The need to recognize the ever-changing nature of technology and implement best practices within all facets of teacher preparation programs, future research can build on these findings by looking at the role and uses of technology within these programs, specifically within generic courses for undergraduate preservice teachers, due to the reported limited amount of modeling in these courses. In addition, as technology continues to change (Polly, 2012), research involving K–12 best practices and technology topics should continue to be conducted so that IHEs can stay-up-date on modeling appropriate skills that preservice teachers need for the profession, as also suggested by Ottenbreit-Leftwich, Ertmer, & Tondeur (2015).

## Implications for Practice

As IHEs are transitioning to meet the new *CAEP* standards, the findings of this study suggest important implications for planning technology preparation of preservice teachers (a) within the IHE and with (b) the partnering K–12 field placement schools. The suggestions for future practice are described below, as suggested by informants in this study and the findings in the research literature.

### Planning Within the IHE

First, due to reported varying levels of technology use in generic undergraduate courses both in this study and also found in the previous research literature (Teclehehaimanot, Mentzer, & Hickman, 2011), IHEs should focus on helping administrators to build a supportive culture for teacher educators that encourages systemic technology infusion across the teacher preparation program through the use of a technology plan, supported by administrators and a technology committee. In addition, technology committees at IHEs should not only plan formal professional development experiences for teacher educators to develop and keep their technology dispositions current, but also prepare them with the knowledge and skills needed to recognize, address, and implement *ISTE-NETS* standards and model best practices across the curriculum, as reported by IHE 2. Therefore, with systematic planning efforts and curriculum redesign at IHEs, teacher educators can infuse technology in all courses and all levels. Moreover, as nearly all of the IHEs in this study did not require preservice teachers to take the required undergraduate technology course concurrently with the methods coursework, planning efforts should be made toward including authentic

technology experiences for preservice teachers, including opportunities to observe, design and implement technology-infused lesson plans and experience the most current and up-to-date educational technology topics and skills that are needed to succeed in the K–12 field, as nearly all IHEs reported in this study.

### Planning Between the IHE and K–12 Field Placement Schools

As IHEs are preparing to meet *CAEP*'s Standard 2 (Appendix A), field placement schools continue to remain a challenge due to varying levels of technology access and support, as found in this study. As reported by many informants, preservice teachers can overcome access barriers at field placement schools by bringing tools from the IHEs in order to experiment and practice with technology in an authentic environment. IHEs should be more involved in developing partnerships with inservice teachers in K–12 field placement schools that embrace technology; thus, collaboratively working toward identifying and teaching the best methods for using educational technology because there is "a disconnect between the strategies that college students are learning in their teaching methods classes and the technology that teachers are currently using in the classroom to enhance student achievement" (Project Tomorrow, 2009, p. 13).

## Conclusion

The findings of this study suggest that effective technology integration continues to be a challenge for teacher preparation programs at top IHEs. Nearly all educational technology implementation challenges reported over the past three decades (Betrus, 2012; Cuban, 1986; Ertmer, 2005; Hew & Brush, 2007) still largely persist as stakeholders attempt to implement best practices. The findings of this study indicate that

as teacher preparation programs are tasked with meeting revised and multiple sets of standards, they are also met with new challenges surrounding effective technology integration, within both their IHE and partnering K–12 field placement schools. These findings of this study contribute to the existing body of research literature that technology integration in top IHEs was an evolving process with past challenges. Despite these new and lingering challenges, top IHEs utilized several strategies to stay current and implement the best technology practices.

The timeliness of this study is important to the field because *NCATE*-accredited IHEs must meet and respond to *CAEP*'s new standards (2013) by 2016. Interestingly, only one IHE (8) has created a technology plan to meet the cross-cutting theme of technology and diversity. Additionally, one IHE (2) reported incorporating *ISTE-NETS* standards into technology planning for teacher educators. Last, one IHE (10) reported that preservice teachers are required to take this course concurrent with the methods course. With this, the findings of this study suggest both future research for the field and important implications for preparing preservice teachers with technology within teacher preparation programs at IHEs, as well as partnering K–12 field placement schools.

**Appendix A**
*CAEP* Standards (2013)

**Standard 1: CONTENT AND PEDAGOGICAL KNOWLEDGE**

*The provider ensures that candidates develop a deep understanding of the critical concepts and principles of their discipline and, by completion, are able to use discipline-specific practices flexibly to advance the learning of all students toward attainment of college- and career-readiness standards.*

**Standard 2: CLINICAL PARTNERSHIPS AND PRACTICE**

*The provider ensures that effective partnerships and high-quality clinical practice are central to preparation so that candidates develop the knowledge, skills, and professional dispositions necessary to demonstrate positive impact on all P-12 students' learning and development.*

**Standard 3: CANDIDATE QUALITY, RECRUITMENT, AND SELECTIVITY**

*The provider demonstrates that the quality of candidates is a continuing and purposeful part of its responsibility from recruitment, at admission, through the progression of courses and clinical experiences, and to decisions that completers are prepared to teach effectively and are recommended for certification. The provider demonstrates that development of candidate quality is the goal of educator preparation in all phases of the program. This process is ultimately determined by a program's meeting of Standard 4.*

**Standard 4: PROGRAM IMPACT**

*The provider demonstrates the impact of its completers on P-12 student learning and development, classroom instruction, and schools, and the satisfaction of its completers with the relevance and effectiveness of their preparation.*

**Standard 5: PROVIDER QUALITY ASSURANCE AND CONTINUOUS IMPROVEMENT**

*The provider maintains a quality assurance system comprised of valid data from multiple measures, including evidence of candidates' and completers' positive impact on P-12 student learning and development. The provider supports continuous improvement that is sustained and evidence-based, and that evaluates the effectiveness of its completers. The provider uses the results of inquiry and data collection to establish priorities, enhance program elements and capacity, and test innovations to improve completers' impact on P-12 student learning and development.*

## Appendix B

NBPTS Five Core Propositions

**Proposition 1:** Teachers are committed to students and their learning.

**Proposition 2:** Teachers know the subjects they teach and how to teach those subjects to students.

**Proposition 3:** Teachers are responsible for managing and monitoring student learning.

**Proposition 4:** Teachers think systematically about their practice and learn from experience.

**Proposition 5:** Teachers are members of learning communities.

## Appendix C
ISTE Standards for Teachers

1. **Facilitate and inspire student learning and creativity**
Teachers use their knowledge of subject matter, teaching, and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

a. Promote, support, and model creative and innovative thinking and inventiveness
b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources
c. Promote student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes
d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments

2. **Design and develop digital age learning experiences and assessments**
Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop the knowledge, skills, and attitudes identified in the Standards*S.

a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity
b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress
c. Customize and personalize learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources
d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards, and use resulting data to inform learning and teaching

3. **Model digital age work and learning**
Teachers exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society.

a. Demonstrate fluency in technology systems and the transfer of current knowledge to new technologies and situations
b. Collaborate with students, peers, parents, and community members using digital tools and resources to support student success and innovation
c. Communicate relevant information and ideas effectively to students, parents, and peers using a variety of digital media and formats

d. Model and facilitate effective use of current and emerging digital tools to locate, analyze, evaluate, and use information resources to support research and learning

4. **Promote and model digital citizenship and responsibility**

Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices.

a. Advocate, model, and teach safe, legal, and ethical use of digital information and technology, including respect for copyright, intellectual property, and the appropriate documentation of sources
b. Address the diverse needs of all learners by using learner-centered strategies providing equitable access to appropriate digital tools and resources
c. Promote and model digital etiquette and responsible social interactions related to the use of technology and information
d. Develop and model cultural understanding and global awareness by engaging with colleagues and students of other cultures using digital age communication and collaboration tools

5. **Engage in professional growth and leadership**

Teachers continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources.

a. Participate in local and global learning communities to explore creative applications of technology to improve student learning
b. Exhibit leadership by demonstrating a vision of technology infusion, participating in shared decision making and community building, and developing the leadership and technology skills of others
c. Evaluate and reflect on current research and professional practice on a regular basis to make effective use of existing and emerging digital tools and resources in support of student learning
d. Contribute to the effectiveness, vitality, and self-renewal of the teaching profession and of their school and community

## Appendix D

ISTE Standards for Students

1. **Creativity and innovation**

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

a. Apply existing knowledge to generate new ideas, products, or processes
b. Create original works as a means of personal or group expression
c. Use models and simulations to explore complex systems and issues
d. Identify trends and forecast possibilities

2. **Communication and collaboration**

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.

a. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media
b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats
c. Develop cultural understanding and global awareness by engaging with learners of other cultures
d. Contribute to project teams to produce original works or solve problems

3. **Research and information fluency**

Students apply digital tools to gather, evaluate, and use information.

a. Plan strategies to guide inquiry
b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media
c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks
d. Process data and report results

4. **Critical thinking, problem solving, and decision making**

Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

a. Identify and define authentic problems and significant questions for investigation
b. Plan and manage activities to develop a solution or complete a project
c. Collect and analyze data to identify solutions and/or make informed decisions
d. Use multiple processes and diverse perspectives to explore alternative solutions

5. **Digital citizenship**
Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

a. Advocate and practice safe, legal, and responsible use of information and technology
b. Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity
c. Demonstrate personal responsibility for lifelong learning
d. Exhibit leadership for digital citizenship

6. **Technology operations and concepts**
Students demonstrate a sound understanding of technology concepts, systems, and operations.

a. Understand and use technology systems
b. Select and use applications effectively and productively
c. Troubleshoot systems and applications
d. Transfer current knowledge to learning of new technologies

## Appendix E

Recommended Strategies for Preservice Teachers to Learn How to Use Technology in Teacher Preparation Programs

| Strategy and Characteristics | Literature | Advantages of Strategy | Limitations of Strategy |
|---|---|---|---|
| **Single technology course** *stand-alone course in several formats of content, project, or process-based* | (Albion, 2001)<br>(Hargrave & Hsu, 2001)<br>(Kay, 2006)<br>(McRobbie et al., 2000)<br>(Polly et a., 2010)<br>(Wang, 2012) | improve self-efficacy (Albion, 2001)<br>overview of use of technology in teaching (McRobbie et al., 2000)<br>develop strong foundation of technology skills (Hargrave & Hsu, 2001; Kay, 2006) | learning skills in isolation (Gunter, 2001)<br>topics taught to minimal degree (Kleiner et al., 2007)<br>content varies (Iverson, Lewis & Talbot, 2008; Kleiner et al., 2007)<br>focus on use of hardware, software and productivity tools, rather than technology integration practices (Graham, Tripp, & Wentworth, 2009; Hughes et al., 2012)<br>does not result in implementation of digital technologies in their teaching (Kay, 2006; Niess, 2012) |
| **Mini-workshops** *short focused seminars in key areas (Kay, 2006)* | (Kay, 2006)<br>(Teclehaimanot & Lamb, 2005) | other strategies can be used in a workshop to reinforce efficiency of training outcome (Teclehaimanot & Lamb, 2005) | If used instead of single-course, computer skills sacrificed (Kay, 2006) |

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| **Technology integration in all courses** *weaves use of technology in all preservice education courses, particularly methodology courses* | (Brush & Appelman, 2003)<br>(Bullock, 2004)<br>(Hyndman, Wirtz, Pierce & Erickson, 2007)<br>(ISTE, 2003)<br>(Kay, 2006)<br>(Mills & Tincher, 2003)<br>(Mouza et al., 2014)<br>(Neiss, 2005)<br>(Polly et al., 2010)<br>(Smaldino & Muffoletto, 1997) | promote confidence of using technology skills (Voithofer, 2005)<br>learning with computers, not about them (Doering, Hughes, & Huffman, 2003; Kay, 2006)<br>can help preservice teachers advance their TPACK knowledge (Mouza et al., 2014) | difficulty to transferring what is learned to field experience (Brush, 2003) |
| **Modeling technology use** *in methodology courses and field experiences; provide preservice teachers with concrete examples of how technology can be used in classroom* | (Angeli & Valanides, 2009)<br>(Bullock, 2004)<br>(Fleming, Motamedi & May, 2007)<br>(Goktas, Yildirim & Yildirim, 2009)<br>(Hunt, 1997)<br>(ISTE, 2003)<br>(Kay, 2006)<br>(Project Tomorrow, 2013)<br>(Stobuagh & Tassell, 2011)<br>(Thompson, Schmidt & Davis, 2003)<br>(Tondeur et al., 2012) | strong positive effect on how preservice teachers will use technology in future classrooms (Angeli & Valanides, 2009; Hall, Fisher, Mutant & Halquist, 2006)<br>motivates preservice teachers and helps them understand value of using a particular technology (Lim & Chan, 2007)<br>the more technology integration demonstrations or hands-on activities that preservice teachers obtain, the more confidence they develop using technology (Fleming, Motamedi & May, 2007) | inability of faculty to provide meaningful and effective technology examples (Eifler et al., 2001; Kay, 2006) |
| **Using multimedia** *grab-bag of multimedia-based approaches, including technology case studies, online courses, and e-portfolios* | (Kay, 2006) | increased accessibility of course because it is delivered online (Kay, 2006) | problem-based, constructive learning difficult to achieve (Kay, 2006; Marra, 2004) |

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| **Collaboration among preservice teachers, faculty, and mentor teachers**<br>*develop communities of practice, expertise directories, and best practice examples* | (Fry & Bryant, 2006)<br>(Goktas et al., 2008)<br>(Bullock, 2004)<br>(ISTE, 2003)<br>(Kay, 2006)<br>(Polly et al., 2010)<br>(Sherry & Chiero, 2004)<br>(Voithofer, 2005) | provides opportunities to explore and practice technological applications in supportive environment<br>develop positive relationships between local public schools and the university<br>increase comfort level of using technology (Kay, 2006; Thompson et al., 2003)<br>provides with models of technology integration and appropriate pedagogy practices (Sherry & Chiero, 2004) | time needed to develop effective learning communities (Thompson et al., 2003)<br>all parties must be motivated (Thompson et al., 2003)<br>if one part of community is resistant to use of technology, effectiveness of strategy is compromised (Carroll et al., 2003) |
| **Practicing technology in the field**<br>*actively support the production and delivery of technology-based lessons by preservice teachers* | (Alger & Kopcha, 2011)<br>(Brush et al., 2003)<br>(Basham, Palla, & Pianfetti, 2005)<br>(Bullock, 2004)<br>(Dawson, 2006)<br>(Hew & Brush, 2007)<br>(ISTE, 2003)<br>(Kay, 2006)<br>(Ottenbreit-Leftwich et al., 2010)<br>(Neiss, 2005)<br>(Tearle & Golder, 2008)<br>(Tondeur et al., 2012) | when practicing digital tools in the field, preservice teachers become more confident (Hew & Brush, 2007) with technology use and develop positive attitudes toward technology (Bahr, Shaha, Farnsworth, Lewis & Benson, 2004)<br>learn from hands-on experience and how technology affects learning in classroom (Brush et al., 2003; (Ottenbreit-Leftwich et al., 2010)<br>need authentic situations to apply and practice new knowledge (Tondeur et al., 2012) | when used as the only strategy, preservice teachers can feel unprepared (Brush et al., 2003) |

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| **Focusing on education faculty**<br>*improving the attitudes, ability, and use of computers to improve overall use in program* | (Goktas et al., 2008)<br>(Kay, 2006)<br>(Tondeur et al., 2012) | cohesive environment can be created to effectively introduce and model technology (Kay, 2006)<br>more competent staff should lead less competent ones (Goktas et al., 2008)<br>IHE should provide staff development (Tondeur et al., 2012)<br>Technology planning should involve teacher educators (Tondeur et al., 2012) | unclear if improving faculty attitude and skills actually transfers to preservice teachers' use of technology in classroom (Kay, 2006) |
| **Focusing on mentor teachers**<br>*typically used with collaborative approach; relationship develops between mentor teacher and preservice teacher who work together to produce meaningful use of technology* | (Kay, 2006)<br>(Bullock, 2004)<br>(Kenny, 2009)<br>(Tondeur et al., 2012) | takes less time than full collaborative model (Kay, 2006)<br>mentor teachers play a critical role in developing preservice teachers' professional knowledge (Cheng & Zhan, 2012)<br>co-operation between IHE and field placement schools should be supported (Tondeur et al., 2012) | Mentor teachers' technology skills vary with effectively using technology (Dexter & Reidel, 2003) |
| **Improving access to software, hardware, and support**<br>*provide preservice teachers with laptops and hardware* | (Dawson, 2008)<br>(Bullock, 2004)<br>(Goktas et al., 2008)<br>(Kay, 2006)<br>(Tondeur et al., 2012) | resources are an important condition for technology integration (Goktas et al., 2008) (Tondeur et al., 2012) | without key access elements, other strategies are bound to have limited effect (Kay, 2006) |
| **Aligning theory and practice**<br>*Link theoretical information to practice* | (Angeli & Valanides, 2009)<br>(Brush et al., 2003)<br>(Jang, 2008)<br>(Goktas et al., 2008)<br>(Tondeur et al., 2012) | Help preservice teachers to understand reasoning behind using technology (Brush et al., 2003) | Preservice teachers often struggle with linking theory to practice (Moore, 2003) due to isolation of some technology courses or lack of experiences observing technology uses in the field (Karchmer-Klein, 2007) |

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| **Reflecting on attitudes about the role of technology in education**<br>*Use discussion groups, observations, and writing* | (Ertmer & Ottenbreit-Leftwich, 2010)<br>(Jang, 2008)<br>(O'Reilly, 2003)<br>(Tearle & Golder, 2008)<br>(Tondeur et al., 2012) | Tying active learning to development of positive attitudes toward technology (Jang, 2008) | Can be challenging for teacher preparation programs to do with both preservice teachers and teacher educators (Brush et al., 2003) |
| **Learning technology by design**<br>*Planning and preparation time and support to the creation and implementation of technology-enhanced lesson plans* | (Angeli & Valanides, 2009)<br>(Jang, 2008)<br>(Thompson et al., 2003)<br>(Tondeur et al., 2012)<br>(Sahin, 2003) | Preservice teachers have no prior knowledge related to designing these lessons or activities (Thompson et al., 2003) | Difficult to locate field placements with high levels of technology access and inservice teachers with effective technology integration skills (Neiss, 2012)<br>Preservice teachers design these activities, rather than get the opportunity to implement in field (Voogt et al., 2012) |
| **Collaborating with peers**<br>*Discussing concerns and exchanging points of view as important and non-threatening* | (Angeli & Valanides, 2009)<br>(Barton & Haydn, 2006)<br>(Brush et al., 2003)<br>(Jang, 2008)<br>(Tearle & Golder, 2008)<br>(Thompson et al., 2003)<br>(Tondeur et al., 2012) | Students can help each other (Brush et al., 2003) and receive input from each other (Thompson et al., 2003) in a low-threatening environment (Angeli & Valanides, 2009) | |

## Appendix F

2015 U.S. News and World Report (2014): Top 98 Public Schools (National Universities)

| | | | | | |
|---|---|---|---|---|---|
| 1. University of California-Berkeley | 19. University of Connecticut | 36. University of Alabama | 55. University of California-Riverside | 73. Arizona State University | 92. Virginia Common-wealth University |
| 2. University of California-LA | 20. University of Georgia | 36. University of California-Santa Cruz | 55. University of South Carolina | 73. Mississippi State University | 94. University of Central Florida |
| 3. University of Virginia | 21. Clemson University | 36. University of Colorado-Boulder | 57. Michigan Technological University | 73. Oklahoma State University | 94. University of South Florida |
| 4. University of Michigan-Ann Arbor | 21. University of Maryland-College Park | 40. Auburn University | 58. University of Arizona | 73. Oregon State University | 94. West Virginia University |
| 5. University of North Carolina-Chapel Hill | 21. University of Pittsburgh | 40. Colorado School of Mines | 58. University of Kentucky | 73. Rutgers University of New Jersey-Newark | 97. University of North Dakota |
| 6. College of William and Mary | 24. Purdue University-West Lafayette | 40. Florida State University | 60. Colorado State University | 73. University of Texas-Dallas | 98. Indiana University of Pennsylvania |
| 7. Georgia Institute of Technology | 25. Rutgers-New Brunswick | 40. University of Massachusetts-Amherst | 60. Temple University | 79. New Jersey Institute of Technology | 98. Northern Illinois University |

| | | | | | |
|---|---|---|---|---|---|
| 8. Pennsylvania State University-University Park | 25. Texas A&M University-College Station | 44. Binghamton University-SUNY | 60. University of Utah | 79. University of Mississippi | 98. Southern Illinois University-Carbondale |
| 9. University of California-Davis | 25. University of Minnesota-Twin Cities | 44. University of Missouri | 63. Missouri University of Science and Technology | 81. Illinois State University | |
| 9. University of California – San Diego | 25. Virginia Tech | 44. University of New Hampshire | 63. University at Albany-SUNY | 81. San Diego State University | |
| 11. University of California-Santa Barbara | 29. Michigan State University | 47. Iowa State University | 63. University of Arkansas | 81. University of Alabama-Birmingham | |
| 11. University of Illinois-Urbana-Champaign | 29. University of Iowa | 47. North Carolina State University-Raleigh | 63. University of Illinois-Chicago | 81. University of Rhode Island | |
| 11. University of Wisconsin-Madison | 31. Indiana University-Bloomington | 47. University of Kansas | 63. Washington State University | 85. University of Hawaii-Manoa | |
| 14. University of California - Irvine | 31. Miami University-Oxford | 47. University of Nebraska-Lincoln | 68. Kansas State University | 85. University of Maryland-Baltimore County | |

| | | | | |
|---|---|---|---|---|
| 14. University of Florida | 31. University of Delaware | 47. University of Oklahoma | 68. Louisiana State University-Baton Rouge | 85. University of Massachusetts-Lowell |
| 16. Ohio State University-Columbus | 34. Stony Brook-SUNY | 47. University of Tennessee | 68. Ohio University | 88. Texas Tech University |
| 16. University of Texas-Austin | 34. University of Vermont | 53. University at Buffalo-SUNY | 68. University of Cincinnati | 88. University of Idaho |
| 16. University of Washington | 36. SUNY College of Environmen-tal Science and Forestry | 53. University of Oregon | 72. George Mason University | 88. University of Louisville |

**Appendix G**

Sources of Interview Questions for Deans/Checklist Used During Interviews

## Checklist for Interview with Dean/Associate Dean

**Question 1:**

**What are overall requirements for preservice teachers to graduate?**

**a. Technology requirements?**

- technology stand-alone course (Gronseth et al., 2010; Kleiner, Thomas, & Lewis, 2007; Kay, 2006)
  - basic computer skills
  - designing technology-rich lesson plans (Kleiner, Thomas, & Lewis, 2007)
- methods technology projects (Gronseth et al., 2010)
- other educational technology projects (Gronseth et al., 2010)
- teacher observations (Gronseth et al., 2010; Project Tomorrow, 2013))
- field experiences (Brush, Glazewski, et al., 2003; Gronseth et al., 2010)
- student teaching (Gronseth et al., 2010)
- tiered series of courses infused throughout entire program (Brush & Appelman, 2003; Sanzon, Hunt, & Bevill, 2002)

**Question 2:**

**How does your school prepare preservice teachers to teach with technology?**

- integrating technology in all courses (Kay, 2006; Brush & Appelman, 2003; Niess, 2008; Sanzone, Hunt, & Bevill, 2002)
- multimedia-based approach (Kay, 2006; Project Tomorrow, 2013)
  - technology case studies, online courses, e-portfolios (Kay, 2006)
- focusing on education faculty (Kay, 2006)
  - improving attitudes, ability, and use of computers (Kay, 2006)
- delivering a single technology course (Kay, 2006; Gronseth et al., 2010; Kleiner, Thomas, & Lewis, 2007)
  - content-based, project-based, or process-based (Kay, 2006)
  - provide overview of use of technology in teaching
  - develop strong foundation of technology skills
- modeling how to use technology (Angeli & Valanides, 2009; Kay, 2006; Project Tomorrow, 2013
  - subject matter appropriate technology(Koh & Divaharan, 2011; Ottenbreit-Leftwich et al., 2012; Wetzel, Buss, Foulger, & Lindsey, 2014)
  - provide preservice teachers with concrete examples of how technology can be used in classroom (Kay, 2006)
  - Recommended by ISTE/NCATE
- collaboration among preservice teachers, mentor teachers, and faculty (Kay, 2006; Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013; Vanderline, van Braak, & Tondeur, 2010)
  - developing communities of practice, knowledge repositories, expertise directories, peer and mentor assistance and best practice examples (Carroll et al., 2003; Kay, 2006)
- practicing technology in the field (Kay, 2006)
  - support the production and delivery of technology-based lessons (Kay, 2006)
  - Recommended by ISTE/NCATE
  - learn from hands-on experience
  - focus on how technology affects learning in classroom
- offering mini-workshops (Bullock, 2004; Kay, 2006)

- offered by faculty
- support other aspects of technology enhanced program (Kay, 2006)
- short, focused seminars or labs in key areas (Kay, 2006)
- can include other strategies in workshops (i.e. e-portfolios, modeling, or specific teaching activities with technology integrated)
- improving access to software, hardware, and support (Kay, 2006; Wetzel et al., 2014)
  - provide students with laptops and software (Kay, 2006)
  - technological support for faculty and preservice teachers
- focusing on mentor teachers (Bullock, 2004; Kay, 2006)
  - mentor teacher with positive attitude toward technology (Bullock, 2004)
  - mentor teacher guides preservice teacher in pedagogy and "real world" experience
  - preservice teachers supports mentor teacher with latest technology and software
- tiered series of courses infused throughout entire program (Brush & Appelman, 2003; Sanzon, Hunt, & Bevill, 2002)
- Combination of strategies (2 or more) (Kay, 2006)
  - most common= modeling/integration, single-course/integration, integration/community strategies (Kay, 2006)

**Question 3:**

**What would you consider the most important technology-related topic or experience addressed that your school provides as a requirement for your preservice teachers before graduating the elementary program? (Gronseth et al., 2010; Ottenbreit-Leftwich et al., 2012)**

- Personal productivity (Gronseth et al, 2010; Ottenbreit-Leftwich et al., 2012)
  - word processors, spreadsheets
- Information presentation (Gronseth et al, 2010; Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013)
  - PowerPoint, digital media
- Administration/classroom management (Ottenbreit-Leftwich et al., 2012)
  - gradebook, attendance, seating charts, course management system
- Communication with peers/parents/students (Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013)
  - by using social media (Project Tomorrow, 2013)
  - email, online chats, newsletters, class web sites, blogs
  - 2.0 tools that are interactive with parents and students
- Analyze student achievement data (Ottenbreit-Leftwich et al., 2012)
  - identify trends, provide remediation to learners, cell phones, immediate feedback, accelerated reader results, assessment, monitor progress
  - learning management systems, portfolios for student tracking systems
  - clickers
- Document personal/professional growth (Ottenbreit-Leftwich et al., 2012)
  - e-portfolios, personal learning networks, Twitter, blogs, book marking web sites
  - document effects having on students' learning (Ottenbreit-Leftwich et al., 2012)
- Teach specific concepts (Ottenbreit-Leftwich et al., 2012)
  - computer-based courseware, tutorials
- Support variety of learning styles (Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013)
  - media for auditory and visual learners
- Support higher order thinking (Ottenbreit-Leftwich et al., 2012)
  - collaborative problem-based activities

- activities that require analysis/synthesis of information
- use of web 2.0 tools to support student collaboration
- design and create webquests
- Classroom preparation (Ottenbreit-Leftwich et al., 2012)
- Access and use electronic resources (Ottenbreit-Leftwich et al., 2012)
  - websites, online databases, web quests, Google searches
- Support learners with special needs (Gronseth et al., 2010; Ottenbreit-Leftwich et al., 2012)
  - assistive technologies, special software
- Create authentic learning experiences with technology (Project Tomorrow, 2013)
- How to teach online classes (Project Tomorrow, 2013)
- Identify and evaluate quality digital content to use in instruction (Project Tomorrow, 2013)
- Create and use video, podcasts, and other media (Project Tomorrow, 2013)

**Question 4:**

**What are your school's learning goals/outcomes? (Tondeur et al., 2012) (2nd and 3rd ring)**

a. **Is there a technology component to your school's learning goals/outcomes?**

- Integrates vision and strategic direction of entire teacher education program (Lavonen et al., 2006; Tondeur, Van Keer, van Braak, & Valcke, 2008)

b. **If so, what has been the evolution of incorporating this technology component into the learning goals/outcomes?**

- Possible if in a planned manner
- a systematic process (Hall & Hord, 2010; Lim & Hang, 2003)
  - requires time to change
- developed together by all stakeholders (Goktas et al., 2009; Lavonen et al., 2006; Thompson et al., 2003)
  - emphasis on staff as important (Lavonen et al., 2006)
- supported by a task force (Goktas et al., 2009; Lavonen et al., 2006; Thompson et al., 2003)
- aimed at empowering end users (Goktas et al., 2009; Lavonen et al., 2006; Thompson et al., 2003)
- updated on a regular basis (Goktas et al., 2009; Lavonen et al., 2006; Thompson et al., 2003)
- Resources guided by (Seels, 2003; Thompson et al., 2003)
  - administrative needs
  - financial needs
  - teaching needs
- Technology planning as difficult due to varying technology skill levels of teacher educators (Goktas et al., 2008)
- technology coordinator takes leadership role (Haydn & Barton, 2007)

**Question 5:**

**What are the expectations or requirements of faculty members to use technology in your school?**

- Modeling and demonstrating use (Angeli & Valanides, 2009; Kay, 2006; Project Tomorrow, 2013)
  - subject matter appropriate technology (Koh & Divaharan, 2011; Ottenbreit-Leftwich et al., 2012; Wetzel, Buss, Foulger, & Lindsey, 2014)
- Help other faculty members (Goktas et al., 2009) (Thompson et al., 2003)
- link theory to practice for preservice teachers (Goktas et al., 2008; Jang, 2008)
- help preservice teachers reflect on their attitudes of technogloy use (Bullock, 2004; Goktas et al., 2009)
- continuous feedback to preservice teachers via technology (Lavonen et al. 2006)
- syllabi emphasize integration of technology in objectives and assignments to be viewed as integral part of course (Wetzel et al., 2014)
- ensure activities and content reflect the knowledge and skills used in the field (Gronseth et al., 2010)

**Question 6:**

**What types of technology are available at your school for faculty members to use during instruction of students? (Goktas et al., 2008; Ottenbreit-Leftwich et al., 2012; Tondeur et al., 2012; Wetzel et al., 2014)**

- e-portfolios (Ertmer, 2005; Ottenbreit-Leftwich et al., 2012; Tondeur et al., 2012)
- interactive whiteboards (Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013)
- digital camera
- clickers (Ottenbreit-Leftwich et al., 2012)
- mobile devices to leverage learning (Project Tomorrow, 2013)
- word processing, databases tools, spreadsheets (Gronseth et al, 2010; Project Tomorrow, 2013)
- digital texthooks (Project Tomorrow, 2013)

**Question 7:**

**What types of professional development opportunities does your school offer faculty members? (Tondeur et al., 2012)**

- mandate participation of faculty members (Wetzel et al., 2014)
- training to promote active engagement (Wetzel et al., 2014)
- teaching and learning within TPACK framework (Niess, 2011; Wetzel et al., 2014)
- training to become role models (Barton & Haydn, 2006)
- technology planning sessions (Vanderlinde, van Braak, & Tondeur, 2010)
- workshops (Clift et al., 2001; Tondeur et al., 2012)
- consultants (Clift et al., 2001)
- sharing of information (Clift et al., 2001)
- help other faculty members (one on one support) (Goktas et al., 2009; Thompson et al., 2003; Tondeur et al., 2012)
- community of instructors among "early adopters" as examples to others to develop community among instructors (Wetzel et al., 2014)

**Appendix H**

Sources of Interview Questions for Department Heads/Checklist Used During Interviews

## Checklist for Interview with Department Heads

**Question 1:**

**Does your school have a technology plan? (Tondeur et al., 2012)**

- Technology planning as difficult due to varying technology skill levels of teacher educators (Goktas et al., 2008)
- Resources guided by (Seels, 2003; Thompson et al., 2003)
  - administrative needs
  - financial needs
  - teaching needs

**a. If so, who was involved in its development and implementation?**

- Possible if in a planned manner
- a systematic process (Hall & Hord, 2010; Lim & Hang, 2003)
- developed together by all stakeholders (Goktas et al., 2009; Lavonen et al., 2006; Thompson et al., 2003)
  - emphasis on staff as important (Lavonen et al., 2006)

**b. Is the plan supported?**

- supported by a task force (Goktas et al., 2009; Lavonen et al., 2006; Thompson et al., 2003)
- aimed at empowering end users (Goktas et al., 2009; Lavonen et al., 2006; Thompson et al., 2003)
- updated on a regular basis (Goktas et al., 2009; Lavonen et al., 2006; Thompson et al., 2003)

**c. If you are the program director or department head of technology education, what is your role in this plan?**

- technology coordinator takes leadership role (Haydn & Barton, 2007)
- faculty member works with technology coordinator (Wetzel et al., 2014)

**Question 2:**

**To what degree do the faculty members use technology for instruction?**

**a. What types of technology do the faculty members use?**

- collaborative writing tools (i.e. wikis) (Project Tomorrow, 2013)
- e-Portfolios (Ertmer, 2005; Ottenbreit-Leftwich et al., 2012; Tondeur et al., 2012)
- assistive technologies (Gronseth et al., 2010)
- social networking tools (i.e. blogs and Facebook) (Project Tomorrow, 2013)
- interactive whiteboards (i.e. Smart Boards, Promethean Board) (Project Tomorrow, 2013)

- multi-media presentations (Project Tomorrow, 2013)
- word processing, spreadsheets, database tools (Gronseth et al, 2010; Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013)
- student owned mobile devices (Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013)
- virtual field trips
- social bookmarking tools (Ottenbreit-Leftwich et al., 2012)
- tools for student assessment (i.e. clickers) (Ottenbreit-Leftwich et al., 2012)
- content specific tools for instruction (Koh & Divaharan, 2011; Ottenbreit-Leftwich et al., 2012; Wetzel, Buss, Foulger, & Lindsey, 2014)
- online or hybrid teaching (Project Tomorrow, 2013)
- creation of own digital media for instruction (Project Tomorrow, 2013)
- leverage technology for a variety of learning styles (Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013)
- create authentic, real-world learning applications with technology (Project Tomorrow, 2013)
- digital communication tools (i.e. class web site, blog) (Thompson, 2008; Ottenbreit-Leftwich et al., 2012)
- digital textbooks (Project Tomorrow, 2013)

**b. How do they use technology? (i.e. instruction, productivity, assignments, etc.)**

- personal productivity (Gronseth et al, 2010; Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013)
- information presentation (Gronseth et al, 2010; Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013)
- access and use of electronic sources for instruction (Ottenbreit-Leftwich et al., 2012)

**Question 3:**

**Are the faculty offered training or workshops to aid them in teaching with technology?**

- training to become role models (Barton & Haydn, 2006)
- Workshops (Clift et al., 2001; Tondeur et al., 2012)
- consultants (Clift et al., 2001)
- faculty leadership - faculty member works with technology infusion coordinator (meets with instructors) (Wetzel et al., 2014)
- training to promote active engagement (Wetzel et al., 2014)
- teaching and learning within TPACK framework (Wetzel et al., 2014)
- 3 way professional development (mentor teachers, preservice teachers, and teacher educators) (Thompson et al., 2003; Tondeur et al., 2012)

a. **In turn, do faculty members with stronger technology skills collaborate and teach other faculty members who may not be as confident in their technology skills?**

- Help other faculty members (Goktas et al., 2009; Thompson et al., 2003; Wetzel et al., 2014)

b. **Is there any technology strategy planning among your colleagues at your school?**

- technology planning sessions (Vanderlinde, van Braak, & Tondeur, 2010)
- faculty leadership model (Wetzel et al., 2014)
- community of instructors among "early adopters" as examples to others to develop community among instructors (Wetzel et al., 2014)

**Question 4:**

**Please describe some of the experiences for preservice teachers in their methods classes.**

- collaborate and work with peers on technology tips and usage (Project Tomorrow, 2013)

a. **Do these faculty members model how technology can be used in variety of ways to teach content? Please explain.**

- Modeling in methods or other courses (Angeli & Valanides, 2009; Bullock, 2004; Gronseth et al, 2010; Project Tomorrow, 2013)
- subject matter appropriate technology (Koh & Divaharan, 2011; Ottenbreit-Leftwich et al., 2012; Wetzel, Buss, Foulger, & Lindsey, 2014)

**Question 5:**

**How do you choose placement schools for the preservice teachers?**
(Bullock, 2004; Hollins, 2011; Ottenbreit-Leftwich et al., 2012; Polly, Mims, Shepherd, & Inan, 2010; Tondeur et al., 2012; Wetzel et al., 2014)

co-operation with K-12 schools should be supported (Goktas et al., 2008; Thompson et al., 2003)

a. **What is this process like?**

b. **Do you consider the level of technology use in the school? Or of the inservice teachers?**

- type or amount of accessibility of technology (Bullock, 2004; Lavonen et al., 2006)
- guidance on how to find and use (Haydn & Barton, 2007)
- support/encouragement of technology use by mentor teacher (Bullock, 2004)
- modeling by mentor teacher (Angeli & Valanides, 2009; Bullock, 2004; Kay, 2006)

- subject matter appropriate technology (Koh & Divaharan, 2011; Ottenbreit-Leftwich et al., 2012; Wetzel, Buss, Foulger, & Lindsey, 2014)
- collaboration between preservice teachers and mentor teachers to develop technology lessons (Bullock, 2004)
- field school placement expectations and support for technology use (Bullock, 2004)
- student and parental enthusiasm and support for using technology in classroom (Bullock, 2004)
- amount of access to technology and/or support (Bullock, 2004)

**c. Do you discuss and collaborate on common technology experiences between your school and the placement school?**

- collaboration for preservice teachers to experience technology integrated lessons (Wetzel et al., 2014; Hollins, 2011)
- interview inservice teachers about communication techniques with teachers (Ottenbreit-Leftwich et al., 2012)
- form partnerships with inservice teachers to collaboratively work toward identifying and teaching the best methods for using technology (Ottenbreit-Leftwich et al., 2012)

**Question 6:**

**Does your teacher preparation program strive to link theory and practice for the preservice teachers? Please explain and provide examples.**

- technology focused workshops for preservice teachers (Bullock, 2004)
- perservice teachers' vision of technology as integral part of instruction rather than "add on" (Bullock, 2004)
- preservice teachers to understand reason behind using technologies (Brush et al., 2003; Jang, 2008; Tearle & Golder, 2008; Tondeur et al., 2012)
- theory and application of knowledge in real-world classroom examples (Angeli & Valanides, 2009; Tondeur et al., 2012)
  - learning technology by design (Tondeur et al., 2012)
  - implementation of technology activities in field experience (Gronseth et al., 2010)
- technology to support higher-order thinking skills & student-centered practices (Ottenbreit-Leftwich et al., 2012)
- syllabi emphasize integration of technology in objectives and assignments to be viewed as integral part of course (Wetzel et al., 2014)
- combination of theory in lecture and practice during lab (Angeli & Valanides, 2009)
- combination of short lectures/demos and practice work (Lavinen et al., 2006)
- use teacher educators as role models (Angeli & Valanides, 2009; Tearle & Golder, 2008; Tondeur et al., 2012)

**a. If so, do you consider the TPACK model to be an important piece of aiding preservice teachers to make sensible choices in their uses of technology when teaching specific content to a target group?** (Wetzel, Buss, Foulger, & Lindsey, 2014)

**b. If so, is this different from what has been done in the past?**

**Question 7:**

**Since you took your position as program director or department head, what have you changed in regards to technology use for teaching and learning? (Tondeur et al., 2012)**

- systematic change efforts (Hall & Hord, 2010; Thompson, et al., 2003; Wetzel, Buss, Foulger, & Lindsey, 2014)
- long period with constant reiterations to see change in technology integration (Seels et al., 2003)

    a. **How was this different from before?**

    b. **Do you have future ideas for change?**

**Question 8:**

**In your opinion, what is the most important technology-related topic or experience that your school provides as a requirement for your preservice teachers before graduating the elementary program? (Gronseth et al., 2010; Ottenbreit-Leftwich et al., 2012)**

- Personal productivity
- Information presentation (Project Tomorrow, 2013)
- Administration/classroom management
- Communication with peers/parents/students (Project Tomorrow, 2013)
    - by using social media (Project Tomorrow, 2013)
- Analyze student achievement data
- Document personal/professional growth
    - e-portfolios to document effect having on students' learning (Ottenbreit-Leftwich et al., 2012)
    - e-portfolios developed throughout entire teacher education program (Hyndman et al., 2007; Ottenbreit-Leftwich et al., 2012)
- Teach specific concepts
- Support variety of learning styles (Project Tomorrow, 2013)
- Support higher order thinking
- Classroom preparation
- Access and use electronic resources
- Support learners with special needs (Gronseth et al., 2010)
- Create authentic learning experiences with technology (Project Tomorrow, 2013)
- How to teach online classes (Project Tomorrow, 2013)
- Identify and evaluate quality digital content to use in instruction (Project Tomorrow, 2013)
- Create and use video, podcasts, and other media (Project Tomorrow, 2013)
- Use technology to support curricular goals (Gronseth et al., 2010)

**Question 9:**

**In your opinion, how would you like to see technology integrated into your school's preservice teacher education program?**

    a. **Is this different from what is already in place?**

## Appendix I
Survey Questions

Dear Respondent, My name is Dana Susko and I am a graduate student in the field of Educational Media and Technology at Boston University. As part of the research for my dissertation, I am interested in learning about how the best institutions with undergraduate, preservice education programs are preparing teachers to use technology in teaching and learning situations. Because your institution has been identified as one of the top programs in the country, I would like to request your participation in this study. I have created a short survey for faculty members at your school or college of education to gain a sense of the experiences that your undergraduate, preservice teachers acquire at your institution. The completion time for the survey is approximately 10–15 minutes. At the end of the survey, you will be asked if you would like to participate in a follow-up interview of about 15 minutes via Skype. Confidentiality will be strictly maintained. Only the researcher will have access to your responses. Research materials will be kept up to seven years at which time they will be destroyed. The potential risk to participants in this study is extremely low. You are free to not answer any questions you may find objectionable. It is important that you understand that your participation is completely voluntary. This means that even if you agree to participate you are free to withdraw from the study at any time, or decline to participate in any portion of the study. If you have questions please contact Dana Susko by email at dsusko@bu.edu or my academic advisor Donna Lehr at dlehr@bu.edu. You may also obtain further information about your rights as a research subject by calling the BU CRC IRB Office at 617-358-6115. If you have understood the above statements, please continue to answer the questions below to indicate your consent to participate in this study. Thank you for your participation!

Q1 Do you teach undergraduate, preservice teachers at your college of education?

- ❑ Yes (1)
- ❑ No (2)

If No Is Selected, Then Skip To End of Survey. If Yes Is Selected, Then Skip To Gender:

Answer If Do you teach undergraduate, preservice teachers at your school/college of education? Yes Is Selected

Q2 Gender:

- ❍ Female (1)
- ❍ Male (2)

Q3 Which best describes your title at your college of education?

- ❑ Professor (1)
- ❑ Associate Professor (2)
- ❑ Assistant Professor (3)
- ❑ Instructor (4)
- ❑ Clinical Instructor (5)
- ❑ Clinical Associate Professor (6)
- ❑ Clinical Assistant Professor (7)
- ❑ Lecturer (8)
- ❑ Doctoral Student/Post Doc (9)
- ❑ Adjunct Professor (11)
- ❑ Other (10) _____

Q4 Which best describes your department at your college of education?

- ❑ Educational Technology (14)
- ❑ Special Education (1)
- ❑ Science Education (2)
- ❑ Reading (3)
- ❑ Elementary Education (4)
- ❑ History and Social Science (5)
- ❑ Mathematics Education (6)
- ❑ Higher Education Administration (7)
- ❑ Early Childhood Education (8)
- ❑ Health, Physical Education, and/or Coaching (9)
- ❑ Literacy and Language (10)
- ❑ Policy, Planning, and Administration (11)
- ❑ Deaf Studies (12)
- ❑ Bilingual Education and/or TSEOL (13)
- ❑ School Administration or Leadership (16)
- ❑ Other (15) _____

Q5 List the course title(s) that you are teaching this semester, as well as the following information:

| | Course Title (1) | Does this course include preservice teachers? (Yes/No) (2) | What type of course is this (methods, lab, field experience, other)? (3) | How is the course delivered (face to face, online, or hybrid)? (6) | Do the course objectives emphasize the integration of technology in the syllabus? (Yes/No) (4) | Do the course assignments emphasize the integration of technology in the syllabus? (Yes/No) (9) |
|---|---|---|---|---|---|---|
| Course 1 (1) | | | | | | |
| Course 2 (2) | | | | | | |
| Course 3 (3) | | | | | | |
| Course 4 (4) | | | | | | |
| Course 5 (5) | | | | | | |

Q6 A technology plan is: a plan prepared by a school or library to explain how telecommunications and information technology will be used to achieve educational goals or curriculum reforms. Based on this definition, how aware are you of your college of education's technology plan?

- ❍ I don't know if my college of education has a technology plan. (1)
- ❍ I know we have a technology plan, but I'm not aware what it involves. (2)
- ❍ I know we have a technology plan and I'm aware of what it involves. (3)
- ❍ I know we have a technology plan and I helped develop it. (5)
- ❍ I know my college of education does not have a technology plan. (4)

Please answer the following questions to indicate how much you disagree or agree with the following statements:

Q7 I am aware of professional development opportunities offered by my institution to increase my knowledge to teach technology integration to preservice teachers.

- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q8 I am aware of opportunities to access technology resources in order to facilitate teaching and learning in my class(es).

- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

For each of the following statements, please indicate the extent to which you have participated in the following experiences at your institution within the last two years.

Q9 At my institution, I help my colleagues with technology use for educational purposes.
- ❍ Never (6)
- ❍ Less than once a semester (1)
- ❍ Once a semester (2)
- ❍ Once a month (3)
- ❍ Once a week (4)
- ❍ More than once a week (5)

Q10 At my institution, I seek help from my colleagues with technology use for educational purposes.
- ❍ Never (6)
- ❍ Less than once a semester (1)
- ❍ Once a semester (2)
- ❍ Once a month (3)
- ❍ Once a week (4)
- ❍ More than once a week (5)

Q11 At my institution, I collaborate with K–12 inservice teachers on using technology for educational purposes.
- ❍ Never (6)
- ❍ Less than once a semester (1)
- ❍ Once a semester (2)
- ❍ Once a month (3)
- ❍ Once a week (4)
- ❍ More than once a week (5)

Q12 For each of the following statements, please indicate the extent to which you have provided the following experiences for undergraduate, preservice teachers at your institution within the last two years. "In my class, I…"

| | Never (1) | Once a semester (2) | Twice a semester (3) | Once a month (4) | Once a week (5) |
|---|---|---|---|---|---|
| Model how to use various technologies or digital tools (1) | ❍ | ❍ | ❍ | ❍ | ❍ |
| Teach the theory behind using instructional technologies (2) | ❍ | ❍ | ❍ | ❍ | ❍ |
| Provide opportunities for students to practice and apply new technology knowledge (3) | ❍ | ❍ | ❍ | ❍ | ❍ |
| Provide opportunities for students to collaborate with their peers when learning about instructional technology (4) | ❍ | ❍ | ❍ | ❍ | ❍ |
| Ask students to think about, reflect and discuss their beliefs and attitudes toward the role of technology in education with their peers (5) | ❍ | ❍ | ❍ | ❍ | ❍ |
| Provide appropriate time and support for lesson planning and preparation | ❍ | ❍ | ❍ | ❍ | ❍ |

| | | | | | |
|---|---|---|---|---|---|
| that incorporate technology (6) | | | | | |
| Provide appropriate scaffolds for lesson planning and preparation that incorporate technology (7) | ❍ | ❍ | ❍ | ❍ | ❍ |
| Provide evaluative feedback on students' technology competencies (8) | ❍ | ❍ | ❍ | ❍ | ❍ |
| Ask students to create a technology-integrated lesson plan or activity (9) | ❍ | ❍ | ❍ | ❍ | ❍ |
| Provide students with current information about instructional technology and its use in the field (10) | ❍ | ❍ | ❍ | ❍ | ❍ |
| Provide opportunities for students to practice with numerous digital tools and technology (11) | ❍ | ❍ | ❍ | ❍ | ❍ |

Q13 Below are various instructional technology skills that are included in some teacher education programs. Please identify which of the following technology skills you have taught your undergraduate, preservice teachers in any of your classes within the last two years. If you would like to include the tools that you use to teach these skills, please type in the available boxes below each statement.

- ❑ Increase personal productivity using technology (1) _____
- ❑ Create visual presentations using technology (2) _____
- ❑ Administer or manage materials in the classroom using technology (3) _____
- ❑ Communication to students and/or parents using technology (4) _____
- ❑ Analyze student achievement data for feedback and assessment to improve instruction using technology (5) _____
- ❑ Document and reflect professional growth using technology (6) _____
- ❑ Enhance student engagement, motivation, collaboration, and higher order thinking skills using technology (7) _____
- ❑ Use technology to create differentiated instruction to support learners with special needs (8) _____
- ❑ Plan lessons, teach specific concepts, and prepare materials using technology (9) _____
- ❑ Access and use electronic resources (10) _____
- ❑ Create authentic experiences for learners using technology (11) _____
- ❑ Identify quality digital content to use in the classroom (12) _____
- ❑ I don't teach any of these skills in my class(es). (13)

Q14 Think about the class in which you use technology the most and identify if you:
1) use the tool or process in your class to aid instruction
2) prepare preservice teachers on how to use the tool or process in their future classrooms/teaching situations

| | Do you use this tool/process in your class to aid instruction (i.e. ask students to use this tool to demonstrate their understanding of a concept)? | | Do you instruct preservice teachers on how to use this tool/process in their future teaching situations? | |
|---|---|---|---|---|
| | Yes (1) | No (2) | Yes (1) | No (2) |
| collaborative writing tools (i.e. wikis) (1) | ❍ | ❍ | ❍ | ❍ |
| e-Portfolios (2) | ❍ | ❍ | ❍ | ❍ |
| assistive technologies (3) | ❍ | ❍ | ❍ | ❍ |
| social networking tools (4) | ❍ | ❍ | ❍ | ❍ |
| interactive whiteboards (i.e. Smart Boards, Promethean Board) (5) | ❍ | ❍ | ❍ | ❍ |
| multi-media presentations (6) | ❍ | ❍ | ❍ | ❍ |
| word processing, spreadsheets, database tools (7) | ❍ | ❍ | ❍ | ❍ |
| student owned mobile devices (8) | ❍ | ❍ | ❍ | ❍ |
| virtual field trips (9) | ❍ | ❍ | ❍ | ❍ |
| social bookmarking tools (14) | ❍ | ❍ | ❍ | ❍ |
| tools for student assessment (i.e. clickers) (19) | ❍ | ❍ | ❍ | ❍ |
| content specific tools for instruction (specify) (11) | ❍ | ❍ | ❍ | ❍ |
| online or hybrid teaching (10) | ❍ | ❍ | ❍ | ❍ |
| creation of own digital media for | ❍ | ❍ | ❍ | ❍ |

| | | | | |
|---|---|---|---|---|
| instruction (13) | | | | |
| leverage technology for a variety of learning styles (17) | ❍ | ❍ | ❍ | ❍ |
| create authentic, real-world learning applications with technology (18) | ❍ | ❍ | ❍ | ❍ |
| digital textbooks (27) | ❍ | ❍ | ❍ | ❍ |
| Other (specify) (12) | ❍ | ❍ | ❍ | ❍ |

Q15 Are there any barriers at your institution that are preventing you from integrating and utilizing technology in your class(es)? If so, please choose all that apply to your experience.

- ❑ Your institution's educational technology infrastructure (1)
- ❑ Lack of interest in using technology (2)
- ❑ Lack of training to use educational technology (3)
- ❑ Lack of time for training and professional development to learn new technology skills (4)
- ❑ Preservice teachers' lack of interest to use technology (5)
- ❑ No barriers present at my institution (6)

Q16 What else could your institution do to improve its effectiveness in preparing your preservice teachers to use technology in their future classrooms?

Q17 Are there any additional experiences, topics, or tools that you offer preservice teachers in your course(s)? If so, please list below:

Thank you so much for your time and participation in this survey!

Q18 If you are willing to be contacted in the near future for a brief, 15–20 minute follow-up interview, please provide your email below. Please type your entire email (name@university.edu).

Q19 If you are willing to provide a copy of your course syllabus or course syllabi, please click the box below. Documents can be emailed to Dana Susko at dsusko@bu.edu

- ❍ Yes! I plan to send my syllabus/syllabi. (1)

**Appendix J**
Sources for Survey Questions

| Survey # | Related Research Literature (if applicable) |
|---|---|
| 1 | x |
| 2 | X |
| 3 | X |
| 4 | X |
| 5 | Wetzel, Foulger, & Lindsay (2014) |
| 6 | Goktas et al., 2008; Seels, 2003; Tondeur et al., 2012 |
| 7 | Clift et al., 2001; Tondeur et al., 2012; Wetzel et al., 2014 |
| 8 | Tondeur et al. (2012) |
| 9 | Goktas et al., 2009; Thompson et al., 2003; Tondeur et al., 2012; Wetzel et al., 2014 |
| 10 | Tondeur et al. (2012) |
| 11 | Tondeur et al. (2012) |
| 12 | Bullock, 2004; Kay, 2006; Gronseth et al., 2010; Project Tomorrow, 2013; Tondeur et al., 2012 |
| 13 | Gronseth et al., 2010; Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013 |
| 14 | AACTE, 2013; Gronseth et al., 2010; Koh & Divaharan, 2011; Ottenbreit-Leftwich et al., 2012; Project Tomorrow, 2013; Thompson, 2008; Wetzel, Buss, Foulger, & Lindsay, 2014 |
| 15 | Gronseth et al. (2010) |
| 16 | |
| 17 | x |
| 18 | x |
| 19 | x |

## Appendix K

Informed Consent for Dean/Associate Dean

My name is Dana Susko and I am a graduate student in the field of Educational Media and Technology at Boston University. As part of the research for my dissertation, I am interested in learning about how the best institutions with undergraduate, preservice education programs are integrating the use of technology in teaching and learning situations. Because your institution has been identified as one of the top programs in the country, I would like to request your participation in this study. I am contacting you as the dean for your involvement in a 30-minute interview. In addition to your interview, I would also like to contact program directors or chairs of both your curriculum and teaching department and educational technology department (if applicable to your institution). Lastly, it would be beneficial to the study to send a brief survey to your faculty members to gain a sense of the technology experiences your preservice teachers acquire at your institution.

Please read the following information carefully regarding your rights as a participant. An interview protocol has been developed for this study. Each participant will be asked to take part in an open-ended interview that will follow the protocol. The protocol is meant to standardize the interviews, but the interviewer may ask follow-up questions related to the knowledge, and/or insight of the individuals. Depending on the location of your school, these interviews will be conducted either in person, over the phone, or Skype. Each interview will last 30 minutes and will be recorded. A list of the interview questions will be e-mailed to you one week before the scheduled interview. As a participant, you will be given the opportunity prior to the interview to ask questions about the research project. If necessary, you may take a break at any time during the interview.

Confidentiality will be strictly maintained. Only the principal investigator and co-investigator will have access to the recordings and transcriptions. Research materials will be kept up to seven years at which time they will be destroyed. The potential risk to participants in this study is extremely low. You are free to not answer any questions you may find objectionable. It is important that you understand that your participation is completely voluntary. This means that even if you agree to participate you are free to withdraw from the study at any time, or decline to participate in any portion of the study, without penalty.

The researcher will contact you to confirm your preferred availability for the interview. A copy of the questions will be sent one week prior to the scheduled interview to the contact information provided below. If you have questions please contact Dana Susko by email at dsusko@bu.edu or Donna Lehr by email at dlehr@bu.edu. You may also obtain further information about your rights as a research subject by calling the BU CRC IRB Office at 617-358-6115.

If you have understood the above statements, please reply to this email to indicate your consent to participate in this study. In your reply, please indicate your available dates and times to participate in the interview and if you prefer phone or Skype. I would appreciate your involvement.

Thank you for your time,
Dana Susko

## Appendix L

Informed Consent for Department Heads

My name is Dana Susko and I am a graduate student in the field of Educational Media and Technology at Boston University. As part of the research for my dissertation, I am interested in learning about how the best institutions with undergraduate, preservice education programs are integrating the use of technology in teaching and learning situations. Because your institution has been identified as one of the top programs in the country, I would like to request your participation in this study. I am contacting you as the chair or department head for your involvement in a 30-minute interview. In addition to your interview, I have already interviewed the dean or associate dean in your school or college of education or he or she has suggested that I contact you.

Please read the following information carefully regarding your rights as a participant.

An interview protocol has been developed for this study. Each participant will be asked to take part in an open-ended interview that will follow the protocol. The protocol is meant to standardize the interviews, but the interviewer may ask follow-up questions related to the knowledge, and/or insight of the individuals. Depending on the location of your school, these interviews will be conducted either in person, over the phone, or Skype. Each interview will last 30 minutes and will be recorded. A list of the interview questions will be e-mailed to you one week before the scheduled interview. As a participant, you will be given the opportunity prior to the interview to ask questions about the research project. If necessary, you may take a break at any time during the interview.

Confidentiality will be strictly maintained. Only the principal investigator and co-investigator will have access to the recordings and transcriptions. Research materials will be kept up to seven years at which time they will be destroyed. The potential risk to participants in this study is extremely low. You are free to not answer any questions you may find objectionable. It is important that you understand that your participation is completely voluntary. This means that even if you agree to participate you are free to withdraw from the study at any time, or decline to participate in any portion of the study, without penalty.

The researcher will contact you to confirm your preferred availability for the interview. A copy of the questions will be sent one week prior to the scheduled interview to the contact information provided below. If you have questions please contact Dana Susko by email at dsusko@bu.edu or Donna Lehr by email at dlehr@bu.edu. You may also obtain further information about your rights as a research subject by calling the BU CRC IRB Office at 617-358-6115. If you have understood the above statements, please reply to this email to indicate your consent to participate in this study. In your reply, please indicate your available dates and times to participate in the interview and if you prefer phone or Skype. I would appreciate your involvement.

Thank you for your time,
Dana Susko

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