TECHNOLOGICAL, PEDAGOGICAL, CONTENT KNOWLEDGE (TPACK): AN EXPLORATORY STUDY OF ADJUNCT FACULTY TECHNOLOGY PROFICIENCY

by

DAVIN V. KNOLTON

B.S., Austin Peay State University, 1986
M.S., Central Michigan University, 2001

AN ABSTRACT OF A DISSERTATION

Submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Educational Leadership
College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

2014

ABSTRACT

In an era of increasing demand for a limited budget, more universities are turning to adjunct faculty to fill the need and to address the student load. Adjunct faculty members are hired for their content knowledge and close association to the business world and industry. This study was conducted to investigate whether a relationship exists between (a) technological pedagogical content knowledge (TPACK); (b) pedagogical training; and (c) personal technology; and to determine which variables have the greatest influence in the willingness of adjunct faculty at a Midwestern higher education institution to choose and integrate digital technology into curriculum and expand to the discussion of TPACK into graduate level education.

TPACK is both a framework and an instrument to measure the level of integration of the primary components of the TPACK framework. TPACK is a term that describes what a teacher must know to integrate technology effectively into curriculum or teacher practices and represents the combination of teacher content knowledge, pedagogical knowledge and technology knowledge as interrelated. TPACK allows educators to consider what knowledge is required to integrate technology into teaching and how they might develop that knowledge within themselves.

The study was conducted with a sample (n=30) of adjunct faculty members from two extension campuses from a Midwestern, Tier 1 university. The data revealed significant relationships between pedagogical training and selection of appropriate technology, and between personal technology use and selection of appropriate technology. The data also revealed that TPACK was a significant predictor; however, the subdomains of TPACK masked the true impact because of the high presence of covariance.

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LIST OF ABBREVIATIONS

ABE – integration in adult basic education

ASUW – Arizona State University West

DVD – digital video disks

ICT – information and communications (computer) technology

PT3 –Preparing Tomorrow's Teachers to Use Technology

NCES – National Center for Education Statistics

NETP – National Educational Technology Plan

NETS-T – National Educational Technology Standards for Teachers

OET – Office of Educational Technology

PK – pedagogical knowledge

PLS – personal technology usage/Personal Life STEMS

Preservice Teacher-TPACK – Preservice Teacher-Technological Pedagogical Content Knowledge

SCS – Second Chance School

SPSS – Statistical Package for Social Sciences

SRL – self-regulated learning

TK – technological knowledge

TPCK/TPACK – technological pedagogical content knowledge

TPASK – technological pedagogical science knowledge

TPCK-SRL – technological pedagogical content knowledge–self-regulated learning

TPB – theory of planned behavior

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challenged your patience from the first class through the defenses, thank you forever. Can I breathe now?

CHAPTER 1 – INTRODUCTION

Introduction

Consider the story of a seasoned and tenured classroom professor that was given the task of teaching an online course in 2003. The teacher was given a textbook, log on instructions for the course management system, and was told to “have at it” (King & Cox, 2011). Furthermore, according to King and Cox (2011) this feeling of not being prepared to teach technology continues to be a source of concern for instructors. This study sought to investigate whether a relationship exists between technological knowledge (TK) and pedagogical training and which variables have the greatest influence on the willingness for adjunct faculty in a higher education institution in integrating educational technology into their curriculum.

This chapter begins with an overview of the background of the problem that frames the study. Following this overview is the statement of the problem, the purpose of the study, the accompanying research questions, the significance of the study, and a brief overview of the research design. The chapter concludes with operational definitions of key terminology used throughout the study.

Background

According to Townsend, DeMarie, and Hendrickson (1998), “Managers in the workplace are challenged to develop strategically flexible organizations in response to increasingly competitive marketplace” (p. 17). With the advent of a new generation of information and communications technology (ICT), new organizational forms that would not have been feasible only a decade ago can be formed virtually and will not be constrained by geography, time, and organizational boundaries (Townsend et al., 1998). Consequently, in the *National Educational Technology Plan* (*NETP*), the U.S.

Department of Education, Office of Educational Technology (OET, 2010) recognized that technology is at the core of virtually every aspect of our daily lives and work, and we must leverage it to provide engaging and powerful learning experiences and content.

The "use of technology in education is not new . . . [and] successive waves of technological innovations have forced changes in conventional methods and tools of education" (Demirbilek, 2010, p. 238). Technology in education is often perceived as how many computers or videocassette recorders are in a classroom and how they might be used to support traditional classroom activities, but this is a misleading and potentially dangerous interpretation. It not only places an inappropriate focus on hardware, but it also fails to consider other potentially useful *idea* technologies that result from the application of one or more knowledge bases (e.g., learning theory; Hooper & Rieber, 1995). According to Bell (2001),

> The U.S. Department of Education has concluded that preparing technology-proficient educators to meet the needs of 21st-century learning is a critical educational challenge facing the nation. For example, more than two thirds of the nation's teachers will be replaced by new teachers over the next decade; therefore, it is crucial to ensure that the next generation of future teachers emerging from the nation's teacher education programs is prepared to meet this challenge. (p. 517)

It is widely suggested, and in some respects accepted, that a so-called Net Generation of students is passing through our universities (Kennedy et al., 2009).

> Digital technology is native to their [Net generation] culture and being . . . . They have spent their entire lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age. (as cited in Prensky, 2001, p. 1)

Warschauer and Liaw (2010) asserted that, over the last decade, digital technologies have gone from being an optional tool for the few to a required tool for the majority. According to the Center for Research and Education on Aging and Technology Enhancement, the successful adoption of technology is becoming increasingly important to functional independence, and not being able to use technology (e.g., computers or the Internet) puts older adults at a disadvantage regarding their ability to live and function independently and to perform everyday tasks successfully (Czaja et al., 2006). As technology becomes more available, the combination of wireless technology and mobile computing results in changes to the learning environment (Alexander, 2004).

According to Charlier and Williams (2011), higher education institutions are increasingly dependent upon using adjunct faculty. Between 1975 and 1995, the number of adjunct faculty doubled and, between 1997 and 2007, the number of adjuncts rose to almost 64% in associate degree granting institutions (Charlier & Williams, 2011). According to the U.S. Department of Education, National Center for Education Statistics (NCES; 2012), 50% of higher education faculty was composed of part-time or adjunct faculty. Lei (2009) asserted that the U.S. Department of Education had awarded more than $275M for the Preparing Tomorrow's Teachers to Use Technology (PT3) program and 441 grants since 1999 to prepare teachers to teach 21st century students. Lei (2009) also pointed out that "besides hardware, teacher technology professional development remains the most common top priority educational technology expenditure in most states" (p. 87).

In his handbook for training program directors, Mitchell (1997) suggested using external staff or adjunct faculty in educational programs, and further proposed five reasons for hiring outside consultants: expertise, short-term expansion of staff, political leverage, cost-effectiveness, and opportunities for internal staff to learn new skills and competencies. Regarding community colleges, Wyles (1998) reported that "higher education has become structurally dependent on part-time faculty and that while trying to meet the community college's challenge—meeting escalating demands with declining resources—has resulted in spiraling increases in part-time faculty hiring" (p. 89).

According to Mitchell (1997), adjunct faculty members were originally meant to bridge the gap of student demand with a short-term expansion of staff or provide a cost effective solution in a program. Adjunct faculty in higher education is often hired to maintain close ties with business and industry; therefore, many adjuncts are practitioners in the field in which they are teaching (Wyles, 1998). Wyles' (1998) findings are consistent with the U.S. Department of Education, NCES (2012) survey that reports a rising trend both nationally and across all disciplines that colleges and universities are hiring an increasing number of part-time and adjunct faculty members (Charlier & Williams, 2011; Fagan-Wilen, Springer, Ambrosino, & White, 2006; Fjortoft, Mai, & Winkler, 2011; Wyles, 1998). Fagan-Wilen et al. (2006) identified that universities employ an increasing number of adjunct faculty as social work faculty and that universities fill more than 40% of all faculty positions across the university and across disciplines with part-time or adjunct faculty.

Charlier and Williams (2011) reported that enrollment in community colleges has increased and budgets have decreased; therefore, employing adjunct faculty is a critical part of many college institutional plans. Charlier and Williams (2011) also reported that "with 54.85% of faculty members in average sized community colleges were employed part-time and carried 30.17% of the teaching load and larger institutions employed an average of 68.25% adjunct or part-time faculty teaching 42.54% of the institutional load" (p. 163).

Brand (1998) stated,

> According to the U.S. Congress, Office of Technology Assessment (1995), the lack of teacher training is one of the greatest roadblocks to integrating technology into a school's curriculum. That same report revealed that most school districts spend less than 15% of their technology budgets on teacher training and professional development. (p. 1)

With the increasing number of faculty–practitioners [adjunct faculty] in higher education, faculty coordinators or faculty development staff in higher education programs must adjust professional or faculty development time to account for their increasing the overall effectiveness and ability to transfer their expertise to an increasing number of next generation adults who are entering higher education programs (Chen, 2012; Lester, 2011; Richter, Kunter, Klusmann, Ludtke, & Baumert, 2011). As more adjunct faculty members are employed, the need increases to ensure that all faculty members are technologically trained to a sufficient standard to meet the needs of a technologically savvy generation of learners; therefore, Chen (2012) stated that professional development becomes essential for teachers to learn new skills and to reach out for efficient teaching resources.

The complexity of the higher education environment had escalated; therefore, the Association of College and Research Libraries (2000) published *Information Literacy Competency Standards for Higher Education* (American Library Association, 2000). Although aimed at the individual level, the standards preceded Brandt's (2001) research that described the importance of information technology literacy as a precursor to information literacy, and the International Society for Technology in Education (2000) published the first *National Educational Technology Standards for Teachers* (*NETS-T*).

According to Georgina and Hosford (2009), "In the beginning of the IT [information technology] movement, little consideration had been given to authentic faculty training" (p. 690). Likely, the assumption was that the faculty would learn to use the system to accommodate their instructional needs. According to Georgina and Hosford (2009), faith in the faculty's ability appeared to outweigh the reality of learning a new paradigm. When observing faculty technology training opportunities, Georgina and Hosford (2009) discovered that 94.9% of the faculty surveyed from the Colleges of Education of 15 universities reported that their universities offered some form of faculty technology training. However, only 50.4% attended university-sponsored technology trainings *to some extent* and only 7.2% of faculty claimed that they attended to *a very great extent*. This low percentage might help to explain why more than 33.4% of faculty surveyed preferred to teach in a traditional classroom without the integration of technology (Georgina & Hosford, 2009).

According to Keengwe and Georgina (2012), in higher education a critical concern yet remains that IT training focuses more on the technical point and click aspects of a learning management system platform without concern for the content of the course. Brandt (2001) asserted that a "technologically fluent person must be able to understand technology broadly enough to apply it to everyday usage and recognize when IT can assist or impede in the achievement of a goal" (p. 74). Therefore, teacher education should be more than just demonstrating the latest technology, but rather should enable teachers to understand how technology can assist students to meet required curriculum standards (Okojie & Olinzock, 2006).

Congruent with Okojie and Olinzock (2006), Means (2010) argued, "Despite decades of national, state, and local promotion of educational uses of technology, classroom practice in most schools has changed little from that of the mid-20th century" (p. 285). Although some schools have developed technology training for faculty, a comparative analysis of technology use in the classroom from 2003 to 2007 showed that technology use increased only from 17% to 22% with faculty as the primary impediment (Tamim, Lowerison, Schmid, Bernard, & Abrami, 2011). With so much money allotted to education and technology, King and Cox (2011) asked how this could happen. According to Wetzel and Williams (2005), Arizona State University West (ASUW) sought to understand why students who graduated from their program did not feel prepared to teach with technology. The two major reasons that they felt unprepared were that the "graduates had not seen exemplary modeling of using technology effectively by their faculty and did not find it used when they entered the field" (Wetzel & Williams, 2005, p. 45). Teacher professional development has been one of the enduring themes over the past 20 years and is often highlighted in these reports as the single most important step toward the infusion of technology into education (Culp, Honey, & Mandinach, 2005).

Statement of the Problem

Many institutions rely heavily on adjunct faculty (Caffarella, 2002; Charlier & Williams, 2011; Fjortoft et al., 2011; Latta, 2004; Schneider, 2004; Todd, 2004). Additionally, using technology has been shown to be important in the workplace (Alexander, 2004; Czaja et al., 2006; Laru & Järvelä, 2008; Madigan, 2006; Warschauer & Liaw, 2010). According to Georgina and Hosford (2009), only a small percentage of faculty members attend technology training provided. The TPACK framework research with Kindergarten–Grade 12 (K–12) teachers documents a disconnection between technology, pedagogy, and content (Angeli & Valanides, 2005; Greenhow, Dexter, & Hughes, 2008; Hofer & Swan, 2006; Kanuka, 2006; Mishra & Koehler, 2006). Although applicable to other settings such as preservice teacher education and elementary education (Borthwick et al., 2008; Chai, Koh, & Tsai, 2010; Foulger & Williams, 2007; Koehler, Mishra, & Yahya, 2007), the TPACK framework and instrument has not been used with adjunct faculty of graduate programs at American higher education institutions to assess their understanding of technology, pedagogy, and content integration.

Thus, adjunct faculty have not incorporated technology into curriculum; therefore, in this study, the researcher investigated using the TPACK framework and instrument to determine (a) whether a difference existed between technology selections of adjunct faculty who are pedagogically trained and those that are not; (b) whether and to what extent personal technology use (PLS) influences adjunct faculty willingness to integrate technology; and (c) which of these variables have the greatest influence of predicting adjunct faculty's integration of technology into curriculum.

Purpose of the Study

The purpose of this quantitative study was to investigate whether a relationship exists between (a) TPACK subdomains, (b) pedagogical training, and (c) personal technology. Furthermore, this researcher sought to determine which variables have the greatest influence in the willingness of adjunct faculty at a higher education institution to choose and integrate digital technology into curriculum.

Research Questions

In this study, the researcher has asked three research questions. They are listed with their accompanying null hypotheses:

1. Research Question 1: Does a difference exist in faculty who rate themselves higher on the pedagogical knowledge (PK) scale compared to faculty who rate themselves lower on the PK scale in selecting appropriate digital technology for classroom learning outcomes?

Stated as a null hypothesis:

- H_0: No statistically significant difference exists between faculty who rate themselves higher on the PK scale compared to faculty who rate themselves lower on the PK scale in selecting appropriate digital technology for classroom learning outcomes.

2. Research Question 2: Does a difference exist in classroom technology integration between faculty who use technology in their private lives and faculty who do not use technology in their private lives in classroom technology integration?

Stated as a null hypothesis:

- H_0: No statistically significant difference exists between faculty who use technology in their private lives and faculty who do not use technology in their private lives in classroom technology integration.

3. Research Question 3: Does PK, TK, PLS, or classroom technology integration predict using technology in curriculum?

Stated as a null hypothesis:

- H_0: Pedagogical knowledge, TK, PLS, and classroom technology integration score do not predict using technology in curriculum.

Significance of the Study

In this study, the researcher presents evidence that adds to the body of literature in the area of integrating technology into educational curriculum and expands the discussion of TPACK as a framework and as an instrument measuring technology integration. Additionally, the researcher presents evidence that that TPACK framework can be expanded into graduate level education. Recent TPACK framework research has centered on preservice training and education for teachers entering the elementary and secondary fields and with competing research to determine the validity of the TPACK as a beneficial framework (Archambault & Barnett, 2010). Although the TPACK framework has proven beneficial in the areas of elementary and secondary preservice education, little or no identifiable research demonstrates using the TPACK framework for adjunct faculty in a part-time teaching role in choosing appropriate technology for educational outcomes. Therefore, one of the primary goals of this research is to investigate which factors influence or help predict adjunct faculty's willingness to incorporate appropriate technology into their curriculum, which in turn provides better curriculum and progressive educational measures in the classroom for their adult student populations (Mishra & Koehler, 2006).

According to Donnelly (2010), in higher education institutions, using online technologies has become an increasingly important challenge in academic staff development. Furthermore, Donnelly (2010) stated, "It is important to seek best practices for how to combine instructional strategies in face-to-face and computer-mediated environments that take advantage of the strengths of each and avoid their weaknesses" (p. 350). Higher education faculty development program directors responsible for implementing online, e-learning, m-learning, and blended learning may benefit from this study.

Assessment of the factors that influence adult educators for integration of technology into curriculum might assist educational technologist and program developers to plan for education. This study might also inform the training of adjunct faculty and assist adjunct faculty in merging effective pedagogical strategies for adult learners to engage with curriculum in a more active manner and increasing their student's ability for knowledge construction and making of meaning.

Research Design Overview

This research is a quantitative, pre-experimental, static group comparison, research design (Campbell & Stanley, 1963), which is also known as a nonexperimental, quantitative, cross-sectional, predictive study, research design (Johnson & Christensen, 2014). An independent sample *t* test and a multiple logistic regression were the primary quantitative analyses performed. A static group comparison design does not include the random assignment of participants; therefore, it is considered a pre-experimental design. According to Johnson and Christensen (2014), a nonexperimental, quantitative, cross-sectional, predictive study, research design is a type of design that is focused on the primary research objective in which the independent variable is not manipulated and the participants are not randomly assigned. Additionally, in cross-sectional research, data are collected from research participants at a single point in time or during a single brief period, the data directly apply to each case at that period, and comparisons are made across the variables of interest (Johnson, 2001).

The study was conducted at two, small, Midwestern, graduate degree granting, extension campuses from a Midwestern university that followed the Carnegie classification guide is a Tier 1 institution. Although the main campus is not a Tier 1 institution, both extension campuses in the State of Kansas are Tier 1 institutions. The population and sample consists of adjunct faculty employed by the university on a course-by-course basis. The university offers no formal, faculty mentorship program. However, the university does offer an optional, online course for how to use the learning management system. The university provides an annual, mandatory, faculty development meeting; however, this meeting is generally relegated to administrative matters.

Campus A generally employees 58 adjunct faculty members and offers the following degrees:

- Master of Business Administration.
- Master of Arts in Business and Organizational Security Management.
- Master of Arts in Human Resources Management.
- Master of Arts in Information Technology Management.
- Master of Arts in International Relations.
- Master of Arts in Management.
- Master of Arts in Procurement and Acquisitions Management,

Campus B generally employees 11 adjunct faculty and offers the following degrees:

- Master of Business Administration.
- Master of Health Administration.
- Master of Arts in Human Resources Development.
- Master of Arts in Human Resources Management.
- Master of Arts in Management and Leadership.

At each campus, classes meet one night per week for 4 hours. Each course is 8–10 weeks in length. Each class meets face to face with students, who generally take one or two courses per term.

A self-report digital survey instrument delivered via Survey Monkey™ was be used to collect the data. Multiple regression analysis was accomplished to determine a correlation between the predictor variables (pedagogical training, technological training, PLS, and technological content knowledge [TCK]) and the criterion (the integration of appropriate technology into curriculum).

Limitations of the Study

This study has six limitations:

1. Participants might have more subjective responses because of social desirability.
2. All faculty members in this study are adjuncts.
3. The population sample is limited to the adjuncts who respond to the survey.
4. The population in this study is contracted on a course-by-course basis in an accelerated program at one institution and may only be directly generalizable to that one institution.
5. The results might not be generalizable to institutions with full-time adjuncts.
6. Population size is small and was underrepresented by females and ethnic minorities; therefore, the results might not be generalizable to other institutions.

Definition of Terms

Adjunct faculty. Non-tenure track faculty serving in a temporary or auxiliary capacity to teach specific courses on a course-by-course basis. Excludes regular part-time faculty graduate assistants, full-time professional staff of the institution who might teach individual courses (such as a dean or academic advisor), and appointees who teach noncredit courses exclusively (U.S. Department of Education, NCES, 2012).

Blended learning. Combines face-to-face instruction with computer-mediated instruction (Bonk & Graham, 2006).

Constructivism. Inquiry based learning methods based on cognitive, development and problem solving. Constructivists believe that learning occurs when one constructs both mechanisms for learning and using his or her own background knowledge influenced also by attitudes values and beliefs (Roblyer & Doering, 2013).

Integration of technology into curriculum. The combination of technology (digital tools) and pedagogical techniques into the learning process to facilitate educational needs (Roblyer & Doering, 2013).

Effective integration of technology into curriculum. This integration is achieved when knowledge of both the activity structures and types that are appropriate for teaching specific content and the manners in which particular technologies can be used as part of the lesson, project, or unit design (Harris, Mishra, & Koehler, 2009).

Content knowledge. This knowledge is the actual subject matter that is to be taught and learned (Mishra & Koehler, 2006). Content knowledge (CK) includes the understanding of subjects taught; knowledge of central facts, concepts, theories, and procedures within a given field; knowledge of explanatory frameworks that organize and connect ideas; and knowledge of the rules of evidence and proof (Shulman, 1986; Mishra & Koehler, 2006).

Pedagogical knowledge. This knowledge is deep knowledge about the processes and practices or methods of teaching and learning and how they encompass,, among other things, overall educational purposes, values, and aims (Mishra & Koehler, 2006). PK is also a generic form of knowledge that is involved in all issues of student learning, classroom management, lesson plan development and implementation, and student evaluation (Mishra & Koehler, 2006). PK includes knowledge about techniques or methods to be used in the classroom; the nature of the target audience; and strategies for evaluating student understanding, and requires an understanding of cognitive, social, and developmental theories of learning and how it is applied to learners (Mishra & Koehler, 2006).

Technology knowledge. TK is of operating systems and computer hardware, and the ability to use standard sets of software tools such as word processors, spreadsheets, browsers, and e-mail (Mishra & Koehler, 2006). TK also includes knowledge of how to install and remove peripheral devices, install and remove software programs, and create and archive documents (Mishra & Koehler, 2006).

Pedagogical content knowledge. Pedagogical CK (PCK) is different for various content areas. PCK blends both content and pedagogy with the goal being developed to promote better teaching practices, and overall it addresses the teaching process (Shulman, 1986).

Technological content knowledge. TCK is of how technology can create new representations for specific content (Schmidt et al., 2009).

Technological pedagogical knowledge. Technological PK (TPK) refers to how various technologies can be used in teaching, and to understanding that using technology might change the way instructors teach (Schmidt et al., 2009).

Technological pedagogical content knowledge. According to Schmidt et al. (2009), technological PCK (TPCK) can be defined in three ways:

> 1) Formerly known and referred to as TPCK. As a domain within the TPACK framework, technological pedagogical content knowledge refers to the knowledge required by instructors for integrating technology into their teaching in any content area. Instructors have an intuitive understanding of the complex interplay between the three basic components of knowledge (CK, PK, TK) by teaching content using appropriate pedagogical methods and technologies.
>
> 2) As the encompassing framework from which an instructors' integration of the domains of CK, PK, and TK).

3) As the instrument measuring instructors' integration of the domains of CK, PK, and TK.

Summary

In this chapter, the researcher provides an overview of using adjunct faculty, and how adjunct faculty has grown to become 50% of the teaching staff of an average higher educational facility (U.S. Department of Education, NCES, 2012). Professional development programs vary from institution to institution; however, using online technologies has become an increasingly important challenge in academic staff development (Donnelly, 2010). At a Midwestern institution, the researcher explored whether a relationship exists between (a) TPACK subdomain, (b) pedagogical training, and (c) personal technology; and which variables have the greatest influence in the willingness of adjunct faculty to choose and integrate digital technology into curriculum. An overview of the TPACK framework is provided in Chapter 2 along with how it relates to adult and higher education.

CHAPTER 2 – REVIEW OF THE LITERATURE

Introduction

The purpose of this quantitative study is to investigate with adjunct faculty whether a relationship exists between (a) TPACK subdomain, (b) pedagogical training, (c) personal technology, and which variables have the greatest influence in the willingness of adjunct faculty at a higher education institution to choose and integrate digital technology into curriculum. The researcher outlines the literature review related to this study. In the first section, the researcher reviews the TPACK as the theoretical framework for this study, and the evolution of the TPACK instrument. The second section contains a review of literature surrounding adult learning theory and the TPACK framework's ties to constructivism. The third section contains a review of literature surrounding the trends of integrating digital technology into education and curriculum.

A significant and growing body of research exists on the integration of digital technology into education curriculum. Integrating technology research ranges from technology in the classroom and educational technology to specific teacher educational preparation courses to match digital technology to course material (Graham et al., 2009; Leh, 2005; Markauskaite, 2010). Technology integration has become the phrase that characterizes the efforts to use technology in an educational context (Graham et al., 2009).

Digital technology is employed across a wide area of educational environments; therefore, many researchers have explored the premise that technology effectiveness is greater than cutting-edge hardware or software. Okojie, Olinzock, and Okojie-Boulder (2006), stated that integrating technology into the teaching and learning process is a perennial issue, and that technology used for teaching and for learning should be considered as an integral part of instruction, rather than as an exclusive object.

Therefore, the researcher investigated the potential application of the TPACK framework that Mishra and Koehler (2006) developed, and that is used predominately as a teacher preservice preparation tool for elementary education. The researcher also sought to determine whether a difference exists between the technology that pedagogically trained faculty selected to be integrated into curriculum and the technology that nonpedagogically trained faculty select to be integrated into curriculum. The comparison included the trends, perceptions, and decision-making abilities of the faculty in using digital technology in the classroom.

Theoretical Framework: Technological Pedagogical Content Knowledge

TPACK is a framework, an instrument to measure the level of integration of the primary components of the TPACK framework, and a subdomain contained in the TPACK instrument. In this study, TPACK is described as what a teacher must know to effectively integrate technology into curriculum (i.e., teacher practices), and it represents the combination of teacher CK, PK, and TK as interrelated. TPACK allows educators to consider what knowledge is required to integrate technology into teaching and how they might develop that knowledge within themselves. Mishra and Koehler (2006) applied this framework to both preservice and in-service training and education. Building on Shulman's (1986) CK, Mishra and Koehler (2006) identified TPACK as a framework:

> The basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to

> build on existing knowledge and to develop new epistemologies or strengthen old ones. (p. 1029)

According to Mitchell (1997), the higher education environment presents a unique challenge to educators because 50% of higher education faculty are adjuncts who were hired primarily for their CK or subject matter expertise. Shulman (1986) referred to this knowledge base (i.e., subject matter expertise) in the early concept of CK. Shulman (1986) described the paradigm then in which administrators and policy makers were debating concerns about the professional certification of teachers, about which a sharp distinction existed in CK and PK. Shulman (1986) further stated a need for a more coherent theoretical framework that would show how CK and PK are related. In defining CK, Shulman (1986) said that CK refers to "the amount and organization knowledge in the mind of the teacher and that there are ways of representing that knowledge for students" (p. 9). Shulman (1986) then tied this concept to Bloom's (1956) cognitive taxonomy and understanding of structuring subject matter.

Responding to the Holmes Group (1986) and the Carnegie Task Force (1986) who studied public teacher improvement, Shulman (1987) said that teaching begins with teachers understanding what must be learned and how it must be taught, introducing the idea that a general pedagogical understanding is needed, regardless of the type of faculty who might be teaching. Shulman (1987) advocated a connection or correlation between CK and PK. This correlation is often represented by two circles intersecting each other (Figure 1) and is the basis for the evolution of the PCK.

Shulman (1987) introduced this idea of a correlation between CK and PK while conducting research in conjunction with a Carnegie initiative for the reform of the teaching profession while studying a way to develop a national board assessment for teachers that would be similar to the certification boards for doctors. Through these investigations, Shulman (1987) determined how "particular kinds of content knowledge and pedagogical strategies interacted within the minds of teachers" (p. 5). Shulman (1987) also indicated, "The essential goal of the research conducted was to identify those teacher behaviors and strategies most likely to lead to achievement gains among students" (p. 10), which connects content and PK to effective teaching. Shulman (1987) argued that CK and PK could not be treated independently.

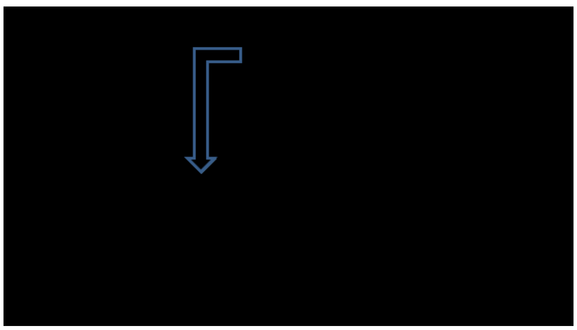

Figure 1. Pedagogical content knowledge (PCK). The two intersecting circles representing pedagogical content knowledge as the correlation of content knowledge and pedagogical knowledge.

Building on Shulman's (1987) assertion regarding pedagogical CK, Koehler and Mishra (2005) introduced the conceptual framework of integrating educational technology into pedagogy: TPACK. This framework adds technology knowledge as a key component of what teachers should know for integrating technology into their pedagogy. By adding technology knowledge to the two original component areas of CK and PK, Mishra and Koehler (2006) created a diagram of the three base components (Figure 2).

The addition of technology knowledge brings a new intersection, creating a special form of knowledge: TPACK (Figure 3). This framework was the result of Mishra and Koehler's (2006) 5-year study that was focused on teacher professional development and faculty development in higher education. Mishra and Koehler (2006) asserted that technological research then was focused more on the introduction of technology into the educational process and not sufficiently on "what teachers need to know in order to appropriately incorporate technology into their teaching" (p. 1018).

Figure 2. The three basic components of TPACK as three intersecting circles representing content knowledge, pedagogical knowledge, and technology knowledge.

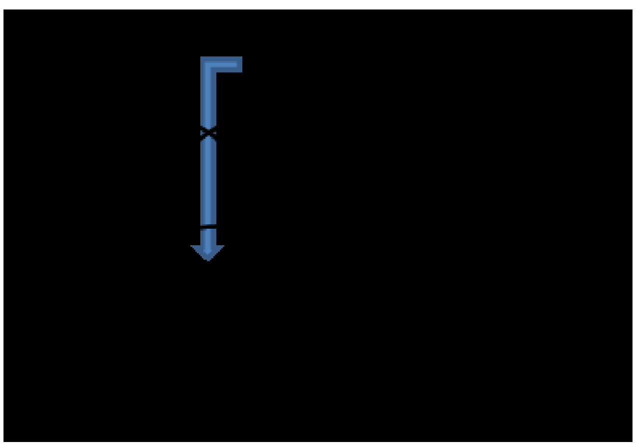

Figure 3. The formation of technological pedagogical content knowledge. The three intersecting circles representing content knowledge, pedagogical knowledge, and technology knowledge result in technological pedagogical content knowledge.

Mishra and Koehler (2006) extended Shulman's (1987) conceptual vision of PCK to include technology as interrelated and to begin to define distinctly educational technology's role in the pedagogical practice. Mishra and Koehler (2006) stated:

> Our framework emphasizes the connections, interactions, affordances, and constraints between and among content, pedagogy, and technology. In this model, knowledge about content (C), pedagogy (P), and technology (T) is central for developing good teaching. However, rather than treating these as separate bodies of knowledge, this model additionally emphasizes the complex interplay of these three bodies of knowledge. (p. 1025)

Furthermore Mishra and Koehler (2006) extended the conceptual comparison by not only comparing the base three components, but also examining the pairwise interrelationships resulting in three base components, three intersecting pairs, and the final consolidation of the three pairs into the resulting triad of TPCK demonstrating the complex interrelationship of the three base components. According to Mishra and Koehler (2006), the result is the following:

> TPCK is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones. (p. 1029)

Furthermore, Mishra and Koehler (2006) outlined, "No single technological solution applies to every teacher, every course, or every view of teaching" (p. 1029). Polly and Brantley-Dias (2009) asserted that the TPACK framework presents a robust way of thinking about effective technology integration, specifically integrating effective technology into learning environments. However, they also agree that the TPACK framework presents a complex environment and further research should address the various complex relationships of the TPACK components.

The Milken Exchange on Education Technology (1999), after conducting several surveys, including a meta-analysis of over 700 previous research publications, concluded that evidence exists that learning technology is less effective or ineffective when the learning objectives are unclear and the focus of technology is diffuse. As Roblyer and Doering (2013) asserted, “Teachers always will be more important than technology” (p. 10), and “We need more teachers who understand the role technology plays in society and education, who are prepared to take advantage of its power and who recognize its limitations” (p. 10).

Thompson and Mishra (2007) changed TPCK to TPACK to articulate more accurately the interrelationship of the components or domains. Using the TPACK framework, Schmidt et al. (2009) developed a TPACK instrument for measuring preservice teachers’ self-assessment of their TPACK and related domains included context in the TPACK framework. Furthermore they asserted that the framework could potentially have an impact on the type of training and professional development of both preservice and inservice teachers. As the TPACK framework became more cohesive, Mishra and Koehler (2006) adjusted the TPACK diagram to demonstrate the framework within subject context as in Figure 4.

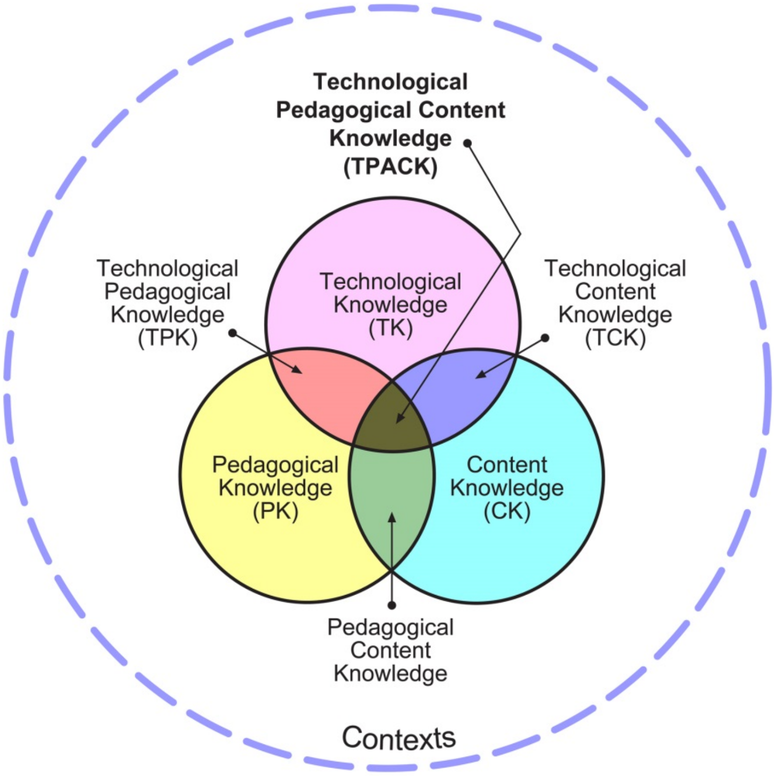

Figure 4. The technological pedagogical content knowledge (TPACK) framework, including context. The TPACK framework represents all seven domains in contexts. From http://www.tpack.org. Copyright 2012 by tpack.org. Used with permission.

Consequently, Shin et al. (2009) conducted a study to investigate whether in-service teacher beliefs about teaching, technology, and the TPACK concept changed after receiving a focused, three-course series of face-to-face and online educational technology courses over a 6-week period. As seen in the prior paragraphs, teacher experience and knowledge have an impact upon a teacher's teaching and classroom instructional actions. The study extended the previous work of several studies conducted in the prior 4 years that used TPACK as the framework. Using TPACK as the framework Shin et al. (2009), conducted a one-group pretest–posttest design using Campbell and Stanley's (1963) research design to see how the teachers viewed the relationship between technology, content, and pedagogy. The experiment participants were comprised of 23 mostly in-service teachers with several years of teaching experience enrolled as students in masters-level courses. Pretest and posttest survey scores in each subcomponent of the TPACK framework were compared using a dependent samples *t* test. The results demonstrated an increase in students overall technology knowledge while their knowledge of content and pedagogy did not increase. However, students understanding of the relationship between technology, pedagogy, and content (TPACK) did improve. The study also concluded that using the TPACK survey instrument as a measuring tool for the integration of technology into curriculum could be used. Although Shin et al. (2009) admitted that some limitations to this study exist, the experiment adds to the overall body of knowledge of the TPACK framework and, as importantly, it demonstrates that the more teachers understand the complex relationship between technology, pedagogy, and content there are better opportunities to develop effective integration of technology into curriculum for in-service teachers.

Cox and Graham (2009) conducted a conceptual analysis of the TPACK framework to help clarify a growing concern over the definitions of the subcomponents of TPACK. According to the authors, a conceptual analysis is usually conducted in an effort to add to the common understanding of words and concepts. During their research, Cox and Graham developed both general and precise definitions for each subcomponent of TPACK and compared the definitions to several case studies to explore whether the meanings matched the concepts and whether the concepts could be matched to the case study scenarios. The result was an elaborated model of the TPACK framework informed by the extensive work of Koehler and Mishra (2005); Harris et al. (2009); Koehler, Mishra, and Yahya, (2007); Angeli and Valanides (2009), and Shin et al. (2009). Cox and Graham (2009) concluded that PCK, as envisioned by Shulman (1987) was "content specific pedagogy and not a general knowledge of pedagogical methods" (Cox & Graham, 2009, p. 63) and that "technological knowledge is focused on emerging technology and thus is measured on a sliding scale depending on the technology of the time" (Cox & Graham, 2009, p. 63). In their conclusions, they raised three issues. First, they felt that it was essential to use the new precise definitions and the elaborated model to conduct in-depth case studies with practicing teachers. Second, the grade level of the teacher and levels of TPACK needed to be explored. Third, for teacher preparation programs, particularly at the secondary level, it is necessary to understand where teachers gain or acquire their TPACK (Cox & Graham, 2009).

In an analysis of 20 years of key policy reports addressing the challenges and opportunities in integrating technology into K–12 education in the United States, Culp et al. (2005) quoted the *A Nation at Risk* (The National Commission on Excellence in Education, 1983) report, which said that all graduating high school students should understand and be able to use the computers of the time (p. 280). Then 20 years later, the No Child Left Behind Act (2001) and the Elementary and Secondary Education Act (2001) "include[d] a recommendation that by the eighth grade all students should be technologically literate and repeatedly references technology as an important source of support for teaching and learning across the curriculum" (p. 280). Culp et al. (2005) concluded that technology literacy means that students should be able to use computers and the technology of the time effectively to support other educational and learning content. Harris et al. (2009) argued that this

> mismatch between educational technology leaders' visions for technology integration and how most practitioners use digital tools is the gap between efficiency applications and a more transformative use of technology since many teachers focus on presentation technology vice technology based curriculum. Simply put many teachers various approaches to technology are more to initiate

> and organize teacher's efforts according to the technology being used rather than the students' needs relative to the curriculum. (p. 395)

Teachers have a need to understand the complex relationship and especially understand the strength and limitations of certain technologies to understand how they support or detract from the students learning. According to Harris et al. (2009), this is especially important in adult education where most adult students must understand how the learning experience applies in their life environment. Harris et al. (2009) concluded that learning about technology is not sufficient; teachers must learn what to do with the technology in the teaching and learning environment. Preservice or in-service training and education has to be balanced to cover the complex relationship of TPACK (Harris et al., 2009).

As the TPACK framework continues to grow in popularity, researchers apply the framework to specific content areas. Jimoyiannis (2010) acknowledged previous research on the need for effective teacher preparation as "an important factor in the successful integration and sustainability of information and computer technology (ICT) in education" (p. 1259). Jimoyiannis (2010) extended the TPACK framework into Technological Pedagogical Science Knowledge (TPASK). This demonstrated how particular content areas apply the TPACK as an overarching framework to view the relationship of content, pedagogy, and technology. Jimoyiannis (2010) supported previous research (Angeli & Valanides, 2009; Cox & Graham, 2009; Culp et al., 2005; Mishra & Koehler, 2006; Shin et al., 2009) that much of educational technology integration is more on using technology as an addition to regular classroom coursework versus selection and integration of effective technology related to the accomplishment of the curriculum. His research confirms that a struggle exists to increase a student's ability to use technology in increasing levels while most teachers continue to focus on the lower levels of just how to use the technology tools rather than integrating the tools into the pedagogical application of the tools.

Jimoyiannis (2010) presented a modification of the TPACK framework as TPASK during his study combining TPACK with authentic learning as an enhanced framework for a science teacher preparation program in Greece in the context of helping teachers in acquiring basic knowledge and skills towards integration of ICT in their classroom. Although the population sample was small (six science teachers with 10–25 years of experience), the results indicated that all participants demonstrated an increase in TPACK knowledge and skills inside their subject matter area and an increase in willingness and confidence to integrate technology into general curriculum. The research shows a flexible application of the TPACK framework into a specific content area that is congruent with the findings presented already on the flexibility of the TPACK framework. According to Jimoyiannis, the ability to measure the integration of effective educational technology is also congruent with assertions that teachers require more specific instruction of the selection and use of technology within curriculum.

Koh, Chai, and Tsai (2010) conducted an experiment to address some of the gaps that they percieved in the development of the TPACK instrument, many of the prior research experiments involved realtively small sample sizes and predominately used a population within the United States. Their research examined the construct validity of a TPACK survey through exploratory factor analysis of responses from 1185 Taiwanese preservice teachers in Singapore. During their research, Koh et al. determined that internal reliability of various TPACK instruments were fairly consistent across the studies they reviewed. They did feel that more studies needed to be accomplished with teachers outside the United States and that larger samples needed to be surveyed. In addition, they identified what they considered as two visible gaps. First, aside from Archambault and Crippen (2009) and Lee and Tsai (2010), studies for construct validity for TPACK surveys [the instrument] were lacking. According to Fabrigar, Wegener, MacCallum, and Strahan (1999) some methodologists believed that an exploratory factor analysis population should be determined by the ratio of variables measured to the number of participants. However, these ratios vary widely from 5:1 to 10:1 and they sometimes come with a minimum population regardless of variable ratio. Koh et al. (2010) proposed, "When three or four measured variables represent each common factor (or grouping) and the communalities are high then accurate estimates of population parameters can be obtained with samples as small as 100" (p. 274). The second gap suggested that the relationship between teachers' demographic profile and TPACK perceptions has not been examined enough.

Therefore, given the gaps Lee and Tsai (2010) determined, Koh et al. (2010) conducted their research using a population of 1664 preservice teachers in their first semester of their teacher education training. Koh et al. developed a 29-question survey and recceived 1185 respondents. Koh et al. conducted an exploratory factor analysis for construct validity, and determined that TK and CK (CK) loaded as separate items, while all other items loaded into three factors of knowledge of teaching with technology, knowledge from critical reflection, and PK instead of the seven components [subdomains] of the TPACK framework. The second conclusion the authors made is that male teachers had greater technology confidence, positive atitude about technology usage, competencey perception and tended to score higher in TK than their female counterparts. It is noteworthy that Koh et al recommend that more comparative studies of generic and subject-specific TPACK surveys be carried out to ascertain the robustness of context-specific TPACK framework items.

According to Archambault and Barnett (2010), any good framework or theory must be tested, proven, and tested again. Therefore, Archambault and Barnett conducted a factor analysis on the TPACK framework using a modified 24-item survey using a population of 596 online teachers from across the United States to test the validity of the TPACK model. Their research suggested that the TPACK framework is helpful from an organizational standpoint, but that it is difficult to separate out each of the domains. Archambault and Barnett (2010) indicated that the "highly accepted seven mutually exclusive domains of the TPACK theory may not exist in practice" (p. 1658) but that "the existence of three factors: pedagogical content knowledge, technological–curricular content knowledge, and technological knowledge" (p. 1658) were reported. The participants did show a connection between technological content, technological pedagogy, and technological pedagogical content questions. However, Archambault and Barnett (2010) stated, "Respondents did not distinguish among these constructs" (p. 1659).

Archambault and Barnett (2010) asserted that the TPACK framework domains are still not clearly understood and could contribute to the difficulty of a teacher's ability to separate the concepts and provide a more definitive response:

It is possible that when experienced educators consider teaching a particular topic, the methods of doing so are considered as part of the content, and when considering an online context, the domain of technology is added to the equation as a natural part of the medium, making it difficult to separate aspects of content, pedagogy, and technology. (Archambault & Barnett, 2010, p. 1659)

Archambault and Barnett (2010) concluded that the TPACK model might be more effective in academia than in actual practice and further assert that the measures might yet be ill defined; therefore, it might be difficult to measure and predict outcomes. Overall, more research must be accomplished to continue to search for ways to prepare teachers for the 21st century and the students they will engage. The TPACK instrument continues to be refined, changed, adapted, and might provide more clarity as each researcher has demonstrated.

Allan, Erickson, Brookhouse, and Johnson (2010) conducted the EcoScienceWorks Project for within Maine's middle school laptop program designed to re-design three existing computer simulations in ecology (SimBiotic Software's EcoBeaker™) and add the capability for students to program their own simulations. According to Allan et al. (2010), the project was a "collaboration including simulation software developers; middle school science teachers; the Maine laptop program; environmental educators; an external evaluator; and a lead organization experienced in teacher guided curriculum development" (p. 36). Allan et al. (2010) used the TPACK model [framework] to integrate the three main domains of the TPACK framework. Their population consisted of 23 Maine middle school science teachers who taught ecology, providing continuous feedback throughout the 3-year project. Prior to the project, the participating teachers reported no prior programming experience; therefore, teachers were given hand-on experience using the modules and programming new simulation exercises in a series of progressively more complex programming challenges. Allan et al. concluded that these workshops reinforced the need to scaffold exercises to allow teachers to develop skills and confidence in the application and manipulation of the simulation technology. Teacher confidence was determined to be a key outcome for the program because teachers would must not only use the tools with their students, but also provide instruction during in-service for other middle-school teachers (Allan et al., 2010).

Allan et al. (2010) demonstrated that teachers increased their understanding of computer simulations and models, thereby, increasing their general technology skills. Teachers recognized the value of effective integration of technology into the various ecology curriculums and the powerful way it stimulated student learning and engagement with material. Although this program was aimed at a middle-school curriculum specific population, it reinforced the flexibility of the TPACK framework regarding what Jimoyiannis (2010) called a sliding scale. Ultimately, Allan et al.'s (2010) findings from the EcoScienceWorks project "provide[d] insights into a model for technology focused curriculum development that promotes TPACK skills in teachers" (p. 42). Overall, significant growth occurred in teacher technology skill, increased CK, and positive changes in pedagogy (Allan et al., 2010).

Investigating technology integration, Niess (2011) furthered using the TPACK framework. In the review of the TPACK framework, Niess (2011) asserted that emerging digital technologies are more accessible day-to-day, confronting teachers with the question of how and when to incorporate those technologies into their various subject areas:

> Teacher educators are, therefore, confronted with redesigning their programs toward the development of the knowledge teachers need for rethinking how technologies might be integrated and acting upon their decisions. Teacher educators raise valid questions and concerns in the search for pre-service, in-service, and professional development experiences to more effectively reshape teachers' thinking and actions. (p. 300)

Using Niess' (2011) study as a research base, TPACK provides a framework for thinking about the knowledge that teachers need to integrate digital technologies into the curriculum as learning tools. As Neiss (2011) stated,

> Careful attention must be paid to what is learned and what is questioned from the studies about TPACK to clarify and develop a more robust and mature understanding of the TPACK construct and what it means for preparing teachers to guide student learning with technologies. (p. 308)

Harris and Hofer (2011) conducted a study of experienced secondary social studies teachers to discover the teachers' TPACK scores as expressed in the teachers planning processes to determine whether TPACK played a role and whether it could be enhanced. Harris and Hofer (2011) developed a series of social studies learning activities using the TPACK development strategy. Harris and Hofer (2011) linked the students' learning needs with combinations of "consciously chosen, content-based learning activities supported by suggested educational technologies" (p. 214).

According to Harris and Hofer (2011), common themes emerged consistently across the participants. During planning, participating teachers noted the specific nature of the curriculum content (standards based) and matched planned learning activities primarily to the nature of that content, rather than to the developmental learning needs of the students. Participants selected activities that were perceived to engage students as long as the activity also met the content first imperative. After the professional development experience, participants also selected technology more often that intellectually stimulated the students. Some teachers viewed the new technology capabilities regarding how it fits within their content or defaulted to technology that they were used to before accepting the new technology. Harris and Hofer (2011) noted that many of the teachers reported that they had "gotten in a rut" (p. 225) prior to the professional development experience; however, all of them reported that they had new learning activities in their toolbox that they could choose that more matched the learning needs of the students. Harris and Hofer (2011) concluded, "A content-based, activity-types approach to technologically inclusive instructional planning is compatible with existing approaches to teaching" (p. 226).

On the premise again of the *A Nation at Risk* (The National Commission on Excellence in Education, 1983) report, the No Child Left Behind Act (2001) and the Elementary and Secondary Education Act (2001), Lux, Bangert, and Whittier (2011) conducted an experient using 120 preservice teachers enrolled in a foundations of educational technology course at a mid-sized western university to develop yet another variant of the TPACK instrument focusing on preservice teachers called the Preservice Teacher–Technological Pedagogical Content Knowledge (Preservice Teacher–TPACK). Years after the *A Nation at Risk* report (The National Commission on Excellence in Education, 1983), emphasis was again placed on integration of educational technology and the importance of technology literacy among students and teachers. In their study, Lux et al. (2011) quoted the *NETP* in which the U.S. Department of Education, OET (2010) called for a renewed focus on better preparing new teachers to use technology. In the *NETP*, the U.S. Department of Education, OET (2010) reiterated, "A large problem of teaching teachers how to use and integrate technology into effective teaching and learning and acknowledges the need to establish online communities to leverage using educational technology to improve teaching" (p. 46).

Lux et al. (2011) asserted, "Assessing preservice teachers' TPACK is important not only for evaluating technology integration competencies within educational environments[,] but also for evaluating the quality of instructional technology training that occurs in teacher preparation programs" (p. 419). Additional researchers (Abbitt, 2011a; Abbitt, 2011b; Luthra, 2010/2011; Morsink et al., 2010/2011; Niess, 2011) continued to document that teacher preservice education coordinators continue to struggle with technology integration.

Kohen and Kramarski (2012) continued the expansion and development of the TPACK framework and the TPACK instrument in their study using nine Israeli preservice high school teachers from different subject-matter disciplines partcipating in a teaching and learning methods course in a university computer lab, focused on teaching and learning methods based on the TPACK conceptual framework. The study goals were to

> develop a conceptual Technological Pedagogical Content Knowledge-Self Regulated Learning (TPCK-SRL) scheme for assessing a teachers' integration of self-regulated learning (SRL) considerations while infusing technology into a TPACK classroom context reflecting all three components' dynamic interaction with SRL and to test this scheme's validity and reliability as a practical tool for measuring effects of teacher education. (p. 1).

Kohen and Kramarski (2012) referred to SRL as a cyclical 3-stage process comprising forethought, action and performance, and reflection.

Kohen and Kramarski (2012) used the TPACK–SRL framework and the transformative and integrative learning approach which was originally used by Angeli and Valanides (2009) in their study discussing issues regarding the epistemology of TPACK. Specifically, where the transformative and integrative views are juxtaposed concluded that "TPACK is a unique body of knowledge that is constructed from the interaction of its individual contributing knowledge bases" (p. 167). Kohen and Kramarski (2012) determined that no value exists in practicing the three bodies of knowledge in isolation to enhance TPACK, but rather that integration is key; however, that integration is usually difficult for preservice and in-service teachers. Kohen and Kramarski (2012) contended:

> Self-regulation allows teachers to think about a technique or experience within each TPCK component, assimilate it, relate it to other components, and take action to change or adapt it to each component's goal. Thus, altogether, using SRL to reflect on their decision-making practices may help teachers internalize and connect between the three key components of TPACK. (p. 2)

Grounded in the TPACK framework with TPACK–SRL, Kohen and Kramarski (2012) demonstrated that the TPACK framework is capable of helping guide the way that teachers view the interaction of technology, pedagogy, and content, and that the intrument is flexible, valid, and reliable.

Dilworth et al. (2012) articulate similar finding in their study by suggesting that teachers view (and must view) emergent technologies as offering opportunities to understand concepts in deeper and more meaningful ways. Dilworth et al. (2012) stated, "This growth in understanding will occur only if teachers learn to use these technologies in effective ways" (p. 11). Dilworth et al. (2012) grounded their research using the U.S. Department of Education's PT3 initiative program launched in 1999 and the National Technology Leadership Coalition (NTLC) organization. They acknowledged the more than 200 TPACK-related articles from a variety of peer reviewed journals as a basis that the TPACK framework and instrument are maturing and influencing both research and practice. Dilworth et al. (2012) concluded,

> If the teacher education faculty members who prepare future teachers do not fully understand the practical implications of this framework, there is little chance that tomorrow's teachers will be able to employ technology effectively. (p. 12)

As TPACK continues to grow and develop, other professionals are starting to apply the TPACK framework to their area of expertise. Linton (2012) demonstrated and proposed a TPACK application to teacher–librarians by examining the changing library and the unique role of the teacher librarian, who is in a position to support both students and teachers. Linton (2012) asserted that this new role is one of empowering teachers with technology skills and assisting them by connecting them with digital content for their curriculum. Linton (2012) affirmed that implementation of the TPACK model "begins with CK and that teachers must develop expertise within their content area and an understanding of how learning develops within that content" (p. 26) and that librarians have a unique place in schools to assist teachers in connecting their expertise through a collaborative commons of multifunctional staff members, educational technologists, and others. Linton (2012) concluded, "The ultimate goal of all instructional support positions, regardless of job description, is improved instruction in order to increase student learning" (p. 27), and said that librarians can play a key role in the integration of digital technology into student learning.

Roblyer and Doering (2013) agreed, "Teachers need to understand the role of technology in education" (p. 10). By looking at the past, they prepared educators for the future by outlining six lessons from the past 60 years of history that apply technology to education:

1. No technology is a panacea for education.
2. Teachers usually do not develop technology materials or curriculum.
3. "Technically possible" does not equal "desirable, feasible, or inevitable" (p. 10).
4. Technologies change faster than teachers can keep up.
5. Older technologies can be useful.
6. Teachers always will be more important than technology.

In response to historical methods of integrating technology, Graham et al. (2009) conducted a case study of 15 in-service teachers who participated in a science professional development program at Brigham Young University. Graham et al. (2009) stated, “Educators recognized that technology skills alone did not serve them well because one could know how to operate a piece of technology without knowing how to use it effectively to promote student learning” (p. 70). This further reinforced earlier findings that integrating technology included more than merely adding digital technology to a classroom environment.

Over the last 2 decades, in response to this emerging trend, the TPACK research discussed prior shows that the TPACK instrument has been employed as the leading means of capturing some of the essential qualities of teacher knowledge required for integrating technology into education. Mishra and Koehler (2006) reinforced Shulman’s (1987) assertion that part of the issue stems from a tendency to look only at various technologies and not to investigate how technology is being or must be used (Mishra & Koehler, 2006).

As has been highlighted from the literature reviewed in this section on integrating technology, a given curriculum is more than simply teaching educators the latest technology to employ. In their book, *Educating the Net Generation*, Oblinger and Oblinger (2005) stated, “Teachers are vital to the learning process, that Tech [Technology] is good, but it is not a perfect substitute” (p. 2.3) and “Learning is based on motivation, and without teachers that motivation would cease to exist” (p. 2.3).

Hu and Fyfe (2010) articulated that, since Mishra and Koehler (2006) introduced the TPACK framework and the TPACK instrument, there “has been an emerging body of literature reiterating the importance of TPACK” (p. 184). Using that framework, Hu and

Fyfe (2010) reported on a teacher education program in a higher education institution that applied the TPACK framework to the design of the institution's preservice ICT course. The ICT course was designed and delivered to students who were enrolled in Master of Teaching students focused on the development of technical skills for teachers. According to Hu and Fyfe (2010), TPACK "enables teachers to select appropriate ICT tools to be used in their classroom to enhance what they teach" (p. 188) and the TPACK framework approach improves teacher confidence and skill in productive technology integration.

As the research stated above demonstrates, and Mishra and Koehler (2006) stated, TPACK has evolved both as a framework and as an instrument to measure TPACK as an "emergent form of knowledge" (p. 1028). Table 1 is a graphical view representing a summarization of the TPACK literature used within this chapter to demonstrate the evolution of the TPACK framework and the TPACK instrument from 2005 through 2013.

Table 1

Summarization of TPACK Literature 2005–2013

Author	**Target population**	**Measuring**	**Method**
Koehler & Mishra (2005)	Education students in online master's program	Individual and group TPCK/TPACK level	35-item survey with independent samples matched pair means *t* test
Koehler, Mishra, & Yahya (2007)	Teachers in design teams	Conversations tracking the development of TPCK/TPACK	Discourse analysis; quantitative and qualitative content analysis
Angeli & Valanides (2009)	Preservice primary teacher's in education course	ICT–TPCK/TPACK	Peer, expert, and self-assessment

Author	Target population	Measuring	Method
Archambault & Crippen (2006/2009)	K–12 online teachers	TPACK self-assessment	24-item survey; Pearson's product–moment correlation
Schmidt et al. (2009)	Preservice teachers PK-6 in an introductory instructional technology course	TPACK self-assessment	47-item survey; factor analysis in subgroups
Shin et al. (2009)	In-service teachers in educational technology master's level courses	TPCK/TPACK self-assessment using Schmidt et al. (2009)	54-item survey; matched-pair *t* test; single-group pretest–posttest
Cox & Graham (2009)	Theoretical study	Understanding of TPCK/TPACK conceptually	Conceptual analysis, or philosophical inquiry
Graham et al. (2009)	In-service teachers in a science professional development	TPCK/TPACK framework for integrating technology	Workshop and learning by doing; paired, sample *t* test; single-group pretest–posttest
Harris, Mishra, & Koehler (2009)	K–12 instructional applications of educational technologies	Using TPCK TPACK/ framework as a way to think about effective technology integration	TPACK "activity types"
Jimoyiannis (2010)	Science teacher preparation program	Defining technological pedagogical science knowledge (TPASK)	Qualitative approach, within phenomenological mode
Koh, Chai, & Tsai (2010)	Singaporean preservice teachers	Construct validity and TPCK/TPACK perceptions	29-item survey; exploratory factor analysis
Archambault & Barnett (2010)	Online teachers across the United States	Construct validity and TPCK/TPACK perceptions	24-item survey; factor analysis and Pearson *r* correlation

Author	Target population	Measuring	Method
Allan, Erickson, Brookhouse, & Johnson (2010)	Maine middle school science teachers	Integrating TPCK/TPACK framework, and science	Project activity and expert evaluation
Hu & Fyfe (2010)	Teacher education program in a higher education	TPCK/TPACK framework for development of technical skills	Project activity
Harris & Hofer (2011)	Secondary social studies teachers	TPCK/TPACK score as expressed in the teachers planning processes	Qualitative interview data and planning product analysis
Lux, Bangert, & Whittier (2011)	Preservice teachers enrolled in a foundations of educational technology course	Variant of TPCK/TPACK; Preservice Teacher–TPACK	27-item survey; exploratory factor analysis
Kohen & Kramarski (2012)	Israeli preservice high school teachers in a teaching and learning methods course	TPCK–SRL scheme	Coding levels, two mapping dimensions, excerpts, and benchmarks; one-way MANOVA; single-group pretest– posttest
Linton (2012)	Teacher–librarians	TPCK/TPACK framework for helping librarians help teachers integrate technology	Collaborative workshops
Roblyer & Doering (2013)	Teachers	TPCK/TPACK framework	Tech-PACK and technology integration platform

Note. ICT = information and communication technology; TPCK/TPACK = technological pedagogical content knowledge; SRL = self-regulated learning.

As Voogt, Fisser, Pareja Roblin, Tondeur, and van Braak (2013) articulated in their review of TPACK literature between 2005 and 2011, significant TPACK research is available that is mostly associated with preservice educators. Similarly, Ward and Benson (2010) stated that considerable attention has been paid to TPACK research in K–12 teacher education. However, the same inquiry into TPACK that relates to higher education was not evident. Rienties, Brouwer, and Lygo-Basker (2013) acknowledged that conducting prior research with preservice teachers is taking “important steps towards validating and refining the TPACK model however, limited research is available in a higher education context” (p. 7).

Ashe and Bibi (2011) stated, “The use of technology in higher education is largely accepted to be an integral part of the student experience” (p. 128). This statement sets the lens that they employed to view and to understand the TPACK framework and implications of the TPACK framework in higher education teaching and how this affects a students’ approach to learning. According to Ashe and Bibi (2011) higher education institutions are now focusing on technology-facilitated environments for quality teaching improvement and that students expect a measure of technology and technological access during their educational journey. Ashe and Bibi advocated that technology has the possibility of changing the learning context to activate different knowledge elements in their schema. Additionally, Ashe and Bibi promoted that an instructors knowledge of technology and how technology is integrated into curriculum becomes an important aspect of an educators knowledge base for teaching 21st century students.

Decades prior to Ashe and Bibi (2011), White (1996) spoke of social studies preservice teachers in a higher education teacher education preperation program, articulating, “We are doomed to teach the way that we have been taught” (p. 69). In this study, White (1996) addressed the issue of teacher prepartation and changing the method of delivery from a teacher-centered transmission model of teaching to a constructivist student-centered model. According to White social studies teachers were largely becoming irrelevant in K–12 schools because they were not engaging the students and creating a learning environment. The teachers were teaching the way that they had been taught in the university and, according to White, this was the fundemental issue at hand. White (1996) stated that there were two items that needed to be incorporated into the teacher preparation program: “a constructivist framework and the appropriate use of technology” (p. 70) in instruction. White (1996) posited that technology and constructivist integration are vital to develop problem-solving and critical thinking skills that allow learning to be embedded in context that is relevant to a student. Furthermore, White (1996) stressed that technology is a major component of a constructivist approach and that information technologies are “motivating, creative, and interactive” (p. 71) and that they promote meaningful learning.

Roblyer and Doering (2013) asserted that technology applications directly support the constructivist strategies, depending upon how they are employed within the learning environment. Furthermore, Roblyer and Doering (2013) stated, “Today’s constructivist integration strategies often focus on having students use data gathering tools (e.g. mobile technologies) to study problems and issues in their locale, and on creating multimedia products to present their new knowledge and insights” (p. 45–46). Roblyer and Doering (2013) stressed the integration of the content, the environment, the technology, and especially the learning outcome to create the learning environment.

Constructivist strategies have been linked directly to integrating technology into curriculum. Baumgartner, Lee, Birden, and Flowers (2003) articulated that constructivism or constructivists believe that learning is a search for meaning and that, in contrast to behaviorism, knowledge is not merely “out there” to be attained (p. 9), rather it is constructed by the learner depending on the knowledge gained and applied to existing experience. Constructivism as a sociocultural theory emphasizes that interaction between an individual and their societal and cultural influences directly contributes to one's individual development. This interaction also includes technology. Furthermore, Vygotsky (1978) argued that society could not be separated from the learning and development of an individual and that social interaction is critical for development of an individual.

Huang (2002) examined the impact of constructivist learning theory through the lens of adult learners in an online educational setting and determined, "Constructivist ideals provide ideas help instructors create learner-centered and collaborative environments that support critical reflection and experential processes" (p. 35). Huang (2002) acknowledged the previous work of Dewey, Piaget, Vygotsky, and Bruner in which they proposed that learners (especially those online learners he examined) could learn actively and construct new knowledge based upon the learner's prior experience. In a constructivist environment, the educator assumes the role of facilitator helping to create an environment in which learners can use prior experience, the classroom experience, and the environment affecting the learner to help the learner create or construct useful knowledge. Huang (2002) also acknowledged and asserted that Piaget and Dewey believed that "the educator's role involves the shaping of the learners' real experience from the environment and knowing what surroundings tend to promote experiences that lead toward growth" (as cited in Huang, 2002, p. 29).

Huang (2002) used Vygotsky's (1978) emphasis on the social context of where learning takes place and how that context has an impact on what is actually learned. Vygotsky's placed critical importance on the interaction of people (other learners and educators) central in his theory of social–constructivism; therefore, Huang (2002) evidentially agreed that the well-constructed environment is conducive to a learner's ability to construct useful and meaningful knowledge. Huang (2002) drew a congruent thread from Dewey through Bruner and Knowles by which adult learner characteristics lend themselves to experiential learning and by which common technologies enable an educator to construct the learning situation to meet the varied needs of adult students. Technologies are not deliverers of content, but tools that educators and students use to construct knowledge and share meaning. Using technology and cultural tools to communicate, exchange information, and construct knowledge is fundamental in constructivism (Vrasidas & McIsaac, 2001).

Trends of Integrating Digital Technology

Baylor and Ritchie (2002) asserted that, for more than 20 years, educational researchers have struggled to identify the value of technology in education citing that our understanding of how technology accentuates student learning as a major part of the problem. Therefore, in this section, the researcher examines research in the three areas of (a) teachers and technology perception, (b) barriers to digital literacy and personal use of technology and how it influences adopting further uses, and (c) higher education and adult education faculty perceptions of technology in their courses.

Teachers and Technology

Roblyer and Doering (2013) said, "Technology is us—our tools, our methods, and our own creative attempts to solve problems in our environment" (p. xvii). They advocated that technology is not an end in itself, but rather a tool used in conjunction with other tools for educators to use to solve problems in society, and especially in education. Roblyer and Doering (2013) further stated the four core principles they used to encompass their thoughts, strategies, and techniques:

> Instructional technology methods should be based in learning theory and teaching practice; uses of technology should match specific teaching and learning needs; old integration strategies are not necessarily bad and new strategies are not necessarily good; and that a combination of technological, pedagogical, and content knowledge is necessary. (p. xix)

According to Roblyer and Doering (2013), if teachers use these four core principles, they can visualize their role in shaping the future of education. The principles illustrate educationally sound methods for teachers to use when integrating effective practices into their curriculum.

The National Defense Education Act (1958) largely targeted college education and is mostly known for providing federal loans for students. However, the National Defense Education Act (1958) also provided funds to state educational agencies for the purposes of improving teaching. Over the past decade, digital technologies have gone from being an optional tool for the few to a required tool for the majority. According to Warschauer and Liaw (2010), 74% of people in the United States use the Internet at home or work today and 87% reported are between the Ages 18–29. King and Cox (2011) stated, “Higher education organizations and classrooms cannot ignore the tsunami of constant technology change” (p. xv). King and Cox (2011) further asserted that faculty are the “front line interacting with the students where in many cases teaching has shifted from brick and mortar teaching environments to providing a more asynchronous, on demand teaching and learning environment” (p. xviii). According to some researchers (King & Cox, 2011; López-Pérez, Pérez-López, & Rodríguez-Ariza, 2011; A. Pearson, personal communication, July 5, 2012; Roblyer & Doering, 2013; Svinicki & McKeachie, 2012), these statements indicate that in the highly rapid pace of digital technology change, faculty professional knowledge, grounded in learning theory and coupled with all the tools of creativity is still the best way to achieve a setting for students to learn.

Although information and communication technologies have become an integral part of life in the United States, they have not yet been adequately integrated into adult language and literacy programs (Warschauer & Liaw, 2010). Although Warschauer and Liaw (2010) referred to adult language and literacy programs in particular, Arne Duncan, U.S. Secretary of Education, articulated in the *National Education Technology Plan* (U.S. Department of Education, OET, 2010) a call to apply the advanced technologies used in the personal lives of Americans into the entire education system. The administration was concerned that the United States ranked ninth out of 36 developed nations in college completion rates citing innovation and ingenuity as key components of how to achieve the goal of leading the world by 2020 (U.S. Department of Education, OET, 2010). Integration of advance technology would be a key as well as focusing what and how we teach to match what people must know and how they learn (U.S. Department of Education, OET, 2010, p. v).

López-Pérez et al. (2011) reinforced the goal of the *National Education Technology Plan* (U.S. Department of Education, OET, 2010) by stating, "A persistent concern in teaching is the aim to achieve a better outcome and to reduce the number of students dropping out of a course" (López-Pérez et al., 2011, p. 818). Using first year undergraduate students in the General Accounting courses offered by a university in Spain, López-Pérez et al. (2011) examined the effect of a blended learning experience on course outcomes and to investigate the student perceptions of the blended learning classroom. A blended learning approach is generally defined as the integration of traditional classroom teaching methods with online or digital technology activities enhancing or replacing portions of the course objectives. However, Bonk and Graham (2006) defined blended learning as “face-to-face instruction with computer-mediated instruction” (p. 5). According to Bonk and Graham (2006), this definition is the most accurate reflection of the historical emergence of blended learning. Therefore, according to Bonk and Graham (2006), “Blended learning is the combination of instruction from two historically separate models of teaching and learning: traditional face-to-face learning systems and distributed learning systems” (p. 5). In their experiment, López-Pérez et al. (2011) included a blended learning environment. A larger percentage of registered students took the final exam, which according to López-Pérez et al. (2011), seemed to have contributed to a positive trend in the results achieved for students passing the final exam. From a student’s perspective, the blended learning environment, inclusion of educational technology to expand or replace certain course objectives, this demonstrated students considered this a useful experience for understanding and learning the subject content. Although the limitation of their study did not include faculty perceptions about the usage of technology, they noted that students felt that they got more of the instructor–learner interaction.

In an earlier study, Kotrlik and Redmann (2005) examined the impact of technology on the teaching–learning process, barriers to technology integration, technology anxiety, and teaching effectiveness and articulate the state of technology integration in adult basic education (ABE). Kotrlik and Redmann (2005) performed a research study using 311 ABE teachers employed by public secondary school systems in Louisiana. Kotrlik and Redmann (2005) stated, “ABE teachers are in the early stages of integrating technology into instruction,” but are “more active in the more exploratory stages of using technology in the teaching–learning process" (p. 215). However, ABE teachers are not being innovative in integrating technology at an advanced level. Kotrlik and Redmann (2005) attributed this lack of innovation to the level of technology education for the instructor to misunderstanding of how technology fits into the curriculum or having no defined means to assess the impact of technology. Kotrlik and Redmann (2005) concluded that teachers must continue to devise ways to integrate technology into their classrooms and curricula and that educational leaders at all levels must encourage teachers to expand using technology in the teaching–learning process. In subsequent studies, Warschauer and Liaw (2010) and Roblyer and Doering (2013) reinforced the idea that faculty do not receive a sufficient level of training for the instuctors to feel comfortable using the technology.

Furthermore, Wetzel and Williams (2004) presented an analysis of a specific succesful PT3 project conducted at ASUW of 41 College of Education faculty members designed for the integration of technology into their classes. The faculty used technology in their classes aligned with the *NETS-T*. The *NETS-T* was developed by the International Society for Technology in Education (2000) on the following premise:

> Effective teachers model and apply the NETS·S as they design, implement, and assess learning experiences to engage students and improve learning; enrich professional practice; and provide positive models for students, colleagues, and the community. All teachers should meet the following standards and performance indicators (http://www.iste.org/docs/pdfs/20-14_ISTE_Standards-T_PDF.pdf).

Wetzel and Williams (2004) conducted a study in response to the concerns of recent graduates of the ASUW College of Education K–12 program that they did not feel prepared to teach with technology. ASUW graduates cited inconsistent or lack of extensive modeling on using technology and a lack of exemplary practices during classroom or field experiences by the faculty. As with López-Pérez et al. (2011) throughout the ASUW experiment, it was generally accepted that students valued the technology usage within the coursework; however, faculty usage of technology and faculty attitudes towards technology reflected in teacher integration of technology within coursework was a major factor in graduates integrating technology within their classrooms.

According Cradler, Freeman, Cradler, and McNabb (2002), who reported for the Center for Applied Research in Educational Technology, in summarizing 26 studies, surveys, and reports related to teacher professional development, 84% of teachers believed that computers and access to the Internet improves the quality of education, two-thirds report that the Internet is not well integrated into their classes. Furthermore, only 20% of teachers considered themselves well prepared to use technology in their classes. According to Cradler et al. (2002),

> An analysis of the studies consistently shows that more than the specific technology or software used, it is the context in which technology is applied that is critical and the extent to which teachers are prepared to infuse technology into curricula and instruction is a major contextual factor. (p. 51)

Ertmer (2005) identified a correlation between teachers' technology skills, their use of technology in classroom instruction, and higher academic achievement; however, according according to Agodini, Dynarski, Honey, and Levin (2003), most researchers agree that a small minority of teachers use computers as part of their instruction in academic subjects with sufficient frequency or skill to improve student achievement.

According to Jimoyiannis and Gravani, (2011) ICTs play a central and pervasive role that permeates every aspect of our social life and that the tremendous growth of new technological environments is considered a driving force that transforms our world into a global, universal society. Therefore, Jimoyiannis and Gravani asserted that improving adult digital literacy is fundamental to confront the issues of exclusion and marginalization in society. Jimoyiannis and Gravani also purported that understanding more about adult digital literacy constitutes the fundamental purpose of their study and to shed light on the educational reality at the Second Chance School (SCS) program in Greece. The SCS project constitutes a flexible and innovative educational program providing education to adults over the age of 18 who have not completed the 9-year compulsory education in Greece. According to Jimoyiannis and Gravani, the role of digital literacy in the curriculum of SCS is vital and the faculty had to be more knowledgeable in digital technology and able to individualize the learning activities to the students because the majority of the students had little to no exposure to digital technology.

According to King and Cox (2011), higher education institutions cannot ignore technology and most higher education faculty were not trained as facilitators in a classroom with technology and with 21st century learners and learning techniques; therefore, it is a journey of learning for both faculty and student. Alexander (2004) asked the question of higher education faculty "do we know how to assess it [IT] for its applicability to our pedagogical and campus needs" (p. 32). In his article, Alexander (2004) related the past experiences of the faculty to growing beyond the sedentary to learning the technologies that the swarms of 21st century learners are bringing to campus when he ask the faculty "are we familiar in social software" (p. 32), introducing the idea that faculty must familiarize themselves with technology beyond the classroom to be able to create "meaningful and positive memory" (p. 34) in the minds of the learners.

Personal Use of Technology

Fleagle (2012) emphasized that the technology revolution has brought pressure upon higher education faculty from both the administration and the students to incorporate technology into curriculum. Fleagle discovered that, although the faculty participants in the study were aware that technology plays an important role in both their personal and professional lives, additonal technology training was required to conform PLS into educational technology usage. Fleagle concluded that not only does technology play a large part of everyone's private lives, but it will transform teaching practices if faculty are shown how to best use it.

Although Czaja et al. (2006) articulated,

> Data on the adoption and use of technology such as computers have generally shown that a number of factors, such as education, socioeconomic status, attitudes toward the technology, the perceived benefits of technology, and access to technology, influence technology adoption. (p. 334)

Likewise Czaja et al. (2006) hypothesized that the higher computer or technology self-efficacy or confidence in using technology one has yields a lower anxiety and predicts a higher technology adoption rate and the usage of more types of technology.

Kennedy, Judd, Churchward, Gray, and Krause (2008) in their 2006 study of more than 2,000 incoming first year Australian university students found that the trend of tech-savvy students is increasing as predicted by Prensky (2001). However, one key note is that, although the trend has increased, it is by no means universal nor does it mean that students are more information literate. However, Kennedy et al. (2008) also found that individuals who are early adopters who embrace emerging technologies in everyday life for noneducational usages might also perceive the same technolgies as having an educational application and be more willing to use the technology. Kennedy et al. (2008) also asserted,

> The positive association between a students' use of technology and their preference for its use at University leaves unanswered the question as to whether students' everyday skills with emerging technologies will correspond to skills associated with beneficial, technology based learning. (p. 119)

However, Kennedy et al. (2008) also advocated that more research is needed and warrant further investigation.

According to Walker and Johnson (2008), user satisfaction is generally considered to be one of the key components for acceptance of technology or information systems. Using the Technology Acceptance Model developed in 1989, Walker and Johnson argued that perceived usefulness and percieved ease of use were fundemental variables determining a users acceptance of technology. Although studying 143 university instructors, Walker and Johnson determined a high correlation between percieved usefuness of technology and the instructors intent to use the technology. Kukulska-Hulme (2012) argued that faculty engagement with technology must go beyond exposure in faculty development and into adoption in their own personal lives to adapt fully to the technological conditions of the new higher education environment.

Alexander (2004) believed that faculty should themselves be prepared to learn social software and mobile learning while understanding the pedagogical importance of harnessing the technology. According to El-Hussein and Cronje (2010), the evolution of handheld devices and wireless technology presents changes not only in personal lives, but also in education. El-Hussein and Cronje (2010) articulated that PLS is prevalent and is reshaping a user's daily life; therefore, visionary educators must consider the implications on the teaching and learning environment. According to Mumtaz (2000), literature demonstrated that those faculty members who are regular users of technology and faculty that perceive technology is useful in their personal lives are more likely to incorporate technology into their instruction.

According to Cradler et al. (2002), 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" (p. 52). Cradler et al. (2002) presented their findings and implications related to preparing teachers to integrate technology effectively into curriculum and instruction through summarizing 26 studies, surveys, and reports related to professional development. Cradler et al. (2002) consistently showed that teachers are "interested in technology, but need increased opportunities to develop their capacities" (p. 50). In a study of a faculty at a medical university, Kazley et al. (2013) reported that most faculty considered e-mail, PowerPoint®, Word, calendar tools, Informational Websites, Smartboard, and basic Microsoft Office® applications as "always used" technology however, additional training which indicated that the faculty felt "they were not using the software to the fullest extent rather than requesting training that the majority of students reported might be more effective" (p. 68).

Ertmer (2005) stated that many the conditions for integrating technology and successful technology integration such as access to technology, favorable institutional support, and training for instructors to deliver online education, appears to be in place in many institutions. However, the common barrier seems to be an instructor's pedagogical belief and argued for continued increase in professional development. Likewise Okojie et al. (2006) contended that using technology for instruction partialy depends on an instructors' ability to explore the realtionship between technology and pedagogy. Kiraz and Ozdemir (2006) articulated that the mere presence of technology in a classroom does not guarantee the use of that technology, that an instructor must accept the notion of the requirement of educational technology in his or her classroom and reaffirm the notion of technology self-efficacy or being comfortable in using technology. Like others before, Kiraz and Ozdemir (2006) articulated that an individual positive attitude toward the use of technology contributes to the overall intent to use technology.

Baylor and Ritchie (2002) identified in their research that the extent to which technology is used outside the classroom for nonschool activities might be an indicator of an instructor's interest and corresponding skill in using technology within the classroom. Furthermore the authors discovered that a combination of personal technology improvement coupled with institutional support for professional development increased faculty confidence and competence with technology inside the classroom. Similarly, Baylor and Ritchie (2002) cited that faculty perceptions of technology and openness to change were more willing to try new ideas in the classroom as well as in their personal life.

Faculty Perceptions of Integrating Technology

King and Cox (2011) articulated that higher education institutions cannot ignore technology, while Alexander (2004) asked higher education faculty if they knew how to assess it for pedagogical needs. Furthermore, Mumtaz (2000) and Savery (2002) demonstrated that faculty perception of usefulness is a key factor in determining whether a faculty member will employ ICT into their learning environment. Therefore, in this section, the researcher will review the literature surrounding faculty perceptions of technology.

Although summarizing research findings over the past 20 years, Mumtaz (2000) provided some evidence of the positive effects of using ICT on learning. Mumtaz's (2000) literature review also investigated some factors that hamper an instructor's willingness to use technology and factors that encourage faculty usage of technology. In spite of such projects, the effects of numerous training programs and an investment by schools in ICT resources, uptake in schools has been disappointingly slow (Cox, Preston, & Cox, 1999; Passey & Samways, 1997). According to Mumtaz (2000), a number of factors were identified that affect a teacher's willingness to incorporate technology into curriculum, including "a lack of teaching experience with ICT; lack of on-site support for teachers using technology; and lack of time required to successfully integrate technology into the curriculum" (p. 320).

Kotrlik and Redmann (2005) demonstrated that the major issues identified in Mumtaz's (2000) review continue to persist by identifying the same barriers in their research. Specifically, barriers ABE teachers were facing while trying to integrate technology into their educational curriculum and the classroom. The barriers included the availability of time to plan for integration of technology into the lesson plan, scheduling Internet research time for students, availability of technology, administrative support for technology, and teacher anxiety about using technology (Kotrlik & Redmann, 2005).

Demirbilek (2010) also conducted a study to determine the current state of the adult educators' attitudes towards using mobile technology and games in educational curricula. Demirbilek (2010) defined adult education as "any formal or informal education or training aimed at an adult population that is older than a traditional university student" (p. 235). Demirbilek (2010) extended the perceptions of educational technology studies and added the additional component of mobile devices that have become so prolific among the general population. Demirbilek (2010) identified one barrier to technology use stating, “Adult educators intent to use electronic games and mobile devices begins with their attitude and perception towards using them in their daily teaching and learning practices” (p. 244). This attitude towards use extends into the educators willingness to use or extent of technology use in their personal lives. Another barrier for educators stems from curriculum planners not involving educators of adults prior to introducing mobile games into educational course material.

Kazley et al. (2013) conducted surveys and focus groups at a medical university located in the southeastern United States of 21 staff members, 250 students, and 29 faculty to examine the use, perceptions, and training needs in the area of educational technology of faculty, staff, and students. The university in Kazley et al.’s (2013) study was comprised of 11 academic programs in the health sciences. Two of the programs were at the bachelor’s degree level and nine were at the graduate degree (master’s or doctoral) level. Three programs were taught in a blended or fully online, distance education format. Although faculty members in the college used many educational technology tools, such as Smartboards and Sympodia, audience response systems, learning management systems, lecture capture, video-conference/recording, patient simulation, and many other hardware and software tools, Kazley et al. (2013) concluded from the survey responses that “the major usage of technology by faculty included accessing Internet resources, word processing, and email and quite often, technology is used by faculty more for administration and research than for instruction” (p. 63–64). In a review of current literature, Kazley et al. (2013) determined that the literature indicated that the perceived value of technology is often be affected by a person’s computer skills and knowledge of the technology. Specifically, Kazley et al. (2013) stated, “Students can perceive technology to have little value—and even to create negative consequences—when it cannot be adequately operated or integrated in class" (p. 64). Kazley et al. (2013) reported that most faculty participants admitted to the challenges of keeping current with educational technology use while sorting through the "good" versus the "ineffective" (p. 67). Lastly, Kazley et al. (2013) recognized that "personal teaching philosophies, together with available time to learn about technology and the demands related to instruction; determine how a faculty member approaches learning about technology and how they choose to integrate it into their teaching" (p. 69).

Lee, Cerreto, and Lee (2010) used Ajzen's theory of planned behavior (TPB) to conduct an experiment in which secondary and high school faculty used computers only to create and deliver lessons, and then used the TPB to investigate teachers' decisions or intentions to use technology in curriculum. Although the research was conducted on secondary and high school faculty, the results were consistent with other higher education literature (Bennett & Maton, 2010; Matus, Summa, & Kuschke, 2011; Tamim et al., 2011). Lee et al. (2010) determined, "Regardless of their [faculty] perceived self-competence; teachers may not use technology if they do not value it in their teaching" (p. 152). Lee et al. (2010) asserted

> Previous experiments using TPB may have led to inconclusive results to describe teachers' beliefs and intentions regarding the integration of electronic technology since there was a wide variety of technology available and there are many different ways for teachers to use a specific technology in the classroom. (p. 154)

Therefore, Lee et al. (2010) stated, "Teachers' attitude, subjective norm, and perceived behavioral control, and the relative importance of these three factors as predictors of behavioral intention might be very different for different technologies thus impacting the intention to implement technology into curriculum" (p. 154).

Tabata and Johnsrud (2008) indicated, “Distance education plays an important role in broadening educational access and increasing higher educational opportunities” (p. 625). However, they also note that the success of distance education is primarily hinged upon faculty who provide quality instruction. Tabata and Johnsrud (2008) noted that, although faculty use assorted technologies such as electronic-mail to contact colleagues and talk to students, and electronic libraries, and Internet searches to facilitate their work, they resist using technologies in delivering distance education for a number of reasons: PLS and individual competencies, time, workload, and institutional support. Tabata and Johnsrud concluded that faculty members who perceive using technology has a positive effect on their work are more likely to use it. In addition, once faculty members start to use technology and become more knowledgeable, they tend to use it more often. They also found that faculty members desire training to become more comfortable with the technology (Tabata & Johnsrud, 2008). This training usually requires institutional support because faculty members are unmotivated to participate in distance education without a strong infrastructure providing technical support, training, and workshops.

In a separate study, Marx (2005) noted that university faculty members are “often reluctant users of technology within their classrooms” (p. 21). Marx (2005) indicated that the main issue is the existing university workload of teaching their class load, conducting research, and publishing requirements detract from the faculty member’s ability to learn and deliberately integrate meaningful technology into their curriculum and courseware. Marx highlighted faculty training through using workshops, individual mentoring, and using various incentives to help entice faculty to explore new and different ways of integrating technology into their coursework. Marx (2005) noted that the technology integration training sessions were offered as voluntary sessions within the faculty professional development program and that "often in the case of voluntary professional development programs, only a core of faculty attended" (p. 23). During the training sessions, Marx (2005) became concerned that the focus of the training was strictly on the basics of using the technology and little or no instruction occurred with integrating technology into the curriculum. Very little focus of student-centered curricula occurred on the next level of integration by linking pedagogy with the technology. Marx was concerned that without the constructivist linking of content, pedagogy, and technology, using technology would not be meaningful.

Building upon Baylor and Ritchie's (2002) premise that educational researchers have struggled to identify the value of technology and how that educators understanding of technology is a major part of the problem, the researcher will examine in this section effective educational technology, technology in higher education, and faculty development and technology. According to Donnelly (2010), using online technologies has become an increasingly important challenge in academic staff development and more research is needed to provide a basis for the right choice of when to use different technologies and how to use them to achieve particular ends. Ward and Benson (2010) assert that technology has dramatically changed the look of 21st Century learners and that professional development focused on understanding the dynamic relationship between content, pedagogy, and technology would result in a greater number of satisfied learners and confident instructors.

Effective Educational Technology

Cagle and Hornik (2001) asserted that technology is not an end in itself, but rather a tool for faculty as a means to an end. Faculty are not merely to master technology, but to master it using the technology to enable students to achieve curricular objectives.

Therefore, in this section, the researcher will review literature surrounding effective educational technology.

In their report to the U.S. Department of Education on the effectiveness of educational technology, Agodini et al. (2003) stated,

> Is educational technology effective in improving student academic achievement? The No Child Left Behind Act (P.L. 107–110) notes that the study should examine the "conditions and practices" under which technology is effective, but the question of whether technology is effective logically comes before questions of the conditions and practices under which it is effective. (p. 2)

According to Agodini et al. (2003), effective technology is on a scale of two factors. The scale addresses two central issues concerning technology: (a) whether technology applications can improve student outcomes (efficacy) while studying the technology applications as they are actually used, and (b) asking whether they do improve student outcomes (effectiveness). According to Agodini et al., a researcher must consider the conditions and practices [the pedagogy] under which technology is effective in enhancing learning.

According to Agodini et al. (2003), it is useful to consider possible approaches for studying the effectiveness of educational technology by conceptualizing the links that connect technology and achievement. Therefore, they suggested a conceptual framework for a technology application that a teacher might use to support instruction. Figure 5 shows the conceptual framework linking a technology application and learning. Although Agodini et al. demonstrated the model on a K–12 system, is also can be applied to the university level.

Agodini et al. (2003) used this conceptual framework to demonstrate the linkages between technology and context: (a) that the institution has specific learning objectives with a measurable outcome, (b) that the instructor has a choice to integrate technology that suppports the learning outcome desired, and (c) that the achivement can be measured to determine an whether an increase in learning has occurred. Using this framework, Agodini et al. (2003) linked technology, pedagogy, content, and context to a measurable outcome that demonstrated the effectiveness of integration. Furthermore, Agodini et al. (2003) modified the framework under teacher instructional approach to include the ability of one group of teachers to not include technology in the approach to isolate the differences between teachers who did and did not incorporated technology. Agodini et al. (2003) indicated that using this approach generates two outcomes that can be measured to provide quantifiable evidence of succesful or effective integration.

[redacted]

Figure 5. Conceptual framework linking technology and learning. Modified conceptual framework linking a technology application and learning. Original framework from *The effectiveness of educational technology: Issues and recommendations for the national study* (DRAFT) by R. Agodini, M. Dynarski, M. Honey, & D. Levin (2003). Washington, DC: U.S. Department of Education.

According to Vrasidas and McIsaac (2001), for “successful technology integration in schools, teacher education programmes must play a crucial role” (p. 129). Teacher preparation on technologies should provide teachers with a solid understanding of the various media, their capabilities, and their constraints. Such understandings can only emerge when teachers are actively involved in teaching and learning with technology across the various disciplines.

Although this research focuses on K–12 teachers, a translation occurs to a higher education setting. Furthermore, studies by Vrasidas and McIsaac (2001) agreed with Barron and Goldman's (1994) original findings suggesting that teachers should not be taught about technology, but how to use technology for constructing, organizing and communicating knowledge and that one can best learn how to use a computer while working on a meaningful task. Vrasidas and McIsaac (2001) went on to say that in a course on educational technology for teachers, the goal should not "simply be to teach the use of several technology systems, their advantages and disadvantages; instead, the goal should be to provide students with opportunities to think like experts in making instructional decisions, selecting media for appropriate use, structuring learning activities and employing sound pedagogical strategies in real-life contexts" (p. 130).

Kagima and Hausafus (2001) advocated that the rapid growth of IT provides access to educational resources and learning opportunities like no other time. This access is both a challenge to higher education institutions and an opportunity. According to Kagima and Hausafus, using educational technology can enhance the range and scope of what students can learn by creating an environment that supports effective educational practices. Kagima and Hausafus articulated that the technology must be integrated thoughtfully to support meaningful learning for engaging learners. Kagima and Hausafus (2001) articulated that, for faculty the integration of technology into their learning environments "allows educators to tailor educational resources for a diversity of learning styles, cultural differences, skill levels, motivations, disabilities, and educational objectives" (p. 34). Furthermore, Kagima and Hausafus (2001) asserted that, for educators to integrate technology into their teaching and learning environments, teachers must believe that student learning is more effective with technology integrated than without. In addition, Kagima and Hausafus (2001) stressed that faculty must receive institutional support to overcome the faculty perception of a lack of educational opportunities, promotion, and tenure rewards.

Technology in Higher Education

According to Wilson (2003), technology is pervasive in our lives and that student, faculty, and the public demand that technology become part of the educational process. However, the integration of technology into higher education is met with barriers, including the need to develop technology support programs for faculty and staff, time for faculty to learn the technology and how to employ it, and incentives for faculty to develop the effective use of technology in the learning environment. Furthermore, Wilson (2003) stated, "Exemplary teaching combines the skillful use of pedagogy with content expertise and innovative use of technology" (p. 61).

Integration of Technology

Mishra and Koehler (2006) said that the TPACK framework allows educators to consider what knowledge is required to integrate technology into teaching and how they might develop that knowledge within themselves. Additionally, Mishra and Koehler acknowledged that in the past a tendency existed to look only at the technology and not at how the technology was used. Archer and Garrison (2010) emphasized that distance education and later blended education has a special connection to technology and adult education from the earliest forms of distance education using the technology of the postal system. Distance education was developed primarily to address the geographic barriers that hinder adult learning opportunities and that distance education has a long and strong connection to adult education (Kasworm, Rose, & Ross-Gordon, 2010). Furthermore Kasworm et al. (2010) asserted that the theory and practice of distance education are very largely a subset of the theory and practice of adult education. According to Kasworm et al., distance education is dependent upon some form of technology to help facilitate communication among students that is sometimes taken for granted in face to face settings. According to Bonk and Graham (2006), the convergence of face-to-face instruction and computer-mediated instruction into a blended learning environment is the greatest unrecognized trend in higher education today.

Similarly, according to Carlson et al. (2012), most universities have capitalized on advances in technology by offering more online courses and higher education administrators are encouraging instructors to teach online courses or combine modes of delivery via the hybrid or blended learning course model. Furthermore, Carlson et al. (2012) asserted that the explosion of new media has "slowly placed increasing pressure on instructors to incorporate online media in a way that achieves learning outcomes equal to face-to-face instruction" (p. 336) and have changed how professors deliver content to students. Carlson et al. (2012) further suggested that the Internet and emerging technologies have redefined the instructor's role and the teacher–student relationship, for technology expands the bondaries of the classroom, creating new instructional interactions other than face-to-face collaboration.

Greer and Mott (2010) suggested that the role of the instructor is to select the type of technology and technology use that is consistent with content and within context to facilitate student learning and that instructional strategies are what really make a difference in how adults learn. Collins (2010) stated that an instructor's understanding of learning styles is an important part of designing a course that uses technology appropriately and that touches on the variety of learning styles of adults with the goal of matching the technology to the learning style. In addition to the instructors role, Greer and Mott (2010) asserted that the learner owns a portion of the responsibility for learning that also includes conducting a self-assesment of their own technological readiness and acquiring and maintaining the skills to support their learning. In addition, Greer and Mott pointed out that many higher education institutions are now publishing student technology requirements prior to student enrollement in a course.

Kukulska-Hulme (2012) stated that higher education institutions are currently in a position of having to adapt to external conditions created by the wide-spread adoption of technology. The explosion of social media, social networking and the proliferation of mobile devices provide a unique challenge to higher education faculty faced with a much more highly diverse student population where social technology has become an unquestionable part of how they learn. In their study, Kukulska-Hulme (2012) pointed out that faculty must adopt a lifelong learning perspective that will enable the higher education workforce to adapt to this technolologically saturated environment. Not only are the digital natives of Prensky (2001) entering higher education looking for technology enabled learning content, but also more mature learners are entering and even returning to study and update their skills for career advancement. Brooks (2010) observed that, in this age of technological advancement, higher education faculty are being asked to learn and employ technological approaches witin their classroom and that, given the technological pressures on faculty, significant changes have occurred to the roles and objectives that must be considered and met within the institution.

Bonk and Graham (2006) suggested that technological innovation is occurring at a very high speed as technologies become an integral part of a person's eveyday life. With this technological expansion comes the ever-expanding range of opportunities and possible solutions that can be applied to teaching and learning. Ross and Gage (2006) assert that blended learning has become a highly effective means of addressing the diverse needs of higher education institutions as blended learning technologies are being used to meet student and higher education institutional challenges. Although many universities are using distance learning, blended learning has increased in popularity to meet the diverse student population needs and in some cases institutions have reduced time to graduation by increasing scheduling options for students to complete required course work. Ross and Gage observed that, in other cases, some univeristies have enhanced certain programs to create blended degree programs where a student is not "a traditional student" or an "online student," but chooses from all types of courses to achieve his or her degree. Looking into the future, Ross and Gage predicted that what will sperate one institution from another is not whether they have blended learning, but how do they do the blending.

Faculty Development and Technology

Given the extreme number of adjunct faculty employed throughout institutions of higher education Green (2007) argued that adjunct faculty members have a crucial role in fulfilling an institutions' mission and will have an enormous impact on institutional culture. Therefore, it is critical that institutional leaders develop effective professional development activities. Diegel (2010) acknowledged that faculty at most institutions claimed to have some sort of program defined as faculty development for adjunct faculty. Faculty development programs are widely varied because professional development for adjunct faculty is highly dependent upon institutional resources such as financial, space, appropriate personnel to conduct the courses, and policies of mandatory attendance for faculty. Williams (2003) discussed institutional technology upgrades and integration at the University of Delaware to establish classroom technology levels to meet faculty needs to meet technology usage requests from faculty and to create classrooms that serve different teaching and learning styles. Although this classroom upgrade was to be mainly hardware and software in the classroom, the measure of technology integration would be determined by faculty requests and use instead of simply measuring technology integration as a classroom that contains technology (Williams, 2003).

In research on the role of technology and learning styles, Collins (2010) argued that literature surrounding technology and learning styles focuses specifically on online environments. However, Collins also suggested that technology is equally applicable to face-to-face instruction; therefore, instructors must design learning experiences according to various learning styles. Furthermore, Collins (2010) acknowledged that "instructors cannot be all things to all learners, the knowledge of learning styles can assist instructors in making deliberate decisions about what technologies to incorporate in courses" (p. 167). Greer and Mott (2010) noted that various researchers have observed and indicated that more research is needed to determine what educational strategies and instructional methods would best match learning styles. Greer and Mott (2010) also determined that, through the innovative use of technology, the instructor–student relationship promotes positive learning and that, "when used effectively, any number of instructional technologies can facilitate processes of communication, and so enhance the development of learning relationships" (p. 33).

In an experiment using a learning-by-design course as part of faculty development, Koehler and Mishra (2005) noted that introducing technology by itself to the educational process is not sufficient to ensure technology integration and that technological learning environments serve as the context for instructor professional development. Furthermore, Koehler and Mishra argued that training must go beyond simple technology skill instruction to teach technology in a context that honors the connection between technology, content, and pedagogy. Congruent with the concern of professional development of all faculty members, Umbach (2007) advocated that institutional support for contingent (adjunct) faculty likely increases their commitment to the institution and manifests itself as increased performance and other work behaviors; therefore, it has a more positive effect on students.

Laughner (2003) stated that, when a new building containing state-of-the-art technology in every classroom was opened at Notre Dame University in 1992, a new era in education began. Further, Laughner predicted that technology would play an integral role in teaching and learning. Recognizing that technology of that time was an emerging concept, the institution dedicated services for faculty support including both IT professionals and multiple short training classes to reduce or eliminate obstacles for faculty success. Laughner pointed out that the underlying philosophy of support to faculty included four philosophical imperatives for conducting technology integration with the faculty. Imperative 1 was “No faculty member has to use technology” (p. 6), rather he or she would do so out of choice, choosing, given time, appropriate technology for their courses. Imperative 2 was “Technology is only part of the equation” (p. 6), for pedagogical consequences must be considered. Imperative 3 was “Faculty and student time are precious resources” (p. 7); therefore, IT support personnel would prioritize classroom support to fix instructor technology issues. Imperative 4 was "Even if faculty decides to use technology, they often don't want to become computer experts" (p. 6); therefore, faculty members would be the subject matter experts for the technology development team, not the technology expert for the team (Laughner, 2003).

Kukulska-Hulme (2012) asserted that the challenge for a higher education institution is to find a cost-effective yet engaging solution to the problem of getting faculty to take their own professional development of technology more seriously. Faculty members often receive more training about technology, less training on how teachers learn with technology and less training still on how to use the technology to teach. Brooks (2010) stated that, as technology continues to evolve rapidly and as expectations for faculty to incorporate technology increase, more faculty members will need timely assistance and support to achieve integration of technology.

Summary

In this chapter, the researcher provided an overview of the literature related to this study. In the first section, the researcher reviewed the development and the evolution of TPACK as both a framework and an instrument and reviewed the literature surrounding the trends of integrating digital technology into education and curriculum. Using the research concerning K–12 teachers' and higher education faculty's use of technology both personally and professionally, the researcher articulated the idea that teacher-training institutions and educational institutions that employ them must assist faculty in developing technological skills that coincide with the pedagogical integration of technology.

CHAPTER 3 – METHODOLOGY

Introduction

The purpose of this quantitative study was to investigate whether a relationship exists between (a) TPACK subdomain, (b) pedagogical training, (c) personal technology, and which variables have the greatest influence in the willingness of adjunct faculty at a higher education institution to choose and integrate digital technology into curriculum. The research design for this study is a quantitative pre-experimental static group comparison.

In this chapter, the researcher describes the research methodology used and includes discussions on 10 topics: the research design, rationale for methodology, context, context, sampling frame and setting, sampling technique, survey instrumentation, data collection, means of data analysis, and protection of human rights. The chapter ends with a summary.

The researcher proposed to investigate using the TPACK framework with adjunct faculty to determine whether a difference exists between adjunct faculty who are pedagogically trained to use technology and adjunct faculty who are not pedagogically trained to use technology, and to determine whether and to what extent PLS influences adjunct faculty willingness to integrate technology. In addition, the researcher explores which of these variables have the greatest influence of predicting adjunct faculty's integration of technology into curriculum.

Research Questions

The researcher outlined three research questions from the overall purpose of the study. The research questions are listed with their accompanying null hypotheses:

1. Research Question 1: Does a difference exist in faculty who rate themselves higher on the PK scale compared to faculty who rate themselves lower on the PK scale in selecting appropriate digital technology for classroom learning outcomes?

Stated as a null hypothesis:

- H_0: No statistically significant difference exists between faculty who rate themselves higher on the PK scale compared to faculty who rate themselves lower on the PK scale in selecting appropriate digital technology for classroom learning outcomes.

2. Research Question 2: Does a difference exist in classroom technology integration between faculty who use technology in their private lives and faculty who do not use technology in their private lives?

Stated as a null hypothesis:

- H_0: No statistically significant difference exists between faculty who use technology in their private lives and faculty who do not use technology in their private lives in classroom technology integration.

3. Research Question 3: Does PK, TK, PLS, or classroom technology integration predict using technology in curriculum?

Stated as a null hypothesis:

- H_0: Pedagogical knowledge, TK, PLS, and classroom technology integration score do not predict using technology in curriculum.

Research Design

As suggested by Campbell and Stanley (1963), the researcher used in this research a quantitative pre-experimental static group comparison research design or, as suggested by Johnson and Christensen (2014), a nonexperimental quantitative cross-sectional predictive study research design. An independent samples *t* test and a multiple logistic regression were the primary quantitative analysis performed. A static group comparison design does not include the random assignment of participants; therefore, it is considered a pre-experimental design. Table 2 demonstrates the static group comparison design outlining the treatment variable and posttest score comparisons of the groups. The participant groups in the static group comparison are matched according to their answers on the survey instrument to compare one group of participants that has experienced X to a group that has not experienced X.

Table 2

Diagram of the Static Group Comparison Design

	X Treatment	O Posttest
		O Posttest

Note. Experimental and quasi-experimental designs for research, by D. T. Campbell & J. C. Stanley, 1963. In N. Gage (Ed.), *Handbook of research on teaching* (pp. 1–76). Dallas, TX: Rand McNally and Company, p. 12.

According to Johnson and Christensen (2014), a nonexperimental quantitative cross-sectional predictive study research design is focused on the primary research objective in which the independent variable is not manipulated and no participants are assigned randomly. Table 3 demonstrates the research types available according to Christensen and Johnson (2014). In addition, in cross-sectional research, data are collected from research participants at a single point in time or during a single brief period, the data directly apply to each case at that point in time or during that period, and comparisons are made across the variables of interest (Johnson, 2001).

Table 3

Diagram of the Types of Research Obtained by Crossing Research Objective and Time Dimension

	Time dimension		
Research objective	**Retrospective**	**Cross-sectional**	**Longitudinal**
Descriptive	Retrospective, descriptive study (Type 1)	Cross-sectional, descriptive study (Type 2)	Longitudinal, descriptive study (Type 3)
Predictive	Retrospective, predictive study (Type 4)	Cross-sectional, predictive study (Type 5)	Longitudinal, predictive study (Type 6)
Explanatory	Retrospective, predictive study (Type 7)	Cross-sectional, explanatory study (Type 8)	Longitudinal, explanatory study (Type 9)

According to Johnson and Christensen (2014), when manipulation of the variables and random assignment are missing and the researcher does not have direct control to manipulate the variables, the researcher must observe what naturally occurs. In this study, the researcher matched participants within groups on certain variables; however, no assumption is made that participants or groups are equivalent on other variables. When participant matching cannot be assumed to replace randomization and offers a limitation, the correlation between the matching variables should be fairly substantial Fraenkel and Wallen (2009).

According to Johnson (2001), a substantial portion of quantitative educational research is nonexperimental because many variables cannot be manipulated; therefore, a modern research design based upon the two-dimensional classifications of research objective and time is needed. Additionally, Johnson and Christensen (2014) asserted that, despite its limitations, nonexperimental research is very important to the field of education because many educational variables cannot be manipulated. To determine whether a relationship exists between variables some researchers (Creswell, 2009; Fraenkel & Wallen, 2009; Gall, Gall, & Borg, 2003) advocated using a causal-comparative, correlational, or survey study. However, Johnson (2001) developed the nonexperimental quantitative research designs as a method for a "more logical classification of nonexperimental quantitative research" (p. 11).

Rationale for Methodology

According to Johnson and Christensen (2014), researchers are interested in relationships of variables to discover how the world operates and make it better. In using either the static group comparison or the nonexperimental, cross-sectional, predictive designs neither are the participants randomly assigned nor are the dependent variables manipulated. In this study, the participant responses on the survey were used to assemble the groups for comparison helping alleviate experimenter bias during selection of group membership.

According to Punch (2005), in quantitative experimental or quasi-experimental studies the researcher can often be viewed as nonexistent or simply as a data collector. The researcher uses one or more instruments to collect data. In a quantitative research study, the research participants respond to the instrument and do not interact with the researcher.

The nonexperimental design in this study demonstrated strengths in internal validity in all but three areas. The complete sources of invalidity from Campbell and Stanley (1963) are summarized in Table 4.

Table 4

Sources of Invalidity of Pre-Experimental Static Group Comparison

Sources of invalidity											
Internal								External			
History	Maturation	Testing	Instrumentation	Regression	Selection	Mortality	Interaction of selection and maturation, etc.	Interaction of testing and X	Interaction of selection and X	Reactive arrangements	Multiple X interference
+	?	+	+	+	–	–	–	n/a	–	n/a	n/a

Note. In Table 4, a minus (–) indicates a weakness, a plus (+) indicates that the factor is controlled, and a question mark (?) indicates a possible source of concern. From Experimental and quasi-experimental designs for research, by D. T. Campbell & J. C. Stanley, 1963. In N. Gage (Ed.), *Handbook of research on teaching* (pp. 1–76). Dallas, TX: Rand McNally and Company. Campbell & Stanley, 1963, p. 8).

In this study, the three areas of concern or weakness were selection, mortality, and the interaction of selection and maturation and regression. In general, the interaction of the selection of subjects into a specific group is controlled by the anonymous answers on the survey. How the respondents answer the survey during the experiment determines the group assignment. This method allows the group assignment to be more random than it would be with matching, and better accounts for the correlation. The second weakness identified is mortality or the loss of participants from the comparison groups. With the addition of the nonexperimental, cross-sectional, predictive design, data are collected at one specific point in time; therefore, mortality is controlled and becomes a strength for this study.

The third threat to internal validity of the design in this study is regression. Regression is a threat if groups are selected depending on extreme scores that can cloud the observed effect of the treatment (Campbell & Stanley, 1963). However, the sample selection is assigned to groups depending on individual answers to the survey; therefore, participants are divided into two natural groups and the differential recruitment in groups related to the treatment is mitigated.

Population Context

This study was conducted at two extension campuses of a Midwestern university that follows the Carnegie classification guide is a Tier 1 institution with two extension sites in the State of Kansas. The institution serves over 22,000 students in undergraduate and graduate level degree programs. The two extension campuses offer graduate level programs for adults and exclusively employ adjunct instructors. Classes are normally taught one night per week for 4 hours. Academic terms are taught on a compressed schedule of 8–10 weeks in duration. Students are generally professionals who seek an advanced degree for job promotion requirements. Students are primarily Americans with a small percentage of international students. The sample for this study was drawn from the graduate school adjunct faculty who were employed by the university on a course-by-course basis at two extension campuses under the direction of the same director. The sample population included 69 instructors who taught courses for the completion of 11 different graduate degrees. Campus A generally employs 58 adjunct faculty instructors and offers to graduate students seven graduate degrees:

1. Master of Business Administration
2. Master of Arts in Business and Organizational Security Management
3. Master of Arts in Human Resources Management
4. Master of Arts in Information Technology Management
5. Master of Arts in International Relations
6. Master of Arts in Management
7. Master of Arts in Procurement and Acquisitions Management

Campus B generally employees 11 adjunct faculty and offers five graduate degrees:

1. Master of Business Administration
2. Master of Health Administration
3. Master of Arts in Human Resources Development
4. Master of Arts in Human Resources Management
5. Master of Arts in Management and Leadership

Faculty members are offered no formal faculty development prior to assuming their role in the classroom. Faculty members are informed of voluntary self-paced online learning activities from the main campus faculty development Web portal and an annual mandatory 4–hour professional development training session. The faculty development Web portal course consists of basic use of the university's learning management system and how to create an online syllabus in a syllabus creator. The mandatory annual faculty development meeting generally covers administrative matters such as faculty and course feedback reviews, tuition assistance, program status review of the various graduate programs, and administrative matters from the degree or course lead professors.

Sampling Frame and Setting

The sample in this study came from two extension campus faculty populations from a single Midwestern university under the same director and support staff to form a single population pool. The university provides graduate level programs in 11 different master's degree programs. The entire faculty population of 69 adjunct faculty members was invited to participate in the study with 30 (n=30) faculty members responding. A Web survey invitation was e-mailed to all faculty members for equal chance of participation in the study. The sample was drawn from the population of respondents to the survey as a nonrandomized convenience sample.

The number of faculty members small and their access convenient; therefore, a convenience sample technique was used. According to Fraenkel and Wallen (2009), a convenience sample is a population with a group of individuals who are conveniently available for study. A convenience sample has a measure of risk because not all faculty members might respond to the survey, their views and experience might not be included in the research, and the resulting sample and results might not be entirely indicative of the greater population. However, according to Fraenkel and Wallen (2009), the entire population could be invited to participate and, in this study, was invited to participate; therefore, it was likely that the results from the sample would be indicative of the greater population because the sample size was greater than 30 participants.

Sampling Technique

A Web survey was e-mailed to the study population of 69 faculty members currently employed teaching at one of the two extension campus locations for the university. The respondents to the survey were used as the nonrandomized sample population. Fowler (2009) suggested five critical areas or issues for good design of survey research in the total survey design: “The choice of probability or nonprobability sampling; the sample frame (those who actually have a chance to be sampled); the size of the sample; the sample design (the strategy); and the rate of response” (p. 7). Using this design methodology, the researcher was able to describe the sample population in sufficient detail to describe the population overall with reasonable assurance that the sample responses were indicative of the overall target population and to minimize the data errors.

Instrumentation

The survey instrument for this survey was derived from the TPACK survey instrument (Schmidt et al., 2009) and modified for practicing instructors of graduate degree programs. Questions regarding specific courses or disciplines were removed and questions concerning technology use within an instructor's private life were added. Specific instrument modifications were made from the 2009 TPACK instrument and are included in Appendix A.

According to Schmidt et al. (2009), following the development of the TPACK survey instrument, it was modified over time. Koehler and Mishra (2005) used a survey that tracked changes in teachers' perceptions of TPACK domains during an instructional course that emphasized design of educational technology. Angeli and Valanides (2009) incorporated self-assessment, peer assessment, and expert assessment into their survey. Archambault and Crippen (2009) surveyed teachers to rate their own understanding of various instructional and conceptual issues.

Schmidt et al. (2009) developed the TPACK instrument and used a sample of 124 students enrolled in an instructional technology course for PK-6 preservice teachers. The TPACK instrument focuses on measuring preservice teachers' self-assessment of their TPACK and related domains that were included within the TPACK framework. In a similar vein, the researcher modified the instrument to focus on adjunct faculty in higher education, teaching, graduate level degree programs. Specific questions that the researcher deleted, changed, and added from the Schmidt et al. (2009) instrument are contained in Appendix A. The pilot of the instrument resulted in refining the survey language, but did not involve any major changes.

Pilot of the Instrument

The modified TPACK survey (Appendix B) instrument for this study was distributed on two occasions to a similar population of adjunct faculty who were not employed by the intended survey population to examine any resulting changes in validity or reliability and to ensure that changed or added questions load into the correct TPACK domains. The postmodified survey reliability analysis revealed that the instrument exhibited strong reliability. The Cronbach's Alpha (α) score for the modified instrument overall was α=.961 and the Cronbach's α score of the three major components were: technology knowledge (original α=.82/ modified α=.66); CK (original α=.91/ modified α=.72); and PK (original α=.84/ modified α=.79). Although some scores were lower in individual areas, according to Field (2009), an overall Cronbach's α score of .97 is excellent and a Cronbach's α score .60 or higher is acceptable for social sciences. Each question on the survey uses a 5-point Likert scale using the following identifiers: 1 (*Strongly disagree*); 2 (*Disagree*); 3 (*Neither agree nor disagree*); 4 (*Agree*); 5 (*Strongly agree*).

The survey questions focused on measuring the three basic knowledge types of technology, pedagogy, and content. The complete instrument encompasses all seven components: technology knowledge, CK, PK, pedagogical content knowledge, technological CK, technological PK, and TPACK.

Reliability

The reliability of the TPACK instrument on internal consistency reliability using Cronbach's α reliability technique has been accomplished multiple times. As stated above, the Cronbach's α score for the modified instrument in this study was α=.961. However, in Schmidt et al. (2009), a factor analysis was accomplished, problem questions were eliminated, and another factor analysis was accomplished. After the second factor analysis, the instrument exhibited strong internal consistency reliability (Schmidt et al., 2009). The Cronbach's alphas of the three major components were technology knowledge (α=.82); CK (α=.91); and PK (α=.84). These measurements demonstrated sufficient internal reliability to use the instrument during this study. Yurdakul et al. (2012) conducted validity and reliability studies of a modified TPACK instrument using both an exploratory factor analysis and a confirmatory factor analysis using 995 Turkish preservice teachers. They determined that the test–retest reliability coefficient of the modified TPACK scale was .80 and concluded that the scale was consistent.

Protection of Human Rights

This research was conducted under the policies of the University Research Compliance Office Institutional Review Board of Kansas State University and from the Midwestern institution whose adjunct faculty members are being surveyed. Institutional Review Board approval was obtained from Kansas State University (Appendix C) and the Midwestern institution (Appendix D) prior to gathering data. The research subjects were provided an informed consent statement prior to the beginning of the survey and providing results. The confidentiality, rights, and welfare of the subjects were paramount at all times.

Data Collection

The survey instrument for this survey (Appendix B) was derived from the TPACK survey instrument (Schmidt et al., 2009) and modified for practicing instructors of graduate degree programs and was distributed to all current adjunct faculty members of the two extension campuses of a Midwestern university. The survey instrument contained nine demographic questions to describe the sample population adequately. The demographic data collected consisted of gender, number of years teaching at the current university and teaching adults, the primary degree program the adjunct teaches in and the primary degree area of the adjunct, the highest level of degree, the primary extension site of the adjunct instructor, the ethnic background, and whether the adjunct had completed an educational technology course.

The main survey consisted of 40 questions within the TPACK section of the survey measuring the seven subsections or domains of the TPACK theory, and six open-ended questions for explanatory or expounding answers. A reliability analysis for instrument internal consistency was conducted resulting in a Cronbach's α of .961. Prior to the survey respondents had to acknowledge the informed consent (Appendix E). Data were then collected from the participant's self-reported survey answers, entered into the Statistical Package for Social Sciences (SPSS), and statistically analyzed.

The researcher solicited the assistance of the program director over both extension campuses to facilitate the survey. A preparatory e-mail from the program director (Appendix F) was sent to all active adjunct faculty members notifying them of the research. An e-mail invitation to participate from the researcher (Appendix H) was then sent to the program directors same distribution list. The survey was distributed using SurveyMonkey™ to all active adjunct faculty members on the previous two e-mail lists. With the assistance of the program director, weekly e-mail reminders led to a survey response of 43% overall.

Survey Procedures

The survey was hosted on the Survey Monkey™ website. A complete listing of all active and registered adjunct faculty members for the target study was obtained from the university faculty coordinator as approved by the director of the extension campuses. A preparatory e-mail (Appendix F) from the university campuses director was sent to inform the faculty of the proposed research study to ensure that the faculty understood the context of the study and that participation was encouraged, but was strictly voluntary. The e-mail invitation to participate contained a unique participant link for each participant's response. The researcher then sent via the Survey Monkey™ website the invitation to participate in the research study. The informed consent form (Appendix E) was included as the first page the participants viewed. The survey (Appendix B) was constructed so that each participating respondent acknowledged the informed consent banner prior to initiating the survey. The survey was sent and survey data was collected for 60 days. Reminders to participate were sent after 30 days every 7 days to those who had not responded. A response rate greater than a 50% was expected; however, a 43% response rate was obtained with 30 completed surveys. Some respondents left descriptive questions and open-ended questions blank; however, all participants completed the Likert scale questions for each TPACK domain questions. Data were collected by the Survey Monkey™ website and the researcher downloaded the aggregated data into SPSS for analysis.

Data Analysis

For the data analysis phase of this study, the data was downloaded from the Survey Monkey™ website and uploaded into SPSS. The first phase of data analysis was to label and assign the type for all variables. Questions using the Likert scale of 1 (*Strongly disagree*) to 5 (*Strongly agree*) were used for quantitative measure. An internal consistency Cronbach's α score was generated with values above .60 being retained. According to Field (2009), most researchers in books and articles advocate a Cronbach's

α score above .70 to .80 as being an acceptable level. However, Field also noted that social science researchers have a generally accepted a Cronbach's α score above .60 and that the sample size must be a consideration. Sample sizes less than 250 should have a Cronbach's α score of greater than .70. However, according to Clark and Watson (1995), contemporary research in the social sciences requires less strict measurement and commonly uses .60 or .70 as good or adequate. Therefore, a Cronbach's α score above .60 was considered reliable for this study.

During the second phase of the analysis an independent sample *t*-test analysis was conducted to determine relationships between pedagogically and nonpedagogically trained faculty members to answer Research Question 1 and to distinguish between faculty who use and do not use technology in their private lives to answer Research Question 2. The next phase a multiple regression analysis was conducted to determine a correlation between the predictor variables of pedagogical training, technological training, PLS, and TCK score and the criterion variable of the integration of appropriate technology into curriculum. The map of survey questions to Research Questions 1 and 2 is located in Table 5. The map of Survey Question 3 is located in Table 6. (For a complete map of the survey questions to the research questions see Appendix G).

Table 5

Map of Survey Questions for Research Questions 1 and 2

Research question	**Independent variable**	**Dependent variable**	**Primary survey stem no.**	**Analysis**
1	Pedagogical knowledge	Appropriate digital technology (TPACK domain score)	PK: 27, 28, 29, 30, 31, 32, 33, 34 TPACK: 47, 48, 49, 50, 51	Independent sample *t* test

Research question	Independent variable	Dependent variable	Primary survey stem no.	Analysis
			Descriptors: 35, 36, 37, 54	
2	Personal technology usage	Classroom technology integration	PLS: 18, 19, 20, 21, 22 TCK: 38, 39, 40, 41 Descriptors: 23, 24, 25, 26, 55, 56, 57	Independent sample *t* test

Note. PK = pedagogical knowledge; PLS = personal technology use; TCK = technological content knowledge; TPACK = technological pedagogical content knowledge.

Table 6

Map of Survey Questions for Research Question 3

Regression research question	Predictor	Criterion	Primary survey stem no.	Analysis
3	Technological knowledge Pedagogical knowledge Personal technology use TPACK (overall instrument score) Classroom technology integration (TCK)	TPACK (domain score)	TK: 12, 13, 14, 15, 16, 17, PK: 27, 28, 29, 30, 31, 32, 33, 34 PLS: 18, 19, 20, 21, 22 TPACK: 47, 48, 49, 50, 51 Descriptors: 42, 43, 44, 45, 46, 52, 53, 54,	Multiple regression

Note. PK = pedagogical knowledge; PLS = personal technology use; TCK = technological content knowledge; TPACK = technological pedagogical content knowledge.

Summary

In this chapter, the researcher addressed the research questions, research design, the instrument, data collection, and means of data analysis for this study. This research is an effort to investigate using the TPACK framework to study higher education adjunct faculty to determine whether a difference exists between technology selections of adjunct faculty who are pedagogically trained and adjunct faculty who are not pedagogically trained to determine whether and to what extent PLS influences adjunct faculty willingness to integrate technology. The research was also an effort to determine which of these variables has the greatest influence of predicting the adjunct faculty's integration of technology into curriculum. In Chapter 4, the researcher will discuss the findings of this research project.

CHAPTER 4 – FINDINGS

Introduction

The purpose of this quantitative study was to investigate whether a relationship exists between (a) TPACK subdomain, (b) pedagogical training, and (c) personal technology; and which variables have the greatest influence in the willingness of adjunct faculty at a higher education institution to choose and integrate digital technology into curriculum.

In this chapter, the researcher provides an analysis of the data collected through this research and has divided it into three sections. Section 1 outlines the survey returns and the survey demographic description. Section 2 outlines the data collected from the research questions. Section 3 covers a summary of research findings.

Demographic Description

The sample was taken from a population of active adjunct faculty members currently teaching at one of the two extension locations for the university. The entire population of adjunct faculty instructors (N=69) were invited to participate in the research study with (n= 30) adjunct faculty members responding to the survey for a 43% return rate (see Appendix I for complete demographic distribution tables).

Age

The age range of the sample was 36 to 76, with a mean of 55.5 and a median of 55.0. The sample was determined to be multimodal of 36 and 55. Two participants declined to enter an age. As shown in Table 7, the majority of the sample respondents (33.33%) were Ages 45–54 years; they were followed closely by respondents (30%) Ages 55–64 years. The next largest grouping of respondents (16.66%) was Ages 65–69 years. The category for Ages 24–34 years for the university faculty across all American campuses was not included to compare the categories similarly. Frequency refers only to the respondents of the survey and not the university or national average (see Table 1, Appendix I).

Gender

Males are represented more than females over a 3:1 ratio. The gender of the respondents (see Table 8) shows that the population was 73.3% male, 20% female, and 6.7% unknown (two respondents declined to answer for gender). The adjunct faculty population of the surveyed university is also contained and was distributed with 82.60% male and 17.39% female (see Table 2, Appendix I). Therefore, the sample closely resembles the adjunct faculty population of the university.

Ethnicity

In addition to the disparity among male and female survey participation, ethnicity had an even larger disparity. Among the survey respondents 27 (90%) were White non-Hispanic, one (3.33%) was African American, and two (6.67%) declined to answer (see Table 3, Appendix I for the outlines the ethnicity distribution of the sample).

Education

The entire faculty sample earned at least one master's degree with 12 faculty members (40%) reporting a second master's degree followed closely by nine faculty members (30%) listing some postmaster's work or certificate. Six faculty members (20%) reported completing a doctorate degree. Three faculty members (10%) declined to answer the question (see Table 4, Appendix I for the demonstration of the educational degrees reported by the respondents). Among the sample, 16 faculty members (53.3%) reported having completed an educational technology course where 14 faculty members (46.6%) reported not having completed an educational technology course.

Years Teaching

The entire faculty sample had taught at their current university for at least 1 year (see Table 5, Appendix I). Eleven faculty members (36.6%) had taught for 1–5 years. Eight faculty members (26.6%) had taught for 6–10 years followed closely by seven faculty members (23.3%) having taught for 11–20 years. Four faculty members (13.3%) reported teaching at their current university for more than 20 years with the longest being 28 years.

Four faculty members (13.3%) reported teaching adults for 1–5 years (see Table 6, Appendix I). Eight faculty members (26.6%) had taught adults for 6–10 years. Ten faculty members (33.3%) had for 11 and 20 years. Eight faculty members (26.6%) had taught for more than 20 years.

Primary Program Site and Program Taught

The majority of faculty members 27 (90%) identified their primary instructor site as Campus A, while three faculty members (10%) identified their primary instructor site as Campus B. Seven faculty members (23.3%) reported teaching in the Master of Business Administration program (see Table 7, Appendix I). One faculty member (3.3%) reported teaching in the Business and Organizational Security Management program. Two faculty members (6.6%) reported teaching in the Human Resources Management program. Three faculty members (10%) reported teaching in the Information Technology Management program. Four faculty members (13.3%) reported teaching in the International Relations program. One faculty member (3.3%) reported teaching in the Management program. Five faculty members (16.6%) reported teaching in the Procurement and Acquisitions Management program. Two faculty members (6.6%) reported teaching in the Human Resources Development program. Four faculty members

(13.3%) reported teaching in the Management and Leadership program. No faculty members reported working in Health Administration and one faculty member (3.3%) declined to answer.

Faculty Primary Degree

The participants answered the open-ended question of primary degree earned in a wide variety of degrees (see Table 8, Appendix I). Ten faculty members (33.3%) reported having a master's degree in business administration; they were followed closely by six faculty members (20.0%) who reported having a primary degree in management and leadership. One faculty member (3.33%) reported having a primary degree in human resource management. One faculty member (3.33%) reported having a primary degree in international relations. One faculty member (3.33%) reported having a primary degree in management. One faculty member (3.33%) reported having a primary degree in procurement and acquisitions management. One faculty member (3.33%) reported having a primary degree in human resource development. Eight faculty members (26.6%) declined to answer for primary degree; however, two (6.6%) listed Juris Doctorate; two (6.6%) listed history; one (3.33%) listed adult education; one (3.33%) listed psychology; one (3.33%) listed both a master's degree and doctorate in East Asian studies; and one (3.33%) listed system management as their secondary degree. One (3.33%) declined to answer any degree.

In summary, 30 participants completed the survey resulting in a 43% survey return rate. The majority of research participants reported was White, male, had at least one master's degree, and was Ages 45–54 years. The majority of adjunct faculty has taught at their current university more than 5 years, primarily at Campus A, and has taught adults an average of 16 years. The majority of faculty members have completed an educational technology course.

Research Question 1

In this study, Research Question 1 was, “Does a difference exist in faculty who rate themselves higher on the pedagogical knowledge (PK) scale compared to faculty who rate themselves lower on the PK scale in selecting appropriate digital technology for classroom learning outcomes?” To answer this question, the survey data was downloaded from SurveyMonkey™ and imported into the SPSS and an independent sample *t* test was conducted comparing the mean score of participants who rated themselves higher on the pedagogical scale (respondents scored 3.99) to the mean score of participants who rated themselves lower on the pedagogical scale (respondents scored less than 3.98) in the selection of appropriate digital technology for classroom learning outcomes. The researcher used 3.99 as the cutoff for the groups to separate those who answered 5 (*Strongly agree*) and 4 (*Agree*), indicating a response of positive versus those who answered 3 (*Neither agree nor disagree*), 2 (*Disagree*), and 1 (*Strongly disagree*), indicating a response of neutral or negative. Appropriate digital technology for classroom learning outcomes is operationally defined as the TPACK domain score. Table 7 demonstrates the breakdown of survey questions to Research Question 1.

Table 7

Breakdown of Survey Questions for Research Question 1

Research question	**Independent variable**	**Dependent variable**	**Primary survey stem no.**	**Analysis**
1	Pedagogical knowledge	Appropriate digital technology (TPACK domain score)	PK: 27, 28, 29, 30, 31, 32, 33, 34 TPACK: 47, 48, 49, 50, 51 Descriptors: 35, 36, 37, 54	Independent sample *t* test

Note. PK = pedagogical knowledge; TPACK = technological pedagogical content knowledge.

As shown in Table 8, in Research Question 1 statistically significant difference was found ($t(28)=2.365$, $p<.05$). The mean of the participants who rated themselves higher on the pedagogical scale ($m=4.0522$, sd=.70380, $n=23$) was statistically significantly different than the mean of participants who rated themselves lower on the pedagogical scale ($m=3.3714$, sd=.50897, $n=7$).

Table 8

T-Test Group Statistics

	Pedagogical knowledge	***N***	**Mean**	**Std. deviation**	**Std. error mean**
TPACK	Higher group	23	4.0522	0.7038	0.1468
	Lower group	7	3.3714	0.50897	0.1924

Note. TPACK = technological pedagogical content knowledge.

An independent sample *t* test assumes that the means are equivalent; therefore, conclusions are drawn from the equal variances are assumed row (see Table 9). With an a priori (α) set at .05 the researcher concluded that the .025 in the sig (2 tailed) results demonstrates that a statistically significant difference exists between the two groups.

According to Pagano (2012), with a sample size equal to or greater than 30, the *t* test for independent groups can be used despite minor violations of normality or homogeneity of variance. A combination of the Kolmogorov-Smirnov and the Shapiro-Wilk test demonstrated that the distribution of data was not normally distributed. A Pearson's correlation coefficient of .629 was also calculated to determine effect size. According to Field (2009), where a zero represents no effect and a one indicates a perfect effect, a .629 represents a medium effect.

Table 9

Independent Samples T Test

		Levene's test for equality of variances		***t* Test for equality of means**						
		f	**Sig.**	***t***	***df***	**Sig. (2-tailed)**	**Mean diff.**	**Std. error diff**	**Lower[a]**	**Upper[a]**
Tpack	Equal variance assumed	.624	.436	2.365	28	.025	.68075	.28786	.0910	1.2704
	Equal variance not assumed			2.813	13.74	.014	.68075	.24196	.1609	1.2005

Note. [a]95% confidence interval of the difference.

The independent sample *t*-test score demonstrates that in Research Question 1 that a statistically significant difference exists between the two groups. Therefore, the null hypothesis, "No statistically significant difference exists between faculty who rate themselves higher on the PK scale compared to faculty who rate themselves lower on the

PK scale in selecting appropriate digital technology for classroom learning outcomes" is rejected.

Although a statistically significant difference existed between the two groups, open-ended questions provided a richer description of technology integration. The type of technology used in the classroom to support learning outcomes varied from the basic use of Microsoft Office® products (Word, Excel, and PowerPoint), use of prerecorded digital video disks (DVDs), and curriculum specific technologies such as financial calculations software for business majors to using Internet sites that supplement specific learning outcomes. Only 16% of adjunct faculty members reported using technology such as simulations, games, and distributed group editing software matched to actual learning outcomes.

In the group who rated themselves lower in PK, 86% of the group recorded that they had never attended or completed an educational technology course, compared to 65% of the group who rated themselves higher on the pedagogical scale and had attended or completed an educational technology course. Adjunct faculty who rated themselves higher on the Likert scale (*Agree* and *Strongly agree* groups) were divided on technology use, ranging in similar variations of what they considered digital technology and how it was used. The lower group reported using electronic mail (e-mail), smartboards, Microsoft Office®, posting documents and resources on the institutional learning management system, and using web links to supplemental resources as their usage of technology in the classroom. The higher group also reported using electronic mail (e-mail), smartboards, Microsoft Office®, posting documents and resources on the institutional learning management system, and using Web links to supplemental resources; however, they also reported using Wiki's, podcasts, Skype®, simulations and digital games, iPad applications, videos, YouTube, self-authoring multimedia software applications, various online research databases, and video teleconferencing for students and subject matter experts or guest speakers. Of the population, 70% reported a desire to learn more about emerging technologies, strategy games and simulations, Web applications, video teleconferencing, and audio and video self-authoring software. When asked in open-ended questions, respondents described similar knowledge and use of technology throughout the sample with few of them directly supporting learning activities beyond the curriculum specific type of technologies or using DVDs or videos to augment a lecture.

Research Question 2

In this study, Research Question 2 was, "Does a difference exist in classroom technology integration between faculty who use technology in their private lives and faculty who do not use technology in their private lives in classroom technology integration?" To answer this question an independent samples *t* test was conducted comparing the mean score of participants who rated themselves higher on the scale for PLS to the mean score of participants who rated themselves lower on the PLS in relation to their TCK (see Table 10). A statistically significant difference was found ($t(28)=3.417$, $p<.05$).

Table 10

Breakdown of Survey Questions for Research Question 2

Research question	**Independent variable**	**Dependent variable**	**Primary survey stem no.**	**Analysis**
2	Personal technology use	Classroom technology integration	PLS: 18, 19, 20, 21, 22 TCK: 38, 39, 40, 41 Descriptors: 23, 24, 25, 26, 55, 56, 57	Independent sample *t* test

Note. PLS = personal technology use; TCK = technological content knowledge.

The mean of the participants who rated themselves higher on the PLS scale (*m*=4.1719, sd=.63717, *n*=16) was statistically significantly different than the mean of participants who rated themselves lower on the PLS scale (*m*=3.4286, sd=.54091, *n*=14; see Table 11 for complete *t*-test results). The researcher used a combination of the Kolmogorov-Smirnov and the Shapiro-Wilks test and determined the data was normally distributed.

Table 11

T-Test Group Statistics

Variable	**PLS**	***N***	**Mean**	**Std. deviation**	**Std. error mean**
TCK	Upper group	16	4.1719	.63717	.15929
	Lower group	14	3.4286	.54091	.14456

Note. PLS = personal technology use; TCK = technological content knowledge.

The independent sample *t*-test score demonstrated for Research Question 2 that a statistically significant difference existed with a 2-tailed result of .002 (see Table 12). Additionally, a Pearson's correlation coefficient of .693 was also calculated to determine effect size. According to Field (2009), where a zero represents no effect and a one indicates a perfect effect, a .693 represents a medium effect.

Therefore, Research Question 2, stated as a null hypothesis, "No statistically significant difference exists between faculty who use technology in their private lives and faculty who do not use technology in their private lives in classroom technology integration" is rejected.

The responses to the open-ended questions revealed that between 83%–86% of the population in both groups reported using technologies beyond e-mail, television, DVDs, Microsoft Office® applications, and the institutional learning management system and used forms of Wiki's, distributed learning, smartboards, and other technology. Sixty-seven percent of the population reported they kept up with new technologies with 70% reporting they possessed the technical skills to use technology effectively.

Table 12

Independent Samples t Test

		Levene's test for equality of variances		***t* Test for equality of means**						
		f	**Sig.**	***t***	***df***	**Sig. (2-tail)**	**Mean difference**	**Std. error difference**	**Lower[a]**	**Upper[a]**
TCK	Equal variances assumed	.343	.563	3.417	28.0	.002	.74330	.21754	.29770	1.1889
	Equal variances not assumed			3.455	27.982	.002	.74330	.21511	.30265	1.1839

Note. TCK = technological content knowledge.
[a]95% confidence interval of the difference.

Research Question 3

In this study, Research Question 3 was, "Does PK, TK, PLS, or classroom technology integration predict using technology in curriculum?" To answer this question, a multiple regression analysis was conducted to determine the overall relationship between the predictor variables and using technology in curriculum (TPACK domain score) and how much each predictor contributes to the relationship (see Table 13).

A standard, forced entry, multiple linear regression was calculated to predict participant's use of technology in curriculum depending on their scores of PK, TK, PLS, and classroom technology integration. The linear combination of TCK, PCK, TK, and PLS was significantly related to TPACK where ($F(4,25)=28.093$, $p<.001$), with an R^2 of .818. Participant's TCK was the most significant predictor (.708) followed closely by participants TK (.500).

Table 13

Breakdown of Survey Questions for Research Question 3

Regression research question	Predictor	Criterion	Primary survey stem no.	Analysis
3	Technological knowledge Pedagogical knowledge personal technology usage Classroom technology integration (TCK)	TPACK (domain score)	TK: 12, 13, 14, 15, 16, 17, PK: 27, 28, 29, 30, 31, 32, 33, 34 PLS: 18, 19, 20, 21, 22 TPACK: 47, 48, 49, 50, 51 Descriptors: 42, 43, 44, 45, 46, 52, 53, 54,	Multiple regression

Note. PK = pedagogical knowledge; PLS = personal technology use; TCK = technological content knowledge; TPACK = technological pedagogical content knowledge.

Table 14 demonstrates that approximately 81.8% of the variance of the TPACK can be accounted for by the linear combination of the predictors TCK, PK, TK, PLS, and TPACK Instrument scores with TCK (.708) and TK (.500) demonstrating the great magnitude of this relationship. As a further test of collinearity, TK also demonstrated a variance proportion of .51 indicating that 51% of its variance is loading with the TCK variable. To reduce the multicollinearity the TPACK instrument score was removed as a predictor because the TPACK instrument design appears to have inherent multicollinearity or shared variance (see Tables 15 and 16).

Table 14

Model Summary

Model	***r***	***r* square**	**Adjusted *r* square**	**Std. error of the estimate**
1	.904[a]	.818	.789	.32976

Note. [a]Predictors: (Constant), technological content knowledge, pedagogical knowledge, technological knowledge, personal technological usage/Personal Life Stems. Dependent variable: TPACK = technological pedagogical content knowledge.

Table 15

Change Statistics

	Change statistics					
Model	***r* square change**	***f* change**	***df*1**	***df*2**	**Sig. *f* change**	**Durbin-Watson**
1	.818	28.093	4	25	.000	2.393

Table 1

ANOVA

Model		Sum of squares	*df*	Mean square	*f*	Sig.
	Regression	12.220	4	3.055	28.093	.000[a]
1	Residual	2.719	25	.109		
	Total	14.939	29			

Note. [a]Predictors: (Constant), technological content knowledge, pedagogical knowledge, technological knowledge, personal technological usage/Personal Life Stems. Dependent variable: TPACK = technological pedagogical content knowledge.

Table 17 demonstrates that the significance value of *p*<.001, indicating a significant linear regression and Table 17 demonstrates the estimated scores compared to the actual scores showing the distance from the mean line to the actual score with a 95% confidence level. The unstandardized beta multiple linear regression equation would appear thus:

- TPACK (domain score)=.500 (Technological Knowledge) – .708 (Technological Content Knowledge)

Table 2

Coefficients

Model		Unstandardized coefficients		Standardized coefficients		
		b	**Std. error**	**Beta**	***t***	**Sig.**
1	(constant)	–.026	.585		–.045	.965
	PK	.135	.169	.098	.799	.432
	TK	.500	.194	.528	2.578	.016
	PLS	–.331	.192	–.372	–1.728	.096
	TCK	.708	.162	.686	4.364	.000

Note. R^2=.818 (p<.001); PK = pedagogical knowledge; PLS = personal technology use; TCK = technological content knowledge; TPACK = technological pedagogical content knowledge.

The multiple linear regression for Research Question 3, which is stated as a null hypothesis, "Pedagogical knowledge, TK, PLS, and classroom technology integration score do not predict using technology in curriculum" clearly demonstrates statistical significance; therefore, the null hypothesis is rejected.

The responses to the open-ended questions again revealed that 70% of the participants possessed the technical skills to use technology effectively; although 63% indicated they would seek additional training on using more technology with 23% requesting emerging technologies including web simulations, video, and distance learning tools.

Summary

This chapter presented a summary of the quantitative data collected through this research. Section 1 outlined the survey returns and the survey demographic description.

Section 2 outlined the data collected supporting the research questions. The researcher used a sample of 30 adjunct faculty instructors out of a population of 69, of whom the majority of the sample respondents (33.33%) were Ages 45–54 years. The mean age of the sample was Age 55.5 years. Males accounted for 73.3%, females 20%, and gender of 6.7% of the sample was unknown. The entire population had at least one master's degree with 30% of the participants having more than one master's degree and 20% having a doctorate. The majority of the participants had taught at their current university more than 5 years, primarily at Campus A, and the average had taught adults for 16 years. The majority of faculty members had completed an educational technology course.

An independent samples *t* test was conducted to obtain data for Research Questions 1 and 2 with a linear multiple regression conducted for Research Question 3. From the data, the three null hypotheses were rejected.

A discussion, conclusions, and recommendations from these findings follow in Chapter 5.

CHAPTER 5 – SUMMARY AND CONCLUSIONS

In the preceding chapter, the presentation and analysis of data have been reported. This chapter consists of a summary of the study, discussion of the findings, implications for practice, recommendations for further research, and conclusions. The latter sections are to expand the understanding of the data and to relate it to the literature. In addition, the recommendations are to expand the research base of using the TPACK instrument for higher education adjunct faculty. Finally, a synthesizing statement is offered to capture the scope of what was attempted in this research.

Summary of the Study

Many institutions rely heavily on employing adjunct faculty, and using technology has been shown to be important in the workplace. According to Georgina and Hosford (2009) only a small percentage of faculty members attend the technology training provided and TPACK research with K–12 teachers has documented a disconnect between technology, pedagogy, and content. This study was undertaken to add to the body of literature in the area of integrating technology into educational curriculum and expand the discussion of the TPACK framework into graduate level education. In this study, the researcher proposed (a) to investigate using TPACK as an effective framework for higher education adjunct faculty professional development, (b) to determine whether a difference exists between technology selections of adjunct faculty who are pedagogically trained and technology selections of adjunct faculty who are not pedagogically trained, (c) to determine whether and to what extent PLS influences adjunct faculty willingness to integrate technology, and (d) to determine which of these variables has the greatest influence of predicting adjunct faculty's integration of technology into curriculum.

In this study, the researcher used the TPACK framework and instrument as the basis for the research, using a quantitative approach. TPACK is both a framework and an instrument to measure the level of integration of the primary components of the TPACK framework. The researcher used a quantitative pre-experimental static group comparison, research design, according to Campbell and Stanley (1963) or a nonexperimental quantitative cross-sectional predictive study research design, according to Johnson and Christensen (2014).

The findings from the quantitative survey in this study indicate that the TPACK framework can be useful for determining the level of technology integration for higher education adjunct faculty professional development and visualizing where adjunct faculty integrate technology into curriculum. Open-ended survey questions add understanding to the quantitative survey questions. According to Mishra and Koehler (2009), “The basis of good teaching with technology requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content” (p. 1029). This was demonstrated within the open-ended questions, for the data indicates that an overall categorization of technology integration is the routine use of multimedia inclusions, use of computers for Microsoft Office® applications, and Internet research.

In this study, using the TPACK instrument for higher education adjunct faculty was explored to answer three, basic, research questions that are related to pedagogical training, personal usage of technology, and whether the selected variables could predict the effective integration of technology into curriculum. The following research questions were central to this research study:

1. Research Question 1: Does a difference exist in faculty who rate themselves higher on the pedagogical knowledge (PK) scale compared to faculty who rate themselves lower on the PK scale in selecting appropriate digital technology for classroom learning outcomes?

Stated as a null hypothesis:

- H_0: No statistically significant difference exists between faculty who rate themselves higher on the PK scale compared to faculty who rate themselves lower on the PK scale in selecting appropriate digital technology for classroom learning outcomes.

2. Research Question 2: Does a difference exist in classroom technology integration between faculty who use technology in their private lives and faculty who do not use technology in their private lives?

Stated as a null hypothesis:

- H_0: No statistically significant difference exists between faculty who use technology in their private lives and faculty who do not use technology in their private lives in classroom technology integration.

3. Research Question 3: Does PK, TK, PLS, or classroom technology integration predict using technology in curriculum?

Stated as a null hypothesis:

- H_0: Does PK, TK, PLS, or classroom technology integration predict using technology in curriculum?

Discussion of the Findings

In this study, a quantitative analysis was conducted using adjunct faculty members of two, small, Midwestern, graduate degree granting, extension campuses from a Tier 1, Midwestern university because they self-reported their level of pedagogical training, technology usage, and integration of technology into curriculum. The findings provided insight into higher education adjunct faculty training, the usage of the TPACK instrument as a measurement of pedagogical understanding and technological implementation into educational curriculum. The data gleaned from this study was useful in answering the research questions and providing insight for future research. The following section provides discussion and further interpretation of the research questions.

The study population consisted of a sample of 30 adjunct faculty higher education instructors (43%) out of a population of 69 for the two campuses where the majority of the sample respondents (33.33%) were Ages 45–54 years. Masterson's (2010) compared the average age of faculty members and used the reported age of faculty at the University of Arkansas's main campus as a representation of the general faculty population. The University of Arkansas's main campus faculty is Age 65 years (9%) or older and 5% of the faculty members is Ages 70–80 years. According to the National Center for Education Statistic's (2012) Fall 2003 survey results, the national average age for professors is largely grouped between 45–54 years old (32.22%) and 55–64 years old (27.87%).

For generalization purposes, the data revealed that the comparison of the respondent age distribution to the adjunct faculty population for the overall university faculty for all American campuses and to the national average of all faculty members using the national report categories demonstrates that the ages in the sample population are indicative of the greater national population.

In comparing age to the type of technology employed by the sample adjunct faculty members, the data exemplified the statement by Roblyer and Doering (2013) in which they asserted, “We need more teachers who understand the role technology plays in society and education, who are prepared to take advantage of its power and who recognize its limitations” (p. 10). The data revealed no significant difference in the types of technology employed in the classroom.

When asked in open-ended questions, the respondents described similar knowledge and use of technology throughout the sample with few of them directly supporting learning activities beyond the curriculum specific type of technologies or the usage of DVDs or video to augment lecture. According to the Center for Applied Research in Educational Technology (Cradler et al., 2002), only 20% of teachers consider themselves “well prepared” to use technology in their classes, a majority of respondents (60%) in the sample population listed emerging technologies such as Skype™, Web tools, applications, and simulations as technologies on which they desired to have more training, while 17% listed either “none” or “sufficiently technologically prepared” to effectively integrate technology into their curriculum. Among the faculty who listed “none” or “sufficiently technologically prepared,” when asked to describe a specific episode in which they effectively demonstrated combining content, technologies, and teaching approaches in a classroom lesson, the majority replied “using no technology” or “curriculum specific technology required for the class” (e.g. spreadsheet software for finance class).

Research Question 1

Research Question 1 was answered through statistical analysis using an independent sample *t* test and concluded that adjunct faculty who rate themselves higher on the PK scale than faculty who rate themselves lower on the PK scale demonstrated a statistically significant difference in their selection of appropriate digital technology for classroom learning outcomes. A Pearson's correlation coefficient of .629 was also calculated to determine effect size. According to Field (2009), where a 0 represents *no effect* and a 1 indicates a *perfect effect*, a .629 represents a medium effect.

Research Question 1 is significant not only to the population, but also to the faculty coordinator as they plan training for adjunct faculty members. In a handbook for training program directors, Mitchell (1997) suggested using adjunct faculty in educational programs and proposed five reasons for hiring outside consultants: expertise, short-term expansion of staff, political leverage, cost-effectiveness, and opportunities for internal staff to learn new skills and competencies. According to Charlier and Williams (2011), higher education institutions are increasingly dependent upon using adjunct faculty and, as Wyles (1998) expressed, adjunct faculty in higher education are often hired to maintain close ties with business and industry because many are practitioners in the field in which they teach. Adjunct faculty are hired for their connection to business and industry and often are hired for their expertise; therefore, this hiring does not necessarily equate to a comprehensive understanding of teaching methods and needed ability to scaffold learning objectives for student success.

As Mishra and Koehler (2006) stated,

> TPACK is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face. (p. 1029)

Harris et al. (2009) concluded that learning about technology is not sufficient; teachers must learn what to do with the technology in the teaching and learning environment.

The results from the data indicate a significant positive relationship exists in pedagogical training and the selection of effective digital technologies. The group rating themselves higher on the pedagogical scale also reported using more emerging digital technologies such as Wiki's, computer simulation exercises, Skype™, and Google Docs for collaborative writing. Eleven (47%) of the respondents in the group also had higher TK scores whereas 2 (28%) of the respondents in the group who rated themselves lower on the pedagogical scale scored higher on the TK scale and reported using e-mail to connect with students, use of Microsoft Office® products, and Internet links mainly for use with online research as their primary technological tools.

The need for both technological and pedagogical training becomes increasingly important because, as Kennedy et al. (2009) and Prensky (2001) asserted, the digital natives or Net Generation are passing through our universities, having spent their entire lives with the toys and tools of the digital age and they expect to leverage them in their education. It is not sufficient merely to insert technology, for as Roblyer and Doering (2013) stated, "Teachers must understand the role of technology in education" (p. 10). As more adjunct faculty members are employed, universities must increasing ensure that all faculty members are technologically trained to a sufficient standard to meet the needs of a technologically savvy generation of learners. In addition, Chen (2012) stated that professional development becomes essential for teachers to learn new skills and to reach out for efficient teaching resources.

Fifty-three percent of the respondents reported having attended or having completed an educational technology course. Among this group, in the open-ended questions, 56% reported using more Web and emerging technologies, videos to enhance learning, and some sort of digital application to enhance the learning environment. Twenty-five percent of this group also reported not requiring additional technology training. When asked to describe episodes or content in which this group has demonstrated effective combination of technology and content, the data revealed a high use of video teleconferencing for distance student integration into the physical classroom, a high use of video (online and DVD), minor use of simulations and webcasts. In comparison, in the group that had not attended or completed an educational technology course, 64% of the participants wanted more training on emerging technologies. When asked to describe episodes or content in which this group had demonstrated effective combination of technology and content, the data revealed a high use of curriculum specific technologies when technology was employed.

Research Question 2

This research question was answered through statistical analysis using an independent sample *t* test and concluded that adjunct faculty who use technology in their private lives and faculty who do not use technology in their private lives demonstrated a statistically significant difference in their selection of appropriate digital technology for classroom learning outcomes. A Pearson's correlation coefficient of .693 was also calculated to determine effect size. According to Field (2009), where 0 represents *no effect* and 1 indicates a *perfect effect*, a .693 represents a medium effect. Czaja et al. (2006) hypothesize that the higher computer or technology self-efficacy or confidence in using technology one has yields a lower anxiety and predicts a higher technology adoption rate and the use of more types of technology. Although the survey did not address anxiety or self-efficacy, the data indicate a significant and positive correlation between faculty members who rate themselves higher in PLS significantly employ technology in the classroom over those who rate themselves lower in PLS. As Kukulska-Hulme (2012) argued, faculty engagement with technology must go beyond exposure in faculty development and into adoption in their own personal lives to fully adapt to the technological conditions of the new higher educationa environment. As El-Hussein and Cronje (2010) articulated, PLS is prevalent and is reshaping a user's daily life; therefore, visionary educators must consider the implications on the teaching and learning environment. This finding is significant because a majority of respondents (60%) in the sample population listed emerging technologies as something on which they wanted more training to incorporate into their curriculum. This result is consistent with research by Cradler et al. (2002) in which they asserted that surveys consistently showed that teachers are "interested in technology, but need increased opportunities to develop their capacities" (p. 50).

The data revealed that 62.5% of those who scored themselves higher on PLS were also in the group that had attended or completed an educational technology course. As seen in research question one, those who have attended or completed an educational technology course tended to choose more emerging technologies for learning environment enhancement. In addition, 50% of the group who scored higher on PLS also requested additional training on emerging technologies.

Research Question 3

This research question was answered through statistical analysis using a multiple linear regression analysis and concluded that PK, TK, PLS, and classroom technology integration do predict using technology in curriculum. The multiple correlation coefficient was .818 indicating that approximately 81.8% of the variance of the TPACK domain score can be accounted for by the linear combination of the predictors.

According to Nathans, Oswald, and Nimon (2012), multiple regression analyses are commonly employed in social science fields and it is often common for the interpretation of results to reflect an over reliance on beta weights resulting in limited interpretation of variable importance. According to Lebreton, Ployhart, and Ladd (2004), the importance assessed from a predictor's direct affects is the predictive power of each regressor independent of all other regressors and are usually indexed via the squared zero-order correlation coefficients and then rank ordered by their squared correlations from largest to smallest. This rank order of predictor's provides insight for the researcher for targeted intervention of individual predictor's. Table 18 outlines the zero-order correlation coefficients.

Table 3

Zero-Order Correlation Coefficients

Variable	**Zero-order**	**Zero-order squared**
PLS	.587	.345
PK	.629	.396
TK	.725	.563
TCK	.863	.745

Note. PK = pedagogical knowledge; PLS = personal technology use; TK = technological knowledge; TCK = technological content knowledge.

Therefore, using the method described by Lebreton et al. (2004), the predictor's were measured and rank ordered resulting in TCK demonstrating the highest significance and the largest weighted direct impact upon the TPACK domain score. However, TCK demonstrated a high (3.394) variance inflation factor indicating possible multicollinearity or shared variance with the other predictor's. This finding is most likely caused by the inclusion of individual TPACK framework domain variables of PK that had a –.613 Coefficient Correlation, and TK which had a –.007 Coefficient Correlation with the dependent variable TPACK domain score. According to Schmidt et al. (2009), TCK refers to the knowledge of how technology can create new representations for specific content suggesting that by using a specific technology an instructor can change the way learners practice and understand concepts in a specific content area.

The data revealed that the second highest significant impact was TK. However, the TK score also demonstrated a high (5.760) variance inflation factor indicating possible multicollinearity or shared variance with the other predictor's. Additionally, Technology Knowledge also demonstrated a variance proportion of .51 indicating that 51% of its variance is loading with the TCK variable.

Additionally, the data demonstrated a significant negative correlation between PLS, which also had the lowest zero-order correlation. Although the data demonstrated overall that the faculty employed various forms of technology, 57% of the faculty rated themselves lower on the TK scale and indicated in the open-ended survey questions their use of basic office product software, DVDs, televisions, e-mail, and internet searches as the predominant technologies in their curriculum. The data is consistent with a study by Savery (2002), in which surveyed faculty rated themselves "competent to proficient with E-mail, word processing, Internet research, and library research" (p. 3). Additionally, the surveyed faculty also rated themselves lower on both comfort and proficiency with other technologies. Lindner, Murphy, and Dooley (2002) also found that, although faculty members felt that technology is a valuable addition to the teaching and learning environment, the faculty surveyed also had a lack of confidence in their ability to use technology in their teaching environment. The results in this research was consistent with the high level of competency discovered in Lindner et al.'s (2002) research; however, the fact that a significant negative correlation existed would lead one toward a conclusion that PLS does not significantly predict faculty integration of technology into curriculum.

The responses to the open-ended questions again revealed that the majority (70%) of the participants possessed the technical skills to use technology effectively and 63% indicated that they would seek additional training on using more technology. Although the respondents indicated a desire to learn more technology usage, they also indicated that, as adjuncts, the time to research and learn the technology was an issue and that they would like greater institution support. According to Buabeng-Andoh (2012), the attitude of instructors towards technology greatly influences the adoption and integration of computers into the learning environment.

Implications for Practice

Although this study was quantitative and lacked the rich definition that a qualitative component could have added, it yet has implications for individual adjunct faculty members, administrators, and educator professional development program directors. This study yielded important insights for the researcher into the TPACK framework and adds to the research surrounding the validity of the TPACK framework and furthers the investigation surrounding using the TPACK instrument to measure technology integration. The TPACK framework is a very robust and flexible instrument for use in multiple environments, including higher education and adult education settings. However, the typical presentation of the TPACK framework as three equal circles representing the three main domains and intersecting to create the remaining four domains with TPACK (the domain) in the middle is not representative of the disparity of equal weight in practice. The TPACK instrument appears to indicate a high and inherent shared variance among the domains and still requires specific operational definition when employed to reduce the respondent's confusion of domains.

TPACK Framework

Adjunct faculty members will find the TPACK framework a helpful and robust method to examine their own strengths and weaknesses and to apply changes to reinforce their strengths or correct a weakness. According to Lorenzetti (2007), adjunct faculty bring a wealth of real-world experience and subject matter expertise, but might often lack the pedagogical training that full-time faculty might have obtained as part of their preparation courses. However, the data in this research indicated that pedagogical training was not a significant detractor of predicting the integration of technology into curriculum. Although it could be a better predictor with adjunct faculty members at a different university, during this research pedagogical training demonstrated the second lowest predictor with a .396 zero-order weighting. This low rating could be attributed to the location of the university surveyed being collocated with a premier military university from which a large number of adjunct faculty are drawn, or the result could be masked because of the high average number of years (16) teaching adults. Archambault and Barnett (2010) asserted, “It is possible that when experienced educators consider teaching a particular topic, the methods of doing so are considered as part and parcel of the content” (p. 1659).

University administrators, who seek to employ adjunct faculty members or increase technology use in the higher education classroom to be more of a blended learning environment or distance learning instructors, would find the TPACK framework helpful from an organizational standpoint providing a comprehensive snapshot of an instructor’s base capability. During this research, it was noted that many adjunct faculty had a view of what they thought technology integration meant to them and how the different domains of the TPACK framework were understood. Cox and Graham (2009) asserted that TPACK is a sliding framework that uses emerging technologies and is focused on generic pedagogical strategies versus content specific pedagogical strategies, which can help faculty differentiate between different domains related to pedagogy and reduce some confusion among faculty. This knowledge can assist administrators in allocation of funds for faculty training and overall selection of new adjunct faculty members who might better integrate into their departments.

According to Garrison and Vaughan (2013), institutional changes must include raising awareness of the pedagogical benefits of adopting technology and blended learning approaches. Furthermore, institutional support that would guide instructors who had little experience in the technology needed to achieve a blended learning approach. With such knowledge, faculty can focus on the educational benefits and increased avenues of engaging students. Using the premise of Archambault and Barnett (2010) in a more experienced population, administrators could consider focusing more on the pedagogical benefits through technology versus pure pedagogical training during faculty development and combining more pedagogical training with a less experienced population.

Professional development program directors will find the TPACK framework helpful for designing and adjusting faculty training as they design training aligned with faculty trainee needs. Kang (2012), when speaking about online faculty, asserted, "Selection of training content should reflect online faculty needs" (p. 399). This statement is not only true of online faculty training, but also of training for any faculty. Brawner, Felder, Allen, and Brent (2002) stated that engineering faculty development attendance improved significantly when training needs were directed to fulfill specific faculty learning needs. In universities where budget is a major concern and the hiring of adjunct faculty members has increased, limited training budgets must be focused on the improvement of specific faculty must meet university goals and objectives.

During the open-ended questions, respondents requested more training on emergent technologies as the majority indicated that technology could assist in a more comprehensive learning environment. As Garrison and Vaughan (2013) stated, using blended learning approaches is becoming more prevalent in higher education to facilitate effectively and efficiently transform higher education institutions and increase student engagement. Although some respondents indicated that using technology in the current environment (the physical location) was challenging to employ, they yet attempted to integrate more emerging technologies to connect students not only to the material, but also to each other because the majority of graduate students at Campuses A and B are working adults and are often attending from a distance.

According to Wilson (2003), technology is pervasive in our lives and a continuing concern for faculty is to achieve a better outcome from the learning enviornment. Okojie and Olinzock (2006) stated that technology is changing at an alarming rate; therefore, it is imperative that instructors "keep pace with the technological transformation and update their skills" (p. 33). As more institutions turn to a blended learning environment, it becomes more important for faculty to understand the benefits of technology and, as López-Pérez et al. (2011) stated, the positive effect on student motivation and satisfaction. According to Okojie et al. (2006), the degree of success in using technology for instruction could depend in part on exploring the relationship between pedagogy and technology, for it is "essential that educators percieve technology as part of the pedagogical process" (p. 70). Adult educators are the keepers of pedagogy and as such must embrace the pedagogy of technology. TPACK is a framework for integrating technology into teaching in any content area wehter it is online, face-to-face, or in a blended learning environment.

In the open-ended questions, the respondents articulate integrating technology into curriculum through games, simulations, exercises, Web searches, video conferencing to extend the classroom physical walls to students and resources in distant locations. Educators must be prepared to leverage all resources to enable the learning environment giving a measure of control to the student in a student-centriq educational environment.

TPACK Instrument

As seen in the literature, throughout the last two decades, there have been numerous changes and adjustments to the TPACK instrument. Adjunct faculty members will find the TPACK instrument a comprehensive and flexible instrument for self-administration to determine their current level of technology integration and for professional reflection of their teaching style. Shin et al. (2009) indicated in their experiment that, although overall technology, content, and pedagogy score did not significantly increase from pretest to posttest, the participants' overall understanding of the interactions of technology, content, and pedagogy did increase.

University administrators will find that the TPACK instrument is simple to administer and provides a comprehensive indication of a current instructor or perspective instructor's disposition towards technology and technology integration. As discussed earlier, PK was not a significant predictor with the sample in this research; however, Chai et al. (2010) found that preservice participants PK had the most significant impact on prediciting preservice TPACK domain score. This finding provides university administrators a method of targeting initial training to newer employees using pedagogical or technological needs. Faculty development coordinators and human resource training administrators should consider using the TPACK instrument in targeting of faculty and instructor needs for development of TK and TCK to enable a richer learning environment for students.

Recommendations for Further Research

This limited research allowed a look at the TPACK framework, the TPACK instrument, and the TPACK domain for measuring integration of technology into curriculum for adjunct faculty in higher education. The research revealed that, although the TPACK framework has matured, more research is still needed to continue the evolution of the instrument for measuring the domains, and the domains still require further definition in context. Using the results of the study, this section provides recommendations for the university extension campus director and individual adjunct faculty members with respect to the TPACK framework and how an individual TPACK score can be beneficial to technology integration and professional development. However, this research is quantitative; therefore, lacks the rich contextual understanding of how an adjunct faculty's individual TPACK could be used for professional development for integration of technology into curriculum. Further research into adjunct faculty technological and pedagogical training is warranted.

TPACK Framework

The TPACK framework continues to evolve and to be applied to various levels of education from elementary educators to graduate faculty members, and it is also being applied to specific educational fields for improvement of the learning environment. Although some open-ended questions provided limited context to the quantitative domains more extensive mixed method studies should be undertaken to continue to improve the discussion and development of the TPACK framework, especially the instrument. Archambault and Barnett (2010) asserted that one issue confounding the ability to measure TPACK is the development of an “instrument or method to assess for each of the domains described by the framework that will apply in different contexts” (p. 1659). Doering, Veletsianos, Scharber, and Miller (2009) suggested one limitaiton with the TPACK framework lies in the domains and their interaction because the knowledge that an instructor possesses is less important than the knowledge that he or she uses, which indicates that PK might be more important in a given context than CK.

TPACK Instrument

Further research in developing the TPACK instrument must continue with larger populations of graduate faculty especially adjunct faculty serving full-time and part-time at other universities. The multicollinearity of TPACK domains in the multiple regression indicates that a need yet exists for refinement in definitions of the instrument. Further research should also be conducted to compare tenure track and nontenure track full-time faculty. Additionally, with the number of adjunct faculty employed by universities at 50%, research should include factors relating to undergraduate degree or graduate degree to determine whether previous degree would have an impact compared to the number of years teaching or subject content taught.

Additionally, future researchers should consider using a mixed-method research approach to gain the quantitative analysis coupled with the rich faculty participation of the qualitative analysis. The data did not explore the impact of age or gender and there was no indication that instructor age or gender was a contributing factor or had an impact. However, additional research should be conducted regarding the impact of age and gender as technology continuously changes.

Conclusions

This study was undertaken to investigate whether a relationship exists between (a) TPACK, (b) pedagogical training, and (c) personal technology, and which variables have the greatest influence in the willingness of adjunct faculty at a higher education institution to choose and integrate digital technology into curriculum. In a limited way, this study has added to the discussion and knowledge base on the TPACK framework and instrument validity and to a degree examined some factors in predicting effective technology integration into curriculum. The data analysis revealed significant relationships between pedagogical training and selection of appropriate technology and between PLS and selection of appropriate technology. However, the results indicate that average number of years teaching (16 years) may affect or mask the pedagogical training when selecting appropriate technology. PLS might contribute to technology self-efficacy, but does not significantly contribute to predicting effective technology integration. The data also revealed that TCK and TK were significant predictors; however, the subdomains of TPACK masked the true impact because of the high presence of covariance.

In conducting this study, the researcher developed an understanding of technology integration in adult education programs that will contribute to the literature-base of the adult education profession. In addition, leaders who create technology professional development programs for adjunct faculty might receive insights for creating solutions and strategies to target appropriate and meaningful developmental classes. Moreover, understanding the various domains of TPACK might be able to help adult education program planners predict who will and will not integrate technology effectively. Effective technology integration requires faculty to think and act differently, to understand not merely what to teach, but also how to teach applying technology to support learning objectives and create a better learning environment.

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APPENDIX A – SURVEY INSTRUMENT CHANGES

Participants will answer each question using the following five-level Likert scale:

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly agree

Do you wish to participate in this survey?

o Yes o No

Survey of Adjunct Faculty Knowledge of Teaching and Technology

Thank you for taking time to complete this questionnaire. Please answer each question to the best of your knowledge. Your thoughtfulness and candid responses will be greatly appreciated. Your responses are very valuable to this research project. Your individual name or identification number will not at any time be associated with your responses. Your responses will be kept completely confidential. If you desire a copy of the compiled results please contact knolton@kstate.edu. Individual results will not be available since only aggregated results are used.

2. What is your gender?

( ) Female ( ) Male

3. Number of years teaching with your current university?
{enter text answer}

4. Total number of years teaching adults?
{enter text answer}

5. What is your age?
{enter text answer}

6. What primary degree program do you teach?

( ) Master of Business Administration
( ) MA in Business and Organizational Security Management
( ) MA in Human Resources Management
( ) MA in Information Technology Management
( ) MA in International Relations
( ) MA in Management

( ) MA in Procurement and Acquisitions Management
( ) Master of Health Administration
( ) MA in Human Resources Development
( ) MA in Management and Leadership
( ) Other (please specify)
{enter text answer}

7. Which area best describes your primary degree?

( ) Business Administration (MBA)
( ) Business and Organizational Security Management
( ) Human Resources Management
( ) Information Technology Management
( ) International Relations
( ) General Management
( ) Procurement and Acquisitions Management
( ) Health Administration (MHA)
( ) Human Resources Development
( ) Management and Leadership
( ) Other (please specify)
{enter text answer}

8. What is the highest level of degree you have completed?

( ) Doctorate
( ) Post Masters
( ) Masters
( ) Other (please specify)
{enter text answer}

9. Which campus do you primarily teach at?

( ) Fort Leavenworth
( ) McConnell Air Force Base
( ) Other (please specify)
{enter text answer}

10. Which race/ethnicity best describes you? (Please choose only one.)

( ) African American
( ) Asian
( ) Hispanic

( ) Native American
( ) Pacific Islander
( ) White not Hispanic
( ) Other (please specify)
{enter text answer}

11. Have you attended or completed an educational technology course?

( ) Yes ( ) No

12. I know how to solve my own technical problems in the classroom.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

13. I can learn technology easily.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

14. I keep up with important new technologies.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

15. I frequently play around with the technology.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

16. I know about a lot of different technologies.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

17. I have the technical skills I need to use technology.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

18. I use a wide range of digital technology in my personal life outside the classroom.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

19. I know how to solve my own technical problems in my personal life.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

20. I keep up with important new technologies in my personal life.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

21. I frequently play around with technology in my personal life.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

22. I have the technical skills I need to use technology in my personal life.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

23. I have sufficient knowledge about my subject matter.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

24. I have various ways and strategies of developing my understanding of my subject matter.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

25. I have sufficient knowledge of my subject to design a rubric that evaluates my teaching.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

26. I have sufficient knowledge to select technology that matches my subject matter.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

27. I know how to assess student performance in a classroom.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

28. I can adapt my teaching based upon what students currently understand or do not understand.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

29. I can adapt my teaching style to different learners.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

30. I can assess student learning in multiple ways.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

31. I can use a wide range of teaching approaches in a classroom setting.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

32. I am familiar with common student understandings and misconceptions.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

33. I know how to organize and maintain classroom management.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

34. I have had formal pedagogical education or training.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

35. I can select effective teaching approaches to guide student thinking and learning within my subject area.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

36. I can use technology to collaborate with others who are distant from my classroom.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

37. I can create appropriate lesson plans that scaffold to student learning.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

38. I know about technologies that I can use for understanding my subject matter.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

39. I know how to match course objectives to technology.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

40. I know how to match technology to course objectives.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

41. I know how to create a lesson or unit that incorporates Web based tools as an integral part of the course.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

42. I can choose technologies that enhance the teaching approaches for a lesson.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

43. I can choose technologies that enhance students' learning for a lesson.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

44. I think deeply about how technology could influence the teaching approaches I use in my classroom.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

45. I am thinking critically about how to use technology in my classroom.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

46. I can adapt the use of the technologies to different teaching activities.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

47. I can teach lessons that appropriately combine my subject matter, technologies, and teaching approaches.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

48. I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

49. I can use strategies that combine content, technologies, and teaching approaches in my classroom.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

50. I can provide leadership in helping others to coordinate using content, technologies, and teaching approaches at my university.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

51. I can choose technologies that enhance the content for a lesson.

( ) Strongly Disagree ( ) Disagree ( ) Neither Agree/ Disagree ( ) Agree ( ) Strongly Agree

52. Describe/ list the type of technologies you use in your classroom.
{enter text answer}

53. Describe/ list the technologies you wish you had more training.
{enter text answer}

54. Describe a specific episode where you effectively demonstrated combining content, technologies, and teaching approaches in a classroom lesson.
{enter text answer}

55. Describe the type of content you taught and what technology you combined.
{enter text answer}

56. What teaching approach(es) did you implement when you combined content and technology.
{enter text answer}

57. Please add any additional information about content and technology you feel was not covered.
{enter text answer}

Thank you for your participation. Your answers will be combined with other participant answers and will contribute to the fields of adult education and faculty development in the area of technology integration.

Thank you for your time. You may close your browser.

Green Highlight = means it came from the original 2009 Instrument.

Amber Highlight = means it is a question from the original 2009 instrument but I changed it/ modified it…for instance deleted specific content area (math, science, etc.) and just said "within my content area"….
Red Highlight = means this is a question I added.

Questions **Added**:
2. Years of teaching with your current university
3. Total number of years of teaching adults?
5. Which campus do you primarily teach at?
6. Have you attended or completed an educational technology course?
15. I have various ways and strategies of developing my understanding of my subject matter.
16. I have sufficient knowledge of my subject to design a rubric that evaluates my teaching
17. I have sufficient knowledge to select technology that matches my subject matter.
25. I have had formal pedagogical education or training.
27. I can use technology to collaborate with others who are distant from my classroom.
29. I know how to match course objectives to technology.
30. I know how to match technology to course objectives.
31. I know how to create a lesson or unit that incorporates Web based tools as an integral part.

Questions **Changed**:
4. Which Primary degree program do you teach?
14. I have sufficient knowledge about my subject matter. (Reflect academic discipline neutral)
26. I can select effective teaching approaches to guide student thinking and learning within my subject area. (Reflect academic discipline neutral)
28. I know about technologies that I can use for understanding my subject matter. (Reflect academic discipline neutral)
34. I think deeply about how technology could influence the teaching approaches I use in my classroom.
37. I can teach lessons that appropriately combine my subject matter, technologies, and teaching approaches. (Reflect academic discipline neutral)
39. I can use strategies that combine content, technologies, and teaching approaches in my classroom. (Reflect academic discipline neutral)
40. I can provide leadership in helping others to coordinate using content, technologies, and teaching approaches at my university. (Reflect academic discipline neutral)

Questions **Deleted**:
I have had sufficient opportunities to work with different technologies.
All questions dealing with the Models of TPACK (Faculty, PK–6 Teachers) section

APPENDIX B – SURVEY INSTRUMENT

TPACK Dissertation

Informed Consent

The purpose of the research is to investigate which factors influence adjunct faculty's willingness to incorporate appropriate technology into their curriculum. The duration of the study is November 2013 to December 2013.

If you choose to participate in this study, you will be asked to complete an online survey that asks questions about your use of technology and experiences with teaching. Some demographic information will also be collected in order to describe the population involved with the study. In addition to about 35 likert scale stems, you will be asked to describe an incident where you used technology effectively in a course. It should take about 20 minutes to complete the survey. Your identification is protected since all responses are anonymous.

There are no expected discomfort or risks from taking part in this study. If you feel uncomfortable with a question, you can skip the question or withdraw from the study altogether. If you decide to quit at any time before you finished the survey, your answers will NOT be recorded. You can simply leave the website.

Your responses will be anonymous and will be kept completely confidential. Your name or email will not be used when you respond to the Internet survey. Only aggregated data is downloaded to maintain the anonymity of survey participants. All downloaded data will be secured on an encrypted-password protected thumb drive. The aggregated data and informed consent information will be kept in a secure location for three years and then they will be destroyed.

This study may benefit the fields of adult education and faculty development in the area of technology integration. You will have the opportunity to consider your own teaching style and ability to integrate technology into the curriculum for teaching 21st century students. This opportunity may also provide insight for changes in individual instructor curriculum or faculty development programs. In addition, it will add to the body of knowledge for TPACK.

Contact for any problems or questions:
If you have additional questions, please contact: Davin Knolton at davinknolton62@webster.edu or 913-240-6659
Dr. Royce Ann Collins, 22201 W. Innovation Dr., Olathe, KS 66061, or by calling 913-961-4255.

Contact IRB Chair:
The Institutional Review Board at Kansas State University approves all research conducted with human subjects. If you have any questions about the manner in which this study is conducted, you may contact Dr. Rick Scheidt, Chair, Committee on Research Involving Human Subjects, Kansas State University, 1 Fairchild Hall, Manhattan, KS 66506 or by calling 785-532-3224

By clicking "next" you are verifying the following statement:
I have read the above statement and have been fully advised of the procedures to be used in this study. I understand that this project is research, and that my participation is completely voluntary. I understand that if I decide to participate in this study that I may withdraw my consent at any time, and stop participating at any time without explanation or penalty.

*** 1. Do you wish to participate in this survey?**

- ○ Yes
- ○ No

TPACK Dissertation

Survey of Adjunct Faculty Knowledge of Teaching and Technology

Thank you for taking time to complete this questionnaire. Please answer each question to the best of your knowledge. Your thoughtfulness and candid responses will be greatly appreciated. Your responses are very valuable to this research project. Your individual name or identification number will not at any time be associated with your responses. Your responses will be kept completely confidential. If you desire a copy of the compiled results please contact knolton@k-state.edu. Individual results will not be available since only aggregated results are used.

TPACK Dissertation

2. What is your gender?

- Female
- Male

3. Number of years teaching with your current university?

4. Total number of years teaching adults?

5. What is your age?

6. What primary degree program do you teach?

- Master of Business Administration (MBA)
- MA in Business and Organizational Security Management
- MA in Human Resources Management
- MA in Information Technology Management
- MA in International Relations
- MA in Management
- MA in Procurement and Acquisitions Management
- Master of Health Administration (MHA)
- MA in Human Resources Development
- MA in Management and Leadership

Other (please specify)

7. Which area best describes your primary degree?

- Business Administration (MBA)
- Business and Organizational Security Management
- Human Resources Management
- Information Technology Management
- International Relations
- General Management
- Procurement and Acquisitions Management
- Health Administration (MHA)
- Human Resources Development
- Management and Leadership

Other (please specify)

8. What is the highest level of degree you have completed?

- Doctorate
- Post Masters
- Masters

Other (please specify)

9. Which campus do you primarily teach at?

- Fort Leavenworth
- McConnell Air Force Base

Other (please specify)

TPACK Dissertation

10. Which race/ethnicity best describes you? (Please choose only one.)

- African-American
- Asian
- Hispanic
- Native American
- Pacific Islander
- White not Hispanic

Other (please specify)

11. Have you attended or completed an educational technology course?

- Yes
- No

12. I know how to solve my own technical problems in the classroom.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree

13. I can learn technology easily.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree

14. I keep up with important new technologies.

Strongly Disagree	Disagree	Neltheer Agree/ Disagree	Agree	Strongly Agree

15. I frequently play around with the technology.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree

16. I know about a lot of different technologies.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree

17. I have the technical skills I need to use technology.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree

18. I use a wide range of digital technology in my personal life outside the classroom.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree

TPACK Dissertation

19. I know how to solve my own technical problems in my personal life.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

20. I keep up with important new technologies in my personal life.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

21. I frequently play around with technology in my personal life.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

22. I have the technical skills I need to use technology in my personal life.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

23. I have sufficient knowledge about my subject matter.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

24. I have various ways and strategies of developing my understanding of my subject matter.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

25. I have sufficient knowledge of my subject to design a rubric that evaluates my teaching.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

26. I have sufficient knowledge to select technology that matches my subject matter.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

27. I know how to assess student performance in a classroom.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

28. I can adapt my teaching based upon what students currently understand or do not understand.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

TPACK Dissertation

29. I can adapt my teaching style to different learners.

Strongly Disagree | Disagree | Neither Agree/ Disagree | Agree | Strongly Agree

30. I can assess student learning in multiple ways.

Strongly Disagree | Disagree | Neither Agree/ Disagree | Agree | Strongly Agree

31. I can use a wide range of teaching approaches in a classroom setting.

Strongly Disagree | Disagree | Neither Agree/ Disagree | Agree | Strongly Agree

32. I am familiar with common student understandings and misconceptions.

Strongly Disagree | Disagree | Neither Agree/ Disagree | Agree | Strongly Agree

33. I know how to organize and maintain classroom management.

Strongly Disagree | Disagree | Neither Agree/ Disagree | Agree | Strongly Agree

34. I have had formal pedagogical education or training.

Strongly Disagree | Disagree | Neither Agree/ Disagree | Agree | Strongly Agree

35. I can select effective teaching approaches to guide student thinking and learning within my subject area.

Strongly Disagree | Disagree | Neither Agree/ Disagree | Agree | Strongly Agree

36. I can use technology to collaborate with others who are distant from my classroom.

Strongly Disagree | Disagree | Neither Agree/ Disagree | Agree | Strongly Agree

37. I can create appropriate lesson plans that scaffold to student learning.

Strongly Disagree | Disagree | Neither Agree/ Disagree | Agree | Strongly Agree

38. I know about technologies that I can use for understanding my subject matter.

Strongly Disagree | Disagree | Neither Agree/ Disagree | Agree | Strongly Agree

39. I know how to match course objectives to technology.

Strongly Disagree | Disagree | Neither Agree/ Disagree | Agree | Strongly Agree

TPACK Dissertation

40. I know how to match technology to course objectives.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

41. I know how to create a lesson or unit that incorporates Web based tools as an integral part of the course.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

42. I can choose technologies that enhance the teaching approaches for a lesson.

Stronlgy Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

43. I can choose technologies that enhance students' learning for a lesson.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

44. I think deeply about how technology could influence the teaching approaches I use in my classroom.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

45. I am thinking critically about how to use technology in my classroom.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

46. I can adapt the use of the technologies to different teaching activities.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

47. I can teach lessons that appropriately combine my subject matter, technologies, and teaching approaches.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

48. I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

49. I can use strategies that combine content, technologies, and teaching approaches in my classroom.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

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TPACK Dissertation

50. I can provide leadership in helping others to coordinate the use of content, technologies, and teaching approaches at my university.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

51. I can choose technologies that enhance the content for a lesson.

Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
○	○	○	○	○

52. Describe/ list the type of technologies you use in your classroom.

53. Describe/ list the technologies you wish you had more training.

54. Describe a specific episode where you effectively demonstrated combining content, technologies, and teaching approaches in a classroom lesson.

55. Describe the type of content you taught and what technology you combined.

56. What teaching approach(es) did you implement when you combined content and technology.

57. Please add any additional information about content and technology you feel was not covered.

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TPACK Dissertation

Thank You

Thank you for your participation. Your answers will be combined with other participant answers and will contribute to the fields of adult education and faculty development in the area of technology integration.

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APPENDIX C – KANSAS STATE UNIVERSITY IRB APPROVAL

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Royce Ann Collins
Educational Leadership
22201 W Innovation Dr., Olathe KS 66061

Proposal Number: 6859

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 10/03/2013

RE: Proposal Entitled, ""Technological, Pedagogical, Content Knowledge (TPACK): An exploratory Study of Adjunct Faculty Technology Proficiency""

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State University has reviewed the proposal identified above and has determined that it is EXEMPT from further IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB. Any change potentially affecting human subjects must be approved by the IRB prior to implementation and may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2, subsection: ii.**

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that research is exempt does not imply that investigators have no ethical responsibilities to subjects in such research; it means only that the regulatory requirements related to IRB review, informed consent, and assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the Chair of the Committee on Research Involving Human Subjects, the University Research Compliance Office, and if the subjects are KSU students, to the Director of the Student Health Center.

1863 2013 150

203 Fairchild Hall, Lower Mezzanine, Manhattan, KS 66506-1103 | (785) 532-3224 | fax: (785) 532-3278 | k-state.edu/research/comply

APPENDIX D – MIDWESTERN UNIVERSITY IRB APPROVAL

November 1, 2013

TO: Dr. Royce Ann Collins and Davin Knolton

FROM: Barbara Wehling, Chair, Institutional Review Board

RE: Technological, Pedagogical, Content Knowledge (TPACK): An Exploratory Study of Adjunct Faculty Technology Proficiency

STATUS: Approved

NOTES:

- The IRB Proposal Number for this research project FA13-31.
- The proposal has been approved through May 2014. You are required to submit a summary of your findings upon completion.
- Complete the **Periodic Review/End of Project** form upon completion of your research project. You may reapply for a project extension if needed.
- You are also required to promptly notify the IRB Chair of any problems that arise during the course of the research.

Barbara Wehling, Professor
Chair, Institutional Review Board

APPENDIX E – INFORMED CONSENT

Project title: Technological, Pedagogical, Content Knowledge (TPACK): An Exploratory Study of Adjunct Faculty Technology Proficiency

Principle Researcher: Dr. Royce Ann Collins
Co-Investigator: Davin Knolton
The purpose of the research is to investigate which factors influence adjunct faculty's willingness to incorporate appropriate technology into their curriculum. The duration of the study is November 2013 to December 2013.

If you choose to participate in this study, you will be asked to complete an online survey that asks questions about your use of technology and experiences with teaching. Some demographic information will also be collected in order to describe the population involved with the study. In addition to about 35 likert scale stems, you will be asked to describe an incident where you used technology effectively in a course. It should take about 20 minutes to complete the survey. An email will be sent to you with the link to the online survey. Your identification is protected since all responses are anonymous.

There are no expected discomfort or risks from taking part in this study. If you feel uncomfortable with a question, you can skip the question or withdraw from the study altogether. If you decide to quit at any time before you finished the survey, your answers will NOT be recorded. You can simply leave the website.

Your responses will be anonymous and will be kept completely confidential. You will be provided with an Internet link to access the survey. Your name or email will not be used when you respond to the Internet survey. Only aggregated data is downloaded to maintain the anonymity of survey participants. All downloaded data will be secured on an encrypted-password protected thumb drive. The aggregated data and informed consent information will be kept in a secure location for three years and then they will be destroyed.

This study may benefit the fields of adult education and faculty development in the area of technology integration. You will have the opportunity to consider your own teaching style and ability to integrate technology into the curriculum for teaching 21st century students. This opportunity may also provide insight for changes in individual instructor curriculum or faculty development programs. In addition, it will add to the body of knowledge for TPACK.

Contact for any problems or questions:
If you have additional questions, please contact: Dr. Royce Ann Collins, 22201 W. Innovation Dr., Olathe, KS 66061, or by calling 913-961-4255.

Contact IRB Chair:
The Institutional Review Board at Kansas State University approves all research conducted with human subjects. If you have any questions about the manner in which this study is conducted, you may contact Dr. Rick Scheidt, Chair, Committee on Research

Involving Human Subjects, Kansas State University, 1 Fairchild Hall, Manhattan, KS 66506 or by calling 785-532-3224

By clicking on your response below, you are verifying the following statement:
I have read the above statement and have been fully advised of the procedures to be used in this study. I understand that this project is research, and that my participation is completely voluntary. I understand that if I decide to participate in this study that I may withdraw my consent at any time, and stop participating at any time without explanation or penalty.

Please choose the appropriate response:
_____I volunteer to participate (participant will be directed to the survey questions)
_____I do not agree to participate in this study (participant will be directed to a thank you message.)

APPENDIX F – DIRECTOR'S PREPARATORY E-MAIL

Good morning faculty,

I am very thrilled to announce that one of our very own faculty members is about finished with his PhD. Davin "Van" Knolton who teaches in our Fort Leavenworth ITM and SECR programs will be conducting his PhD experiment Nov–Dec 2013 and he needs our help. I highly encourage you (although it is strictly voluntary) to support Van in his efforts. Van is examining technology integration into curriculum for adjunct faculty using a survey instrument called TPACK (which stands for Technological Pedagogical Content Knowledge). He is using the faculty at both campuses as his survey population. Because of our small population size he needs every response he can get. Please be assured that your responses in no way are tracked by the university nor are they connected to your employment with the University….You are simply helping a fellow instructor further his education.

After final Institutional Review Board approval you will receive an individual survey link from SurveyMonkey announcing the request for your participation in Van's survey. If you choose to participate, you will acknowledge the informed consent and take the survey. Your individual responses are anonymous and cannot be linked to you. Once the survey closes, Van will download aggregated data into SPSS and do a quantitative analysis of the survey responses. Again, your individual responses cannot be linked to you.

Webster University is very proud that our faculty are lifelong learners and I highly encourage you to help Van out by responding to the survey when you receive the link. Congratulations to Van for this accomplishment and to our other faculty who are also pursuing PhD's.

Katie Ervin
Director

APPENDIX G – MAP OF SURVEY QUESTIONS TO RESEARCH QUESTIONS

Table 1

Research Questions 1 and 2 Crosswalk

Research Question	Independent Variable (IV)	Dependent Variable (DV)	Primary Survey Stem#	Analysis
RQ1	Pedagogical Knowledge (PK)	Appropriate digital technology (TPACK domain score)	PK: 27, 28, 29, 30, 31, 32, 33, 34 TPACK: 47, 48, 49, 50, 51 Descriptors: 35, 36, 37, 54	Independent sample *t* test
RQ2	PLS	classroom technology integration (TCK)	Personal Life: 18, 19, 20, 21, 22 TCK: 38, 39, 40, 41 Descriptors: 23, 24, 25, 26, 55, 56, 57	Independent sample *t* test

Table 2

Research Question 3 Crosswalk

Regression Research Question	Predictor	Criterion	Primary Survey Stem#	Analysis
RQ3	Pedagogical Knowledge (PK); TK; PLS; classroom technology integration (TCK)	TPACK (domain score)	TK: 12, 13, 14, 15, 16, 17, PK: 27, 28, 29, 30, 31, 32, 33, 34 Personal Life: 18, 19, 20, 21, 22 TPACK: 47, 48, 49, 50, 51 Descriptors: 42, 43, 44, 45, 46, 52, 53, 54,	multiple logistic regression

Table 3

Survey Questions in Construct

Survey Questions	**Construct/Use**
2–11	Background demographic information to describe the population and sample.
12–17	TK – Technological Knowledge
18–22	PLS – Personal Life STEMS
23–26	CK – Content Knowledge
27–34	PK – Pedagogical Knowledge
35–37	PCK – Pedagogical Content Knowledge
38–41	TCK – Technological Content Knowledge
42–46	TPK – Technological Pedagogical Knowledge
47–51	TPACK – Technological Pedagogical Content Knowledge
52–57	Descriptors/ Enumerators

APPENDIX H – RESEARCHER'S E-MAIL INVITATION TO PARTICIPATE

Fellow faculty,

I am in need of your help for my PhD research. About two weeks ago you should have received a link to my research survey. It would have come from Survey Monkey. If you have responded already, thank you very much for your help. You all know that research is difficult and responses are critical with our limited population. I would appreciate very much if you would log into your Webster e-mail and take the survey. It should only take you 20 minutes or less and would be a world of help for me. Please remember that your responses are anonymous and I can only download the aggregated results for analysis. In order for this to be meaningful (have statistical significance) I need all the responses I can get.

Thank you again for your assistance.

Respectfully,

Van Knolton

APPENDIX I – DEMOGRAPHIC DISTRIBUTION TABLES

Table 1

Age Demographic

Age	Frequency	Sample Respondent Percentage	University (Adjunct Faculty) (%) Fall 2013	National Average USDoED, NCES (2003) Survey (%)
35–44 Year Old	3	10	13.56	24.90
45–54 Year Old	10	33.33	23.89	32.22
55–64 Year Old	9	30	33.55	27.87
65–69 Year Old	5	16.66	12.89	4.66
70 and Older	1	3.33	10.13	1.69
Unknown	2	6.66	0.0	N/A[c]
Total	30	99.98[a]	94.02[b]	N/A[c]

Note. [a] Number discrepancy caused by a rounding error. [b] Not all university categories used. [c] Not all USDoED, NCES (2012) survey 2003 data categories used.

Table 2

Gender Demographic

Gender	Frequency	Survey %	University %
Male	22	73.3	82.60
Female	6	20.0	17.39
Unknown	2	6.7	0
Total	30	100	99.99[a]

Note. [a] Number discrepancy caused by a rounding error.

Table 3

Ethnicity

Ethnicity	Frequency	Survey %
White non-Hispanic	27	90
African American	1	3.33
Unknown/ Declined to answer	2	6.67
Total	30	100

Table 4

Educational Degrees

Educational Degree	Frequency	Survey %
More than 1 Master's	12	40
Post Master's	9	30
Doctorate	6	20
Unknown/ Declined to answer	3	10
Total	30	100

Table 5

Number of Years Teaching

Years at current university	Frequency	Survey %
1–5 years	11	36.6
6–10 years	8	26.6
11–20 years	7	23.3
More than 20 years	4	13.3
Total	30	99.8[a]

Note. [a] Number discrepancy caused by a rounding error.

Table 6

Number of Years Teaching Adults

Years Adults	**Frequency**	**Survey %**
1–5 years	4	13.3
6–10 years	8	26.6
11–20 years	10	33.3
More than 20 years	8	26.6
Total	30	99.8[a]

Note. [a] Number discrepancy caused by a rounding error.

Table 7

Primary Program Instructed

Program	Frequency	Survey %
MBA	7	23.3
SEC	1	3.3
HRM	2	6.6
ITM	3	10.0
IR	4	13.3
MGT	1	3.3
PROC	5	16.6
HRD	2	6.6
LDR	4	13.3
MHA	0	0.0
Declined to answer	1	3.3
Total	30	99.6[a]

Note. [a] Number discrepancy caused by a rounding error.

Table 8

Faculty Primary Degree

Degree	Frequency	Survey %
MBA	10	33.3
LDR	6	20
HRM	1	3.33
IR	1	3.33
MGT	1	3.33
PROC	1	3.33
HRD	1	3.33
Declined to answer	9	30
Total	30	99.95[a]

Note. [a] Number discrepancy caused by a rounding error.