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Investigating Faculty Perceptions of Technological Pedagogical, and Content Knowledge (TPaCK) at a Newly Established University

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INVESTIGATING FACULTY PERCEPTIONS OF TECHNOLOGICAL

PEDAGOGICAL, AND CONTENT KNOWLEDGE (TPaCK)

AT A NEWLY ESTABLISHED UNIVERSITY

A Dissertation

by

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ABSTRACT

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This dissertation is in response to Garrett's (2014) dissertation on *"A Quantitative Study of Higher Education Faculty Self-Assessments of Technological, Pedagogical, and Content Knowledge (TPaCK) and Technology Training"* which has been the inspiration and guide throughout the design of this study. The purpose is to assess the perceptions of tenured and non-tenured faculty on technological, pedagogical, and content knowledge (TPaCK) at a recently established university in Texas. More specifically, this study compared and contrasted faculty members' use of technological, pedagogical, and content knowledge (TPaCK) in face-to-face, blended learning, and online environments as methods to enhance learning based on academic college, academic ranking, academic status, years of experience, and gender.

This quantitative study uses the HE-TPaCK survey developed by Garrett (2014) to collect and analyze data around technological, pedagogical, and content knowledge using descriptive statistics and multiple regression analysis. The results showed a significant difference ($p < .007$) in academic college and academic status in the domain of pedagogy knowledge (PK) and technology pedagogy knowledge (TPK). Overall, the results provide implications to drive future professional development at the university, add to the discourse around the conceptual framework of TPaCK, as well as provide additional information on the use of the HE-TPaCK instrument. In addition to implications for the institution and research, this work provides insight to policy makers in regards to incentives and institutional support that would promote the use of technology for the purpose of instruction.

DEDICATION

This dissertation is dedicated to my children Kayleigh, Kendall, Morgan, and Tyler. I know that a lot of sacrifices were made as we went through this journey, but I hope in the end you were able to gain some life-long lessons along the way. Follow your dreams, don't ever give up, and know that I love you more than you will ever know.

This work is also dedicated to my mom and dad. It is hard to describe the love I have for both of you. Your guidance and support throughout my life has made me who I am today and I am forever grateful that God chose you to be my parents. Thank you for everything you have done and continue to do for my little family. I hope I have made you proud.

Finally, I dedicate this work to my loving husband Tim. Thank you for supporting me and encouraging me throughout this journey. Thank you for being both mom and dad on long nights of class and research papers. Thank you for loving me and being my best friend.

Without these individuals in addition to many more family and friends, this dissertation would not be possible.

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I would also like to thank Dr. Javier Cavazos, who patiently guided me through my statistical journey. Your ability to serenely teach and explain concepts kept me on target and sane. In addition, I would also like to thank Dr. Laura Jewett and Dr. Bobbette Morgan for their expertise and direction as I persisted through the completion of this dissertation. Without your support this dissertation would not be possible.

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CHAPTER I

INTRODUCTION

One of the recent trends for colleges and universities is the need to cut operational costs and lower tuition rates all while providing more services to students, parents, and the workforce, which has increased the number of newly established or consolidated universities in American higher education (McBain, 2012). For example in a historic movement, The University System of Georgia completed 7 consolidations between institutions in an 8-year period, which began in 2010. Through this consolidation process, campuses continued to be utilized, however, administrators were combined (Seltzer, 2017). Another example of a recent merge in a two-year institution setting is the 8 Louisiana technical and community colleges. This merger shuffled colleges and lowered administrative costs (Ballard, 2017). The University Systems of Georgia executive vice chancellor for strategy and fiscal affairs asserted that every consolidation or merger is different and that transparency is key throughout the process (Seltzer, 2017). Although the process of consolidation, merging, and absorption varies, along with the terms, typically the process is initiated for and motivated by financial reasons. For the purpose of the study, the term *newly established* refers to campuses of former institutions that no longer exist or that did not previously exist either through consolidation or other means thereof. Similar to the examples above, the site of this study has undergone significant transitions and changes not only in structure, but also terminology referring to the institution. Terms used to refer to the process included consolidated, merged, abolished institutions, new university, and rebranded. For the purpose of this dissertation, I chose to use the term newly established university in the spirit of a neutral umbrella term that acknowledges, yet does not weigh in on, the reasons for or the process of how the current institution formed.

As one would expect, there is a copious amount of effort to make sure that any newly established university is successful including financial aspects, culture and climate of faculty and students, assets of the university, logistics of the transition, and geography of campuses (McBain, 2012; Pierce, 2014). When considering all that occurs in the creation of a newly established university or consolidation of two or more institutions, perceptions of teaching and learning may not be at the forefront of conversation.

Following the trend, The Texas Legislature recently completed the fruition of a newly established, large, distributed campus university. For the purpose of this study, this newly established university will be referred to by the pseudonym University of Transition. The creation of the University of Transition, a complex process, was completed and the first inaugural group of students enrolled in the fall of 2015 (University of Transition, 2015). As a result of the newly established university, new policies, visions, and goals were established to support the structure of the University of Transition. One of the goals behind the University of Transition is to build a "university of the 21st century that uses blended online learning as well as new and highly technologically- equipped classrooms" (University of Transition, 2015, p. 1). This goal serves as the initial interest to understand faculty members' perceptions of their technology, pedagogy and content knowledge.

With the 65 miles that distances the two main campuses, as well as several smaller satellite locations, it is not surprising that the newly founded university is taking interest in increasing blended learning and redesigning learning spaces (Johnson, Adams Becker, Estrada,

& Freeman, 2015). Although there are many definitions of blended learning, this study adopted the definition from Horn and Staker (2011) who describe blended learning as “any time a student learns at least in part at a supervised brick-and-mortar location away from home and at least in part through the Internet with some element of student control over time, place, and/or pace” (p.3).

Similar to the rationale behind consolidating universities, blended learning is being adopted in part for the ability to meet students’ educational needs, improve student outcomes, increase student-to-student communication, as well as reduce the average overall cost per student (Hew & Cheung, 2014). However, the success of blended learning weighs heavily on the ability of faculty to find and implement the right combination of online and face-to-face components such as pedagogical approaches to content knowledge, and the use of online instructional tools (Hew & Cheung, 2014).

In the transition of faculty teaching the traditional face-to-face course to integrating teaching online, Smith (2005) notes that teaching online is a process which requires a specific set of skills and competencies to teach effectively. Also important to note is that faculty should not be expected to intuitively understand how to incorporate technology into their pedagogy and structure of an online course, blended learning course, or even a traditional course that integrates technology into the curriculum and instruction. The development of these technological skills through training and support from the higher education institution is a component identified by faculty to be of the upmost importance (Aycock, Garnham, & Kaleta, 2002; Dziuban, Hartman, Moskal, Sorg, & Truman, 2004). In addition to the notion that implementing online components to a course requires a set of specific skills and professional development, research suggests when integrating the use of technology as a learning mechanism faculty autonomy, workload, and pedagogical interests can be threatened (Austin, 2003; Hearn & Anderson, 2002; Jones, 2011).

The integration of technology within a course requires pedagogical change. Although this may seem to be an easy feat, adapting to new ways of teaching may prove to be difficult, especially for faculty who model their teaching after previous instructors and prior experiences (Oleson & Hora, 2014). Faculty members are more likely to have had training in their discipline but not necessarily pedagogical training. This would include the integration of technology into one's pedagogical practices. However simplistic as this may appear, Mishra and Koehler (2006) posit that when implementing technological change to an existing pedagogical content knowledge there should be evident interlinking between technology, pedagogy, and content (see Figure 1).

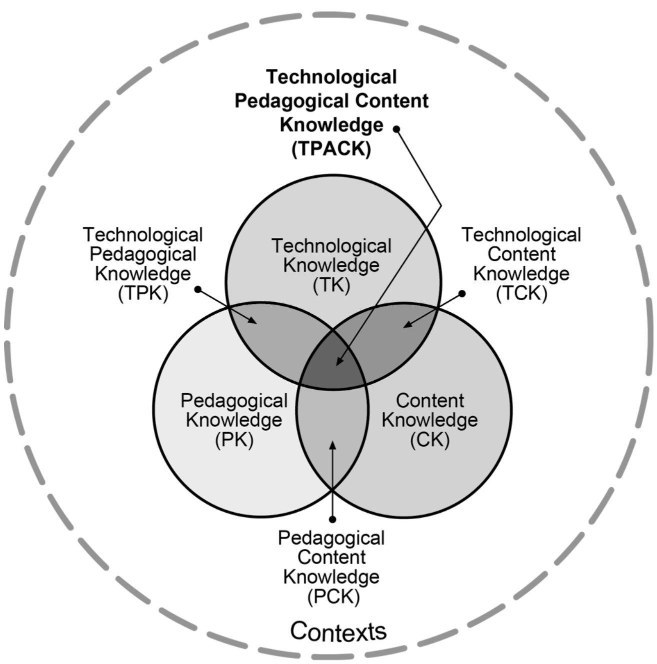

Figure 1. Technological pedagogical and content knowledge model obtained from www.TPaCK.com.

It is a result of this interlinking that faculty develop the knowledge and understanding the how, why, and when of integrating technology into their teaching methods (Garrett, 2014; Mishra & Koehler, 2006). Building off of the preliminary work of Shulman (1987), Mishra and Koehler (2006) have formulated a conceptual framework also known as Technological, Pedagogical, and Content Knowledge (TPaCK). This conceptual framework, serves as the theoretical framework for the current study through the investigation of understanding faculty perceptions of their ability to implement technology into all courses including online or blended learning courses at this recently established distributed campus university.

Statement of the Problem

Based on a series of surveys conducted by Allen and Seaman (2014), which look at the trend of enrollment of online learning, the number of students taking at least one online course has increased by 411,000 allowing the grand total to reach a new time high of 7.1 million students (Allen & Seaman, 2014). With the increased number of students taking at least one online course, the proportion of students being enrolled in an online course has also increased to an all-time high of 33.5 percent (Allen & Seaman, 2014). Since there is undoubtedly an increase in online courses being offered, an expected result of this is a positive influx of the number of faculty members needed to design and teach these courses. To provide a current perspective, in the fall of 2016, the University of Transition had approximately 27,560 students in which 10,869 of those students enrolled in at least one on-line course (University of Transition, 2016). One of the underlying concerns with faculty meeting the growth of online education is the integral part of pedagogical practices in online instruction. Shepherd, Alpert, and Koeller (2007) posit that some instructors may lack the technical competence, knowledge, and confidence, which could adversely effect their perceptions about online teaching or integrating technology into the classroom.

In addition, the site used in this study, a newly established university composed of universities that historically focused on teaching in a setting where the majority of the classes were offered on campus. Thus, the faculty from the original universities, who now teach for the newly established university, likely had little experience with blended and online teaching. With at least half of the students at this university enrolled in an online class, a better understanding of the technological, pedagogical, and content knowledge base of the faculty is warranted.

Purpose of the Study

This study serves as a response to Garrett's (2014) recommendation for future research regarding the use of the HE-PACK instrument as well as the continued investigation of differences between tenured and non-tenured faculty. The purpose of this study is to assess the perceptions of tenured and non-tenured faculty on technological, pedagogical, and content knowledge (TPaCK) at a newly established university in Texas. More specifically, this study compared and contrasted the technological, pedagogical, and content knowledge (TPaCK) of all faculty use of technology tools in face-to-face, blended learning and online environments as methods to enhance learning based on academic college, academic ranking, academic status years of experience, and gender (Garrett, 2014). In surveying the entire university faculty, the results provide insight into the professional development needed and structure for effective implementation of technology into teaching and learning practices.

In addition to furthering the discourse around TPaCK and providing specific implications for the university, the purpose of this study is also to fuel my own insight into professional development opportunities in higher education settings. I am driven by notions such as those by

Stoltzfus, Scragg, and Tressler (2015) who claim that college professors are usually far more versed in research and content than their high school teacher counterparts who typically have deep expertise in pedagogy. This "gap", so to speak, has a great influence on students and their learning through the transition from instructors who have been trained in educational philosophy, instructional practices, and implementation of these practices to brilliant researchers and content masters who may have little to no teaching experience (Stoltzfus et al., 2015). In the spirit of pursuing my own passion for lifelong learning, professional development, and higher education, I hope to take a position in the higher education setting where I can influence teaching practices.

Significance of the Study

As education continues to march through the 21st century, the realm of higher education is continuously tasked with analyzing technological trends and making decisions that will successfully impact student learning (Johnson et al., 2015). In charting through the ever-changing territory of technology, qualified faculty members who can navigate through successfully implementing blended learning and online courses becomes an area of deeper discussion. The shift in expectations of faculty to incorporate technology as instructional tools creates a need to assess more than just pedagogical and content knowledge of faculty.

This study uses the HE-TPaCK survey to collect and analyze data around technological, pedagogical, and content knowledge that can drive future professional development at the university, add to the discourse around the conceptual framework of TPaCK, as well as provide additional information on the use of the HE-TPaCK instrument. In addition to implications for the institution and future research, this work provides insight to policy makers in regards to plausible incentives and institutional support that would promote the use of technology for the purpose of instruction.

Research Questions

Following the lead of Garrett (2014), and in an effort to address the problem for this study, I posed the following research questions are proposed:

RQ1: What is the self-assessment of TPaCK by faculty as measured by the HE-TPaCK survey?

RQ2: Is there a difference in faculty self-assessment of technological, pedagogical, and content knowledge (TPaCK) based on academic college, academic ranking, academic status, years of experience and gender as measured by the HE-TPaCK survey?

Methods

This quantitative study assesses the technological, pedagogical, and content knowledge (TPaCK) of the tenured, tenure-track, and non-tenure track faculty at a newly established university in Texas. This study is based on the quantitative work of Garrett (2014), in which she modified the original TPaCK survey created by Lux, Bangert, and Whittier (2011) to fit the higher education setting. In heeding the recommendation of Garrett (2014), I used this instrument to further provide additional information on the use of the HE-TPaCK survey. Additional items in the demographics section allowed for data collection around years of experience, gender, academic college and technology training. The HE-TPaCK was sent out to faculty members using the Qualtrics online survey system as required by my university. SPSS version 22 was used to analyze the descriptive statistics, multiple analysis variance (MANOVA) and analysis of variance (ANOVA) for variables that showed a significant difference.

Assumptions

There are four notable assumptions in conducting research for this study. First it is assumed that faculty provided an accurate representation of their perceptions. Second, it is assumed that this study provides value to a broader audience beyond newly established universities. The third assumption is that faculty provided unbiased and truthful responses regardless of their academic rank. A final assumption is that the majority of faculty members at the University of Transition are inexperienced or uncomfortable with the use of technology in their courses.

Limitations

The following are possible limitations to this study:

1. The study is limited to faculty represented on the university website as currently teaching at least one course in the spring of 2017. Therefore, participant recruitment was at the mercy of public information records on the website.
2. Using the subgroups tenured, tenure track, and non-tenure track may skew the results, as some faculty may not have candidly expressed their opinions.
3. Due to the dependence on faculty's willingness and availability to participate in the survey, convenience sampling could pose a possible limitation to this study.

Definitions of Terms

Blended Learning is learning that takes place in part inside supervised traditional settings and in part through the Internet with some element of student control over time, place, and/or pace (Horn & Staker, 2011).

Content Knowledge (CK) is the level of knowledge that a faculty member has about the subject matter that is to be learned or taught (Mishra & Koehler, 2006).

Instructional Technology is the study of the relationship between pedagogy and technology. This entails professional experience, practical applications, and best practices to create and promote an effective learning environment (Golde & Dore, 2001).

Newly Established University refers to the creation of a new institution that is distributed among campuses of former institutions that no longer exist or that did not previously exist either through consolidation or other means thereof.

Pedagogical Knowledge (PK) is the deep knowledge about the processes, practices, or methods of teaching and learning to enhance student outcomes (Mishra & Koehler, 2006).

Pedagogical Content Knowledge (PCK) includes the idea of knowledge and pedagogy used to teach specific content through effective teaching strategies (Shulman, 1987).

Technical Content Knowledge (TCK) is knowledge around the way in which technology and content are related and how when integrated together can improve student learning (Mishra & Koehler, 2006).

Technological Knowledge (TK) is the degree of knowledge that a faculty member has obtained about both low and high-tech technology through the means of training or heuristic use (Koehler, 2011).

Technological Pedagogical Content Knowledge (TPaCK) is the conceptual framework that interlinks technology, pedagogy, and content into a comprehensive unit as a means to evolve the learning process (Koehler, 2011).

Technological Pedagogical Knowledge (TPK) is knowledge that is associated with one's understanding of the components and capabilities of technologies to enhance existing pedagogy, as well as student learning (Freeman, 2002; Mishra & Koehler, 2006).

Tenured Faculty are individuals who have met all the requirements for a full professoriate based on their outstanding teaching, research/scholarship and service in the institution. Official titles of participants in this category include professors and associate professors (University of Transition, 2015).

Tenure-Track Faculty are individuals in an institution who are working towards the promotion of tenure. Tenure-track faculty are also known as assistant professors (University of Transition, 2015).

Non-Tenure Track Faculty are individuals not eligible for the promotion of tenure. These individuals are also referred to as lecturers, clinical faculty, or adjunct faculty. At this institution, lecturers have three different levels, which consist of Lecturer I, Lecturer II and Senior Lecturer (University of Transition, 2015).

Organization of the Study

This dissertation is organized into five chapters. Chapter I outlines the purpose of the study and reviews the importance of technological, pedagogical, and content knowledge at a newly established university. Chapter II examines the major themes and topics associated with the study, which include the history of TPaCK, TPaCK investigations in K-12 education, a look at TPaCK in higher education, TPaCK and professional development, and finally instruments of TPaCK. Chapter III contains the research design including questions, research methodology, population and sample, instrumentation, procedures, data analysis, and the summary of the methodology. Chapter IV reports the findings from the study. Descriptive statistics for the data analysis are incorporated within the chapter along with a complete report of the statistical data analysis per each TPaCK domain as well as each variable. Chapter V includes a discussion of results and conclusions developed through the research process as well as data analysis of the study. This final chapter also includes implications and recommendations for relevant application of knowledge gained through this study and outlines future avenues of research.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter provides an overview of the extant literature, which contributes to the discourse around technological, pedagogical and content knowledge (TPaCK) of faculty in the realm of higher education. Within this literature review, concepts covered include (a) the history of TPaCK (b) TPaCK investigations K-12 (c) a look at TPaCK in Higher Education (d) TPaCK and professional development (e) TPaCK instruments. This literature review is composed of empirical and peer reviewed articles from online journals through the University's virtual library, Internet sites, and publicly available information and materials produced by the University of Transition.

History of TPaCK

The history of technology, pedagogy and content knowledge (TPaCK) is one that is built on the understanding of knowledge bases that inform teaching practices. It is Shulman's (1987) work on pedagogical content knowledge (PCK) that provides the foundation for the TPaCK theoretical framework. Shulman (1987) posits that teaching is essentially a learned profession however, the knowledge base of teaching is found within the interaction of content knowledge and pedagogical knowledge. PCK is the ability of teachers to transform their content knowledge to pedagogically wise decisions that can be understood by a variety of students (Shulman, 1987). This development of pedagogy reasoning and action is embedded in a process which begins with comprehension of content, transformation of materials into representations and instructional selection, which leads to evaluation and checking for understanding, followed by reflection of content and practice.

The basic groundwork of PCK built upon Mishra and Koehler (2006) when they presented the technological, pedagogical, and content knowledge, also known as the TPaCK framework, for educational technology. The TPaCK framework focuses on the connections, interactions, and affordances between technology, content, and pedagogy as a means to implement effective instruction (Mishra & Koehler, 2006). Although the TPaCK model is an all-encompassing framework, often times the core content components of technology, pedagogy, and content are seen as separate (Sahin, 2011). In reality TPaCK is composed of seven knowledge bases, three of which are the core knowledge bases, and four are produced from interactions among the core knowledge bases (Pamuk, Ergun, Cakir, Yilmaz, & Ayas, 2013). In an effort to better understand each component of TPaCK, I first present a more in depth look at each of the core knowledge bases.

Content Knowledge (CK)

The knowledge of the curriculum or the discipline one teaches is considered the content knowledge (Koehler, Mishra, Kereluik, Shin, & Graham, 2014; Kushner Benson & Ward, 2013; Mishra & Koehler, 2006; Shulman, 1987). Faculty members, tenured and non-tenured, are considered experts in their respective disciplines and therefore have a deeper understanding of the concepts, theories, and procedures of the subject matter they are responsible for teaching (Koehler, Mishra, & Yahya, 2007; Mishra & Koehler, 2006). Faculty members' content knowledge expands as they participate in activities including professional learning communities, conferences, research, and non-traditional professional development opportunities such as discipline specific blogs (Garrett, 2014; Lux et al., 2011; Yang & Liu, 2004).

Pedagogical Knowledge (PK)

Principles, strategies, techniques, practices, and methods of teaching and learning that structure student learning are all examples of pedagogical knowledge (Koehler et al., 2014; Kushner Benson & Ward, 2013; Mishra & Koehler, 2006; Pamuk et al., 2013; Shulman, 1987). The success of a faulty member's ability to develop strong pedagogical knowledge is dependent upon the comprehension of the material being taught and the understanding of how to transform this knowledge into a learning process where students construct new knowledge (Garrett, 2014; Koh & Divaharan, 2011; Mishra & Koehler, 2006; Shulman, 1987). The decision to explore one's pedagogical knowledge and experiment with different representations of subject matter can be influenced by one's disposition towards teaching (Koehler, 2011; Pamuk et al., 2013; Sahin, 2011).

Technology Knowledge (TK)

The use of the word technology in this framework refers to all the new and old tools, materials, resources, and technical skills used in teaching and learning (Kushner Benson & Ward, 2013; Pamuk et al., 2013). The knowledge base of teachers' abilities to operate these resources and manipulate the tools to integrate into a curriculum is considered technology knowledge (Mishra & Koehler, 2006). Some of the technologies used in this capacity include new technologies such as software and hardware, as well as primitive technologies including books, chalk, and blackboards (Graham et al., 2009; Mishra & Koehler, 2006). A specific example would be the use of Blackboard, which serves as the learning management system and virtual online learning platform for the university in the current study. These examples of technology have allowed faculty to communicate and demonstrate content in a variety of ways (Garrett, 2014; Koehler, 2011; Koh & Divaharan, 2011).

Although the components of content knowledge, pedagogical knowledge, and technological knowledge respectively are important separately the interactions among them are just as important (Mishra & Koehler, 2006; Sahin, 2011). The interactions between the core knowledge bases include pedagogical content knowledge, technological content knowledge, and technological pedagogical knowledge all emerge to complete the TPaCK model (Koehler et al., 2014; Kushner Benson & Ward, 2013; Mishra & Koehler, 2006; Ward & Kushner Benson, 2010). These intersections are discussed in more detail below.

Pedagogical Content Knowledge (PCK)

Pedagogical content knowledge is the first interaction documented by Shulman (1987), which reflects the ways in which teachers connect subject matter to instructional practices (Kushner Benson & Ward, 2013; Pamuk et al., 2013). This interlinking relationship between specific content and instructional methods allows faculty to utilize approaches that promote the material in a manner that is conducive for learning (Garrett, 2014; Koh & Divaharan, 2011). Faculty who can articulate the reasoning behind their arrangement of content and the representation of material are considered proficient in pedagogical content knowledge (Pamuk et al., 2013; Shulman, 1987).

Technological Pedagogical Knowledge (TPK)

Technological pedagogical knowledge refers to the ways in which technology interacts with pedagogical practices to enhance teaching and learning (Koehler et al., 2014; Mishra & Koehler, 2006; Ward & Kushner Benson, 2010). This interaction carries the potential to change the teaching process itself (Kushner Benson & Ward, 2013; Mishra & Koehler, 2006). Within this knowledge base, teachers seek out ways to support or enrich their teaching through the use of specific technological tools and resources (Harris & Hofer, 2011; Mishra & Koehler, 2006; Pamuk et al., 2013).

Technological Content Knowledge (TCK)

The use of technology to enhance content is known as technological content knowledge (Koehler et al., 2014; Mishra & Koehler, 2006; Ward & Kushner Benson, 2010). TCK is essentially about choosing and implementing technology to communicate and represent the content of a subject (Pamuk et al., 2013). It is important for faculty to be able to determine technology applications that constrain the representation of specific content and those that promote a varied and effective manner that represents the content (Kushner Benson & Ward, 2013; Lux et al., 2011).

Technological Pedagogical Content Knowledge (TPCK)

An individuals' TPCK is located at the intersection of core knowledge elements of content, pedagogy, and technology (Koehler et al., 2014; Kushner Benson & Ward, 2013; Mishra & Koehler, 2006). TPCK is usually characterized by the integration of technology into teaching and learning (Lux et al., 2011). For clarification purposes, TPCK is the knowledge base located in the middle of the overlapping core knowledge in the diagram, whereas TPaCK is the acronym that is used when referring to the framework (Kushner Benson & Ward, 2013).

The understanding of the core components of TPaCK and the interlinking domains within serve as the foundation for interpreting faculty perceptions. It is important to note that the evolution of these domains as further research and discourse have added to the conceptual framework of TPaCK over time.

TPaCK Investigations K-12

TPaCK is a framework that has been utilized since its conception from Mishra and Koehler (2006) to combine the fundamentals and dynamics of teaching and learning with technology (Pamuk et al., 2013). It has been reported that over 600 journal articles have been published using TPaCK as a framework with the number of articles continuing to grow as the discussion penetrates multiple venues and fields (Koehler et al., 2014). Most of these studies focused on the implications for pre-service teachers who will become educators in the primary and secondary setting (Koehler et al., 2014; Kushner Benson & Ward, 2013). Although the focus of this study is grounded in higher education, implications from these previous studies add to and extend the literature and conversation around TPaCK.

In analyzing the literature, a common theme is the influence of the TPaCK on good teaching practices and skills encompassing the use of technology. According to Mishra and Koehler (2006), quality teaching is dependent upon how variables such as content knowledge, pedagogical knowledge, and technological knowledge interact with one another, which encompasses the other four domains of the TPaCK. The studies below support the theme of good teaching and discuss the interactions within the TPaCK domains.

Archambault and Crippen (2009) examine teachers' self-assessment of the TPaCK knowledge domains of K-12 teachers who taught online. Archambault and Crippen's study contributes to the theme of "good teaching" by describing the need for teachers to understand the importance of selecting technology that supports the pedagogical and content needs of the students (Garrett, 2014). Using a tailored survey methodology of 596 K-12 online teachers representing 25 states Archambault & Crippen (2009) measured their knowledge in the seven TPaCK domains. The majority of the respondents rated themselves highest in the domain of pedagogy and content conveying their ability and confidence to teach in the traditional classroom. Knowledge levels dropped from pedagogy and content to technology suggesting the lack of confidence in troubleshooting technology issues. Although the scores rose when analyzing TCK, TPK, and TPCK, findings showed that overall, teachers were not as confident when interacting with a domain that included the technology component (Archambault & Crippen, 2009; Garrett, 2014).

Similarly, Maeng, Mulvey, Smetana, and Bell (2013) provide another example of the "good teaching" principle through inquiry instruction and the development of 27 pre-service Science teachers' TPaCK. They conducted their study using a qualitative case study research design to understand how pre-service teachers use educational technologies to support students inquiry investigations and how technology enhanced inquiry instruction demonstrated their developing TPaCK during student teaching (Maeng et al., 2013). Data collection included classroom observations, participant interviews, and artifacts such as lesson plans, student's assignments, presentations, and teacher reflections. Overall they was found that the participants used a variety of different technologies to support inquiry based instruction within their lessons including digital images, animations, simulations, spreadsheets, and probe ware in both small and whole group settings. Additionally, they determined that TPaCK was demonstrated through the decisions teachers made on what type of technology to integrate into certain content and pedagogical practices. Maeng et al. (2013) note the importance of ensuring pre-service teachers engage in teaching methods courses that emphasize how technology can be used to support pedagogical approaches in specific content areas.

Another example of a study using the TPaCK framework to describe "good teaching" principles is the Dong, Chai, Koh, and Tsai (2015) study on pre-service and in-service teachers

TPaCK and beliefs regarding constructivist oriented teaching (CB) and design disposition (DD) in China. Through this study, the researchers surveyed 390 pre-service teachers and 394 in-service teachers to understand any difference between pre-service teachers' and in-service teachers TPaCK, as well as whether CB and DD can be used to predict a teachers TPaCK (Dong et al., 2015). Using the results from the developed survey instrument, validated using factor analysis with a Cronbach's alpha of 0.98, Dong, et al reported that pre-service teachers' associated beliefs of the TPaCK, as well as the associated beliefs CB and DD, were all lower than the in-service teachers. For the pre-service teachers their TPaCK profile determined that these teachers perceived themselves as strongest in terms of TPK and weakest in CK. In-service teachers perceived themselves strongest in their PK and weakest in terms of their TPCK. Both results provide implications for the need for professional development in the area of technology integrated lessons and additional activities that will develop the knowledge bases needed to enhance TPaCK (Dong et al., 2015). Their study also found that through structural equation models the DD consistently predicted both pre-service and in-service teachers TPaCK while CB did not predict pre-service teachers' TPaCK. The reported conclusions allude to the suggestion that if adequate professional development is not provided, teachers' constructivist beliefs may become a barrier for them to implement lessons that require TPaCK and ultimately good teaching (Dong et al., 2015).

Pamuk et al. (2013) explored the relationships among TPaCK components through the examination of pre-service teachers' experiences at a Turkish University. This two-part study aimed to grasp a better understanding of the validity of a TPaCK instrument and to develop a structural model for the knowledge bases. In the first stage of the investigation, they conducted the process of the instrument development and validity. This included a literature review of the items generated, a review of instruments, expert review, and then a student practice with 147 pre-service teachers in the program of social studies and early childhood education (Pamuk et al., 2013). They determined reliability based on factor analysis and content as well as construct validity methods. After the first administration, the 63 item instrument was reduced to 37 items. In the second stage of investigation, they administered the revised TPaCK to 882 pre-service teachers (Pamuk et al., 2013). Using the SEM model and correlation coefficients, the researchers determined that although the core knowledge bases of PK, CK, TK influence TPaCK it is actually the second level knowledge basis of PCK, TCK, TPK that impacted TPaCK (Pamuk et al., 2013). These findings provide additional evidence to the notion that it is the interactions between the core knowledge bases that truly develop TPCK and promote good teaching in an online setting.

TPaCK in Higher Education

Studies of TPaCK in higher education are limited. Most previously conducted investigations, as mentioned above, involve pre-service teachers preparing to enter the K-12 arena (Kushner Benson & Ward, 2013). However, the lack of literature in higher education does not negate the need for further studies, and researchers are on the verge of filling in the gap based on the continued research currently being published.

Over the years, the quality of teaching in higher education has grown in importance. It is known that exceptional teachers are masters of their content and of equal importance knowledgeable in pedagogical thinking and skills (Kushner Benson & Ward, 2013; Postareff, Lindblom-Ylanne, & Nevgi, 2007). Parallel to the shifting focus of content knowledge to the interaction of content knowledge and pedagogy, is the growing discussion and importance of the integration of technology (Kushner Benson & Ward, 2013). The interaction among content, pedagogy, and technology are not only being studied within the face-to-face classroom, but more intensely in the online learning environment. Scott (2009) & Kushner Benson and Ward (2013) agree that the TPaCK framework provides an effective lens through which to conceptualize teaching, which employs technology and learning excellence in higher education.

Kushner Benson and Ward (2013) used the TPaCK framework to evaluate teacher expertise in higher education. With the purpose of understanding the symmetry of the circles in Mishra and Koehler (2006) TPaCK framework, a qualitative study examined and analyzed three professor's TPaCK profiles (Kushner Benson & Ward, 2013). The faculty who participated in the study full time faculty in the College of Education had at least three years' experience. Through face-to-face interviews, non-participant observations, and the analysis of the syllabi, instructional models, and discussion board posts, data was collected over a sixteen-week semester (Kushner Benson & Ward, 2013). After analyzing the data collected, a TPaCK profile created for each participating faculty member revealed that a higher TPCK overlap is present when the participant had a high knowledge base of pedagogy. This finding attests that it is not enough to know how to use technology, but to achieve a true TPCK knowledge base a professor must be able to explain the connection between the technology being used and the pedagogical practice related to the content (Kushner Benson & Ward, 2013). The study concluded with "the development of reflection and understanding of one's personal TPaCK profile may provide insight into professional development needs and a more systematic way to look at one's knowledge in these areas" (Kushner Benson & Ward, 2013, p. 168)

Continuing with the theme of faculty expertise, Lavadia (2017) adds to the literature of TPaCK in the higher education field by exploring tertiary science faculty expertise in the use of technology, as well as their ability to integrate technology into the curriculum and instruction within their discipline. This mixed method study, which included 29 participants, used the theoretical framework of TPaCK and adoption theory of innovation to investigate tenured and non-tenured science faculty. After analyzing the perceived competencies of the science faculty participants, the assessment showed faculty are confident in both Technology Knowledge and Content Knowledge. In addition, faculty rated themselves as knowledgeable in the areas of Pedagogical Content Knowledge and Pedagogical Knowledge, and the lower average percentages appeared in Technological Content Knowledge and Technological Pedagogical Content Knowledge. In addition to the perceived competencies, Lavadia (2017) found technological knowledge to be the leading domain, which explains 35% of the variance in adoption levels of technology into the classroom. Findings from the qualitative interviews, revealed that participants voiced concerns regarding the lack of long term professional development when integrating technology into their practice. Moreover, the types of technology integration implemented into practices of the participants consisted of technology that supported equipment, teacher-centered instruction and assessments such as metabolic carts, simulations, and Kahoot or iClicker (Lavadia, 2017).

Most of the research conducted on faculty TPaCK is focused on both tenured and non-tenured faculty as a variable. Knolton, (2014) offers the perception of a subgroup of non-tenure faculty. In a time of limited budgets and increased student loads, universities are turning toward adjunct faculty to play a larger role in conducting academic classes. Usually adjuncts are hired for their content knowledge and close association to the business. Knolton (2014), investigates the relationships that exist between TPaCK knowledge, pedagogical training, and personal technology in a Midwestern University. The study concluded that a positive relationship exists, in the relationship between pedagogical training and the ability to select effective digital techniques for practice. In addition, faculty who used technology in their private lives positively influences their ability to implement digital tools and techniques in the classroom. Although these results may not be surprising, it serves as additional evidence to the importance of building capacity in faculty TPaCK at all levels of an institution, including adjunct faculty.

In addition to understanding faculty expertise, a study conducted by Larsen (2014) aimed to raise awareness of TPaCK in the higher education field, more specifically in the area of foreign language. Within this study Larsen (2014) analyzed two groups of foreign language faculty, which included instructors and first line supervisors in six higher education institutions. Using a modified TPaCK survey, Larsen found that the first line supervisors evaluated themselves higher in the domains of TPaCK that relate to technology while the instructors rated themselves higher in the area of pedagogical content knowledge. In focusing the shift for TPaCK on this group of higher education faculty Larsen suggests implementing institution wide TPaCK assessments and designing TPaCK –enhanced professional development training opportunities for faculty.

In analyzing the studies conducted in the realm of higher education around the implementation or construct of TPaCK, each provide some type of awareness and in some cases suggestions on how TPCK relates to the professional learning of higher education faculty.

TPaCK and Professional Development

Professional development is not an unfamiliar concept in higher education. Although the concept of professional development takes on many forms and terms: the importance remains the same. It is imperative that 21st century educators understand the learning process and throughout their career invest in professional development (Archambault & Barnett, 2010; Zhan, 2011). This holds true in the case of understanding the interactions of TPaCK, as well. According to Rienties et al. (2013), adequate training should be provided by higher education institutions as a means to raise awareness of technology, pedagogy, and content knowledge in their disciplines, as well as the complex interplays among them.

Faculty must participate in professional development that allows them to reflect and learn how to integrate materials and skills into the classroom over the long term for the greatest impact on student learning (Lawless & Pellegrino, 2007; National Staff Development Council, 2001; Rienties et al., 2013). The Iowa Association of School Boards (2015), claims that in order for professional development to improve student learning it must be grounded in student needs, researched based, collaborative, built in a system, built on effective training processes, and evaluated.

Harris and Hofer (2011) conducted an investigation to understand the impact of a synchronous TPaCK professional development on seven experienced social studies teachers practicing in secondary schools across the United States. This study took place during a five-month period in which data collected included teacher interviews, lesson plan reviews, and teacher reflections dealing with the integration of technology and the transfer into instructional planning. The findings of this study indicated that teachers; knowledge is influenced through factors such as culture, school environment, and socioeconomics (Garrett, 2014; Harris & Hofer, 2011). In addition, Harris and Hofer (2011) concluded that through the analysis of data the teachers' professional development resulted in the incorporation of intentionally planned student centered learning activities and technologies.

Another recent investigation of the impact of TPaCK in higher education is found in Rienties et al. (2013). This study analyzed the impact of a program by the name of MARCH (Make Relevant Choices in Educational Technology), designed to enhance teacher's skills and abilities to integrate information communication technology (ICT) into their practices. This innovative, cross-institutional, online program in the Netherlands served as the basis for the study to determine the impact on teachers' TPaCK skills. This pre-post test design was conducted with 67 teachers from 5 different higher education institutions. The participating faculty completed the MARCH modules in an 8-12 week time frame. These modules were designed around the TPaCK model and aimed to support collaborative online learning while requiring peer feedback and implementation in the classroom (Rienties et al., 2013). The results indicated that all teachers' overall TPaCK scores increased as a result of participating in the modules. In addition to the results of the TPaCK, two other key principles from the study include:

1. The importance of allowing faculty to participate in an authentic experience where they understand what it is like to learn and teach in an online setting using synchronous and asynchronous tools (Rienties et al., 2013).
2. The need to allow faculty sufficient time within any training program to reflect and implement the practices into their own educational design (Rienties et al., 2013).

Overall, the study showed that faculty remained positive about the experience of participating in the MARCH modules to enhance their TPaCK. However, not all effectively learned in this manner, which attests to the need for refining and differentiating comprehensive training programs (Rienties et al., 2013).

According to Alvarez, Guasch, and Espasa (2009), who reviewed 16 blended and online training programs, technology, although the focus, failed to make the connection to pedagogical practices. This contributes to the need for restructuring of training. Professional Development usually isolates technology, which does not develop one's TPaCK (Kushner Benson & Ward, 2013). Alvarez et al. (2009) posits that learning is a social construct and therefore should be reflected in professional development as well. Training should be designed to fit the teaching practices, instead of focusing on learning how to use technology A, B or C (Lawless & Pellegrino, 2007; Rienties et al., 2013). In addition to the need to restructure training, faculty also need to be able to update their skills and expertise in a safe and cost effective manner on a continuous basis (Alvarez et al., 2009; Rienties et al., 2013).

Evidently, a need to explore and research new professional development models and practitioner-oriented approaches that are conducive to the realm of higher education and will positively impact TPaCK development exists. One example focuses on curriculum based TPaCK development through intentional planning. This type of approach focuses on educators planning content goals for instruction and then moving on to major activity types before determining which potential technology tools will enhance the content goals (Harris & Hofer, 2009). Another approach to faculty based professional development is a program at Arizona State University that assists faculty in creating and designing Web 2.0 and social networking components into their courses that enhance content and pedagogy. An outcome of this program is faculty members, in some cases, are actually modifying their content or pedagogy as a result of the affordances the newly learned technology has provided (Archambault, Wetzel, Foulger, & Williams, 2010).

In addition to the practitioner-oriented approaches, some recent models have included a multifaceted approach that involves traditional professional development followed by the professional practice of action-reflection-action (Darling-Hammond, 2006; Jang & Chen, 2010; Larsen, 2014). Czajka and McConnell (2016) demonstrate this type of approach in a case study that utilizes situated instructional coaching as a method for faculty professional development. This model included a coach assisting faculty in reforming the lessons and pedagogy practices.

Additional activities included co-teaching, reorganizing lessons, manipulating materials and participating in coaching sessions that included post class reflections with the coach. The data collected throughout the study showed that instructors were more successful in the delivery and construction of lessons in a more student centered perspective.

Although there are methods and models being used to incorporate TPaCK in higher education through professional development, it is important to analyze the approaches at the K-12 level as some of these proven practices could be adapted to fit into the post secondary level. In a study done by Harris & Hofer (2017), seven schools and districts were recruited to share their best practices of appropriating TPaCK into their professional development. Using the method of a TPaCK symposium, followed by individual school and district interviews, Harris & Hofer (2017) provided some insight on how these entities are utilizing and understanding the concept of TPaCK. The results of this study showed that each district used the TPaCK as some form of a guide or framework, which implemented and supported in many different ways including instructional coaching, professional learning communities (PLC), developing instructional lessons, and collaboratively developing curriculum. Overall, the themes that emerged throughout these districts, which provide insight into the realm of higher education, is first and foremost that professional development has to be put into context and fit the institution's philosophy. In professional development, when developing a plan of implementation, without the consideration of the impact on the context and professional culture, it can be detrimental to the success of utilizing TPaCK as a framework. It is important to be cognizant of the differences in faculty strengths and learning needs. However, as mentioned in Harris & Hofer (2017) based on individual needs, using TPaCK as a construct can assist educators' growth. Instead of using TPaCK as a theoretical knowledge base, applying TPaCK in practice is emphasized.

One of the most important aspects of TPaCK in professional development, regardless of the level of education, is that it has the potential to connect existing disparate professional development initiatives and positively impact curriculum and instruction delivered by educators. The implementation of TPaCK can take on many forms in both theory and in practice, which can professionally grow teachers as they continue to integrate technology into their classrooms.

TPaCK Instruments

In the analysis of the literature, it is evident that several instruments have been created to measure the seven domains of the TPaCK, especially with pre-service teachers. One of the first instruments created to self-assess the knowledge and a skill of TPaCK was by Schmidt, Baran, Thompson, Koehler, and Mishra (2009). This instrument consisted of 75 items and investigated the seven-domain structure with 124 students in a US instructional technology course. This instrument eventually modified continues to be used as a basis for additional data collection with pre-service teachers.

In a study conducted by Koehler, Shin, & Mishra (2012), where they reviewed 303 articles related to TPaCK, there were approximately 141 instruments have been used to measure the understanding of TPaCK. These instruments included 31 self-reported measures, 20 open-ended questionnaires, 31 performance assessments, 30 interviews, and observations (Koehler et al., 2012). The abundance of instruments attests to the interest in assessing teachers self-assessment of TPaCK and understanding of the seven domains associated with it.

Although each study, modification, and validation of instruments used to measure TPaCK is valuable, limited research is available in the context of higher education (Garrett, 2014; Rienties et al., 2013). Researchers interested in developing or modifying instruments to assess faculty TPaCK knowledge and skills are on the rise, since the creation of higher education focused instruments similar to the one created by Rienties et al. (2013). Similar instruments created to focus on higher education include Garrett (2014) who modified the works of Lux et al. (2011) in their creation of a TPaCK survey known as the PT-TPaCK.

An additional modified survey example in higher education includes Lavadia (2017) Sci-TPaCK survey used to analyze science faculty self-assessment of TPaCK. The Sci-TPaCK survey is a rendition of multiple previous surveys including Schmidt et al. (2009) TPaCK survey focused on pre-service teachers, Lux's (2011) PT-TPaCK survey, also for pre-service teachers, and Garrett's (2014) HE-TPaCK survey, designed for higher education faculty.

The trend of modifying the TPaCK instrument is usually associated with Schmidt et al. (2009) pre-service survey (Garrett, 2014; Lavadia, 2017; Knolton, 2014). From this survey researchers modify the contents to fit the population they are investigating. The problem lies in the survey being generalized across multiple populations without sacrificing the reliability and validity of the survey tool.

Summary of Literature Review

This chapter summarizes the previous literature in the area of TPaCK specifically in higher education. Implementing technology in the classroom has provoked an abundance of literature around effectiveness of integration to the knowledge base of an educator. Through this investigation, the literature review revealed several key points that provide a foundation for the components of the current study:

- There is an abundance of literature in the K-12 realm and pre-service teachers with a theme of good teaching practices and skills accompanying the use of technology as well as the ability to select effective technology.

- Overall, educators in higher education and K-12 have a higher self-assessment of pedagogical knowledge and content knowledge than in domains that interact with the core knowledge base of technology.
- There is a need for quality professional development in integrating technology and growing one's TPaCK that incorporates a hands-on approach that is sustained across a support system.

In addition, the literature review also disclosed some gaps and limitations. These have been summarized in the key points below:

- There are many different instruments used to analyze the implications of TPaCK in both higher education and K-12 with concern reliability and validity.
- Measurability of TPaCK in practice is still debatable, as most studies identify only perceptions of self-assessment.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

As mentioned in Chapter I, this study is in response to Garrett's (2014) dissertation *"A Quantitative Study of Higher Education Faculty Self-Assessments of Technological, Pedagogical, and Content Knowledge (TPaCK) and Technology Training,"* which has been the inspiration and guide. With the intent of contributing to the scant discourse around TPaCK in higher education, and more specifically the HE-TPaCK instrument, this study models a hybrid version of Garrett's (2014) approach. The purpose of this study is to allow faculty at a newly established university the opportunity to self-assess their technological, pedagogical, and content knowledge (TPaCK). More explicitly, this study compares and contrasts the technological, pedagogical, and content knowledge (TPaCK) of all faculty members' use of technology tools in face-to-face, blended learning, and online environments as methods to enhance learning based on academic college, academic rank, academic status, years of experience, and gender (Garrett, 2014). This chapter provides the details of the research design and methodology used to conduct the study. The methodology includes a description of the setting, sample, design, instrument, procedures, data analysis, assumptions and limitations. The research questions that guide this study are:

1. RQ1: What is the self-assessment of TPaCK by faculty as measured by the HE-TPaCK survey?

2. RQ2: Is there a difference in faculty self-assessment of technological, pedagogical, and content knowledge (TPaCK) based on academic college, academic ranking, academic status, years of experience, and gender as measured by the HE-TPaCK survey?

Setting

The University of Transition is a newly established university located in Texas. The University of Transition is functioning on two separate main campuses approximately 65 miles apart. The close proximity to the Mexican border at both campuses provides a unique cultural experience for all students. In 2015, The University of Transition reported having an enrollment of 25,382 Hispanic students, which is the highest Hispanic enrollment among all 4-year public universities in the state of Texas.

The creation of a newly established university has proven to have its challenges, but it has also allowed for the opportunity to provide over 120 undergraduate and graduate programs for students in this region of Texas (University of Transition, 2016). As the second largest Hispanic-Serving Institution (HSI) in the nation, The University of Transition provides a bilingual, bicultural, and biliterate education while cultivating innovative 21st century leaders and professionals (University of Transition, 2016). Currently, the academic foundation of The University of Transition is composed of eleven colleges and schools including the new School of Medicine, College of Health Affairs, College of Sciences, College of Liberal Arts, College of Fine Arts, College of Engineering and Computer Science, College of Business and Entrepreneurship, College of Education and P-16 Integration, Honors College, Graduate College, and University College (University of Transition, 2016). Following Garrett's (2014) study, all faculty in the schools and colleges outlined were invited to participate in this study.

Sample

Faculty from all campuses and colleges within The University of Transition served as the population for this study. The convenience sampling method was utilized as members are solicited from a target population that must meet certain criteria and have the ability or willingness to participate at a given time (Etikan, Musa, & Alkassim, 2016). The eligibility criteria for the participants follows: 1) a current employee of the University of Transition who held a faculty position in the fall of 2017, according to the public records of the website; and 2) identifiable as one of the academic rank categories of professor, associate professor, assistant professor, lecturer, clinical, or adjunct.

Using the University of Transition's public website, 1,527 potential participants were identified for this study and were assumed to be teaching at least one course in the spring of 2017. According to the Strategic Analysis and Institutional Report for the University of Transition (2017), there were a total of 1,371 faculty members, which did not include the School of Medicine. Out of the 1,371 faculty members, 448 are tenured, 226 are tenure-track, and 697 are non-tenured. To further break down the academic rank of the potential participants in this study, 176 are classified as professors, 272 are classified as Associate Professors, 226 are classified as Assistant Professors and 697 are classified as other faculty, which includes lecturers, clinical, or adjunct faculty.

Each faculty member is part of one of the previously mentioned colleges. According to the Strategic Analysis and Institutional Report for the University of Transition (2017), there were 157 faculty members in the College of Business and Entrepreneurship, 98 faculty members in the College of Engineering and Computer Science, 133 faculty members in the College of Education and P-16 Integration, 133 faculty members in the College of Fine Arts, 241 faculty members in the College of Health Affairs, 359 faculty members in the College of Liberal Arts, 235 faculty members in the College of Sciences and 15 in the University College. These statistics do not contain the faculty members for the School of Medicine.

To determine if the sample population consists of enough participants, a power analysis was conducted to determine the minimal sample size. With an alpha level significance of .05, moderate effect size (2.5) and sufficient power (.80) a sample size of 54 is necessary to be considered sufficient (Balkin, Ricard, Garcia, & Lancaster, 2011).

Design

The design of this study is both causal-comparative and correlational. The goal of a correlational and a causal-comparative study is to examine the relationships and associations between variables. A causal-comparative design allows for the researcher to find relationships between independent and dependent variables. The purpose for using this design is to determine if the independent variable affected the dependent variable by comparing two or more groups (Salkind, 2010). More specifically a correlational design was used to determine if a relationship existed and if it did, investigate the nature of that relationship (Gravetter & Forzano, 2016). A multivariate analysis of variance (MANOVA) was used as the statistical method for analyzing the categorical variables, while a univariate analysis of variance (ANOVA) was used as post-hoc analyses. Initially, I used MANOVA to examine differences between categorical variables (e.g. gender) across criterion variables of TPaCK subdomain scores. For example, I determined if males and females had differences on pedagogical knowledge. If there were no differences across gender, I did not include this variable in the prediction equation. However, if there was a significant difference, a follow up ANOVA was conducted to determine specific differences between groups.

Instrument

The instrument created by Garrett (2014) that I used in this study was developed based on the Lux et al. (2011) survey designed to assess pre-service teachers. This survey known as the PT-TPaCK consisted of a 45-item survey, which assessed knowledge of TPaCK on a four point Likert scale. The original survey categorized the 45 items into six TPaCK domains. These domains include technology knowledge (six items), content knowledge (six items), pedagogy knowledge (four items), pedagogical content knowledge (six items), technological content knowledge (six items), technological pedagogical knowledge (six items), and technology pedagogy content knowledge (eleven items) (Garrett, 2014; Lux et al., 2011).

In addition to modifying the PT-TPaCK, Garrett (2014) added a section regarding technology training. Garrett (2014) used Georgina and Olsen (2008) 24-item survey, which measured faculty perception of training in higher education as the model for the technology training questions added to the HE-TPaCK. Similar to the design of this 24-item survey, Garrett (2014) used a five-point Likert scale to assess teacher's knowledge.

Modified Instrument

As mentioned above, this study utilized the modified instrument created by Garrett (2014), known as the HE-TPaCK, that aims to measure the TPaCK of faculty in the higher education setting. The original HE-TPaCK is a survey consisting of 49 items, and is measured on a five-point Likert scale to assess responses in the domains specific to the survey (Garrett, 2014). In following the lead of Garrett (2014), the survey used in this study also contains a five-point Likert scale, and consists of ranges that include strongly agree (1), agree (2), neither agree nor disagree (3), disagree (4), and strongly disagree (5) (Garrett, 2014). This scoring system indicates that the lower the score, the more proficient the faculty perceives their ability to enhance student learning through technology, pedagogy, and content knowledge (Garrett, 2014).

The HE-TPaCK survey collected information on demographics as well as the seven domains of TPaCK. However, similar to Garrett (2014), the demographic information that will be solicited from the survey used in this study differ. In an effort to gather the appropriate data, participants were asked 7 demographic questions around academic college, academic ranking, academic status, years of experience, discipline of expertise, technology training, and gender. The rest of the items are categorized into the seven domains of the TPaCK and the technology training session. The domains, number of items, and an example for each can be found below.

1. Content Knowledge (CK) domain consists of six items. An example of a CK item is stated as such: I stay abreast of new research related to my discipline in order to keep my own understanding of my discipline updated.
2. Pedagogy Knowledge (PK) domain is composed of four items. An example of a PK item is stated as such: I am familiar with a wide range of practices, strategies, and methods that I can use in my teaching.
3. Technology Knowledge (TK) domain consists of six items. An example of a TK is stated as such: I recognize that technology use can have positive and negative effects.
4. Pedagogical Content Knowledge (PCK) domain contains six items. An example of PCK will state: I understand that there is a relationship between content and the teaching methods used to teach that content.
5. Technological Content Knowledge (TCK) domain consists of six items. An example of TCK will state: I am aware of how different technologies can be used to provide multiple and varied representations of the same content.

6. Technological Pedagogical Knowledge (TPK) domain consists six items. An example of TPK will state: I understand that in certain situations technology can be used to improve student learning.
7. Technological Pedagogical Content Knowledge (TPCK) domain contains eleven items. An example of a TPCK item is: I understand what makes certain concepts difficult to learn for students and how technology can be used to leverage that knowledge to improve student learning.
8. Technology Training (TT) section contains four items. A sample item for this section is: Technology training should be offered in each academic department at my University (Garrett, 2014).

HE-TPaCK Validity

In analyzing the validity of the instrument, content validation was conducted for the survey. According to Borg and Gall (1983), content validity is described as "the degree to which the sample of test items represents the content that the test is designed to measure." The most common and accepted approach to determining content validity is expert judgment (Pamuk et al., 2013). Garrett (2014) had the HE-TPaCK survey reviewed by five experts to determine content validity. These experts were knowledgeable in the area of TPaCK and/or technology training (Garrett, 2014). Following the lead of Crocker and Algina (1986) each item was assessed and evaluated based on "wording, grammar, ambiguity or any other technical flaws (Crocker & Algina, 1986, p. 81; Garrett, 2014). Following the suggestions of Crocker and Algina (1986, p. 218) experts solicited by Garrett (2014) performed an instrument review to ensure that each item on the survey instrument measured the TPaCK and technology-training concepts intended. After review, the experts provided feedback on the design and development of the instrument, which when received by Garrett (2014), was revamped and redistributed for a consensus of the experts. Through this review process, the content validity was established for the HE-TPaCK survey modified by Garrett (2014). The same survey items were used for this study in the TPaCK domains and technology training; therefore, keeping the established content validity.

HE-TPaCK Reliability

To ensure that the HE-TPaCK survey is measuring what it intends to, a Cronbach Alpha was used to establish internal consistency and reliability. Reliability is the degree of consistency within the instrument where in similar conditions results would be comparable (Gall, Gall, & Borg, 2007). As mentioned above, reliability for the HE-TPaCK survey had been established through Cronbach Alpha. As seen in Table 1, each of the domains and the technology training includes Cronbach Alpha values. The Cronbach Alpha for Content Knowledge (CK) that consisted of six items is .896. The four items in the Pedagogical Knowledge (PK) domain is .871. The Technological Knowledge (TK) domain has a Cronbach Alpha of .733 for six items. Pedagogical Content Knowledge (PCK) has six items, which generated a Cronbach Alpha of .846. The Technological Content Knowledge domain consists of six items and has a Cronbach Alpha value of .822. The six-item domain of Technological Pedagogical Knowledge (TPK) has a Cronbach Alpha of .783. The Cronbach Alpha of the eleven-item domain of Technological Pedagogical Content Knowledge (TPCK) is .943. Finally, the Cronbach Alpha of the Technology Training domain of four items is .670.

It is important to note that although the reported Cronbach Alpha was 0.56 for technology training in Garrett's (2014) instrument, this domain remained in the survey. In this study, the Cronbach Alpha reported a score of 0.67. Heeding to the recommendations of Nunnally's (1978) in which he describes an acceptable reliability coefficient to be .70 or higher. This domain of the survey was excluded from the data and was not analyzed.

Table 1

Cronbach's Alpha Summary of the HE-TPaCK Survey

Domains	Cronbach's Alpha	Number of Items
Content Knowledge (CK)	.896	6
Pedagogical Knowledge (PK)	.871	4
Technological Knowledge (TK)	.733	6
Pedagogical Content Knowledge (PCK)	.846	6
Technological Content Knowledge (TCK)	.822	6
Technological Pedagogical Knowledge (TPK)	.783	6
Technological Pedagogical Content Knowledge (TPCK)	.943	11
Technology Training (TT)	.670	4

Procedures

The procedures for conducting this study was a multiple step process, which began by collecting and creating protocols to provide to the Universities Institutional Review Board (IRB). The first protocol addresses how to identify the convenience-sampling participants being all faculty within each college of The University of Transition. The potential participants were identified through a complied list of faculty members that was extracted from the Universities public website in the Spring Semester of 2017.

Due to the large number of potential participants, an electronic version of the survey was created using the Qualtrics online system. Qualtrics is a web based surveying tool that is required for all students and faculty to use for the purpose of data collection. The modified HE-TPaCK questions for all seven TPaCK domains used in Garrett (2014) along with the demographic questions pertaining to this study which include gender, academic rank, tenure status, years of experience, academic college, discipline of expertise, number of technology trainings and a description of technology training was inputted into the Qualtrics system to create this electronic survey (See Appendix).

In addition to the survey, an electronic informational consent form was presented at the forefront of the survey. Participants were given the option to accept or decline the invitation before accessing the survey. An acceptance served as the acknowledgment of consent and understanding that participation was confidential, anonymous, and completely voluntary. Participants who accepted were directed to the online survey and participants who declined were sent directly to a thank you for your consideration page and did not have access to the survey. In addition, this online survey contained parameters to allow only one survey to be taken per Internet Protocol (IP) address. This step attempted to ensure that only one survey opportunity was taken per participant.

These protocols were packaged into an IRB application and approval was granted in the fall of 2016. The survey was sent out to all faculty that were identified on the university website via a webmail containing an overview of the study and a link to the Qualtrics online survey. The instrument was available to the participants for a total of four weeks beginning in mid May of 2017 though mid June of 2017. A reminder email was sent to all remaining participants who had not completed a survey at the end of the first week. Additional reminder emails were sent to eligible participants at the end of each week until the allotted time expired. Once the data collection period of four weeks concluded, the data was entered into the analysis software SPSS for investigation and output of results.

Data Analysis

The data analysis from the modified 56-item HE-TPaCK and demographics were analyzed using descriptive statistics, MANOVA and ANOVA, to address both research questions in this study. In analyzing research question 1, the data was analyzed using descriptive statistics, which include the mean, mode, and standard deviation for each domain. In addition, an analysis of each item is included as a means to identify trends within the data. Using the responses collected by the five point Likert scale, the average score from each domain serves as the dependent variables for all analysis performed for this question (Garrett, 2014).

Research question 2 is addressed by investigating the relationship between academic college, academic rank, academic status, years of experience, and gender while controlling for the number of technology trainings. I used MANOVA to determine if there are any significant differences across groups on dependent variables. If statistical differences were found, theses variables were added to the final analysis model and an ANOVA was conducted to determine the extent to which predictor variables influence criterion variables. An outline of the data analysis plan is located in Table 2.

Table 2

HE-TPaCK Data Analysis Overview

Research Question	Measure(s)	Independent or Grouping Variables	Dependent Variables	Analysis Method
1	HE-TPaCK survey		Average of TPaCK per domain	Descriptive Statistics
2	HE-TPaCK Survey	Technology Training – Control Variable Years of Experience Academic Rank • Tenure Faculty • Tenure Track Faculty • Non-Tenure Faculty Academic Status • Professors • Associate Professors • Assistant Professors • Lecturers/Clinical/Adjuncts Academic College • The School of Medicine • College of Health Affairs • College of Sciences • College of Fine Arts • College of Liberal Arts • College of Engineering and Computer Science • College of Business and Entrepreneurship • College of Education and P- 16 Integration • University College • Honors College • Graduate College	Average of TPaCK per domain	Multiple Regression Analysis (MANOVA)
2		Based on results of MANOVA	Average of TPaCK per domain	ANOVA

Assumptions

Once again there are four notable assumptions in conducting research for this study. First it is assumed that faculty provided an accurate representation of their perceptions at a newly established university. Second, it is assumed that this study provides value to a broader audience outside newly established universities. The third assumption is that faculty provided unbiased and truthful responses regardless of their academic rank. A final assumption is that the majority of faculty members at this newly established university are inexperienced or uncomfortable with the use of technology in their courses.

Limitations

The following are possible limitations to this study.

1. This study had a sample size of only 248, which although acceptable, limits the study.
2. Using the subgroups tenure, tenure-track, and non-tenure track may skew the results, as some faculty may not candidly express their honest opinion in fear of possible repercussions to future promotions.
3. Due to the dependence on faculty's willingness and availability to participate in the survey, convenience sampling could pose a possible limitation to this study.
4. Another limitation of this study is the lack of causality or the explanations of the cause and effect relationships between variables and TPaCK scores.

Summary of Research Design and Methodology

This chapter describes the quantitative design that was implemented to collect and analyze data for this study. Using the HE-TPaCK survey developed by Garrett (2014), 1,527 faculty at a newly established university were given the opportunity to self-assess their technological, pedagogical, and content knowledge. The Qualtrics online system served as the means to distribute the consent form as well as the actual survey in the spring of 2017. Participants had four weeks to complete the survey. Data collection responses were transferred to the SPSS software, and descriptive statistics as well as multiple regression statistical analysis were conducted.

CHAPTER IV

RESULTS

This chapter reports the results of the survey data collected from faculty at a newly established university as a means to self-assess their technological, pedagogical, and content knowledge (TPaCK). In detail, this study compares and contrasts the technological, pedagogical, and content knowledge (TPaCK) of all faculty use of technology tools in face-to-face, blended learning and online environments as methods to enhance learning based on academic college, academic ranking, academic status, years of experience, and gender (Garrett, 2014). As mentioned previously, this research design consisted of an online survey managed by the Qualtrics system and was analyzed using the SPSS Version 22 software. The results were analyzed with the intent of answering the following research questions:

1. RQ1: What is the self-assessment of TPaCK by faculty as measured by the HE-TPaCK survey?
2. RQ2: Is there a difference in faculty self-assessment of technological, pedagogical, and content knowledge (TPaCK) based on academic college, academic ranking, academic status, years of experience, and gender as measured by the HE-TPaCK survey.

Participant Sample

The sample size for this study consisted of 248 faculty members from the 1,547 emails sent in total. However, out of the 1,547 emails sent 20 were identified as deactivated. From the

1,527 emails that were active, 316 started the survey and 264 surveys were finished. In prepping the data for analysis, 16 surveys did not answer five or more consecutive questions towards the end of the survey. These surveys were omitted from the overall data set using the conventional method of Listwise deletion (Soley-Bori, 2013). For those individuals who chose to skip questions, a marginal mean imputation was computed using the mean of the values in that item and was assigned to the missing value of X (Soley-Bori, 2013). Overall 316 participants started the survey and after prepping the data a 16% response rate was calculated.

The demographic information collected from participants included academic college, academic ranking, academic status, years of experience, hours of technology training and gender. The sample for this study was comprised of 51.6% male participants (n=128) and 48.4% female participants (n=120). Of these 248 participants, 16.9% (n=42) are Professors, 21% (n=52) are Associate professors, 26.2% (n=65) are Assistant Professors, and 35.9% (n=89) Instructors or Lecturers submitted responses to the survey. In addition, 31.9% (n=79) identified themselves as Tenured, 17.3% (n=43) as Tenure-track, and 50.8% (n=126) neither, which would include instructors or lecturers.

Regarding participant teaching experience, .4% (n=1) had zero years teaching experience; 19% (n=47) had 1 to 4 years of teaching experience; 19.4% (n=48) had 5 to 9 years teaching experience, 20.6% (n=51) had 10 to 14 years of teaching experience; 10.9% (n=27) had 15 to19 years of teaching experience; and 29.8% (n=74) had 20 or more years of teaching experience.

Another demographic marker that was collected through the data is academic college. The University of Transition has 11 colleges that compose the academic realm, 9 of which are represented in this study. The School of Medicine represented 9.3% (n=23); College of Health and Affairs represented 21% (n=52); College of Sciences represented 11.3% (n=28); College of

Fine Arts represented 8.1% (n=20); College of Liberal Arts represented 21.8% (n=54); College of Engineering and Computer Science represented 4% (n=10); College of Business and Entrepreneurship represented 9.3% (n=23); College of Education and P-16 Integration represented 14.1% (n=35); and the University College represented 1.2% (n=3). The two colleges not represented by this data include the Honors College and the Graduate College. The Honors College and Graduate College may not be represented in this data set as faculty are not exclusively assigned or affiliated with these colleges but one of the 8 main colleges. A better representation of this information is shown in Figure 2.

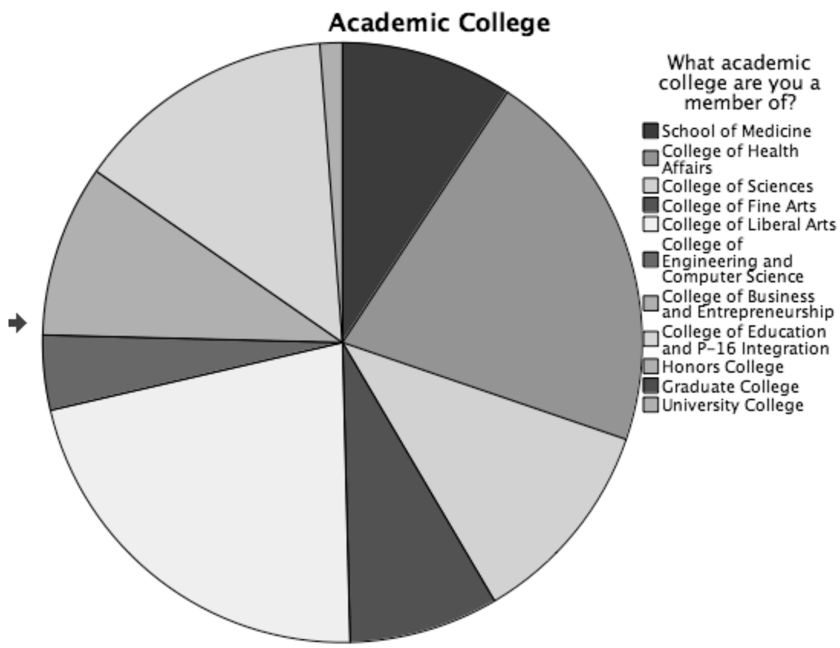

Figure 2. Faculty participants by academic college

The last demographic marker that was collected during this study was the number of technology trainings that participants attended in the last year. Technology trainings is not defined within the survey and was left up to the participants to interpret what is considered technology training. The analysis of this information identified 37.9% (n=94) participants attended zero technology trainings; 55.2% (n=137) participants attended 1 to 3 technology trainings; 5.2% (n=13) participants attended 4 to 6 technology trainings; .4% (n=1) participants attended 7 to 9 technology trainings; and 1.2% (n=3) participants attended 10 or more technology trainings. A comprehensive table of the descriptive statistics can be found in Table 3.

Table 3

Descriptive Statistics

Variable	Response	n	%
Gender	Male	128	51.6
	Female	120	48.4
Academic Ranking	Professor	42	16.9
	Associate Professor	52	21.0
	Assistant Professor	65	26.2
	Instructor/Lecturer	89	35.9
Academic Status	Tenured	79	31.9
	Tenured Track	49	17.3
	Neither	126	50.8
Years of Teaching Experience	0 Years	1	0.4
	1 to 4 Years	47	19.0
	5 to 9 Years	48	19.4
	10 to 14 Years	51	20.6
	15 to 19 Years	27	10.9
	20 + Years	74	29.8
Academic College	School of Medicine	23	9.3
	College of Health Affairs	52	21.0
	College of Sciences	28	11.3
	College of Fine Arts	20	8.1
	College of Liberal Arts	54	21.8
	College of Engineering and Computer Science	10	4.0
	College of Business and Entrepreneurship	23	9.3
	College of Education and P-16 Integration	35	14.1
	University College	3	1.2
Technology Trainings	0	94	37.9
	1 to 3	137	55.2
	4 to 6	13	5.2
	7 to 9	1	0.4
	10 +	3	1.2

The response rate for this study is 16%. The low response rate could be attributed to the timeline in which the survey was distributed which was in late spring. However, although there was only a 16% response rate to the original survey, the distribution between participants in gender, academic rank, as well as tenured and tenured track vs. non tenured are equally distributed within this sample. Based on the distribution, this group of participants represents a generalizable makeup of the university.

Research Question 1

As previously mentioned, the first research question follows Garrett (2014) in its entirety and reads, "What are faculty self-assessments of TPaCK as measured by the HE-TPaCK survey?" Using the HE-TPaCK survey, participants were asked to assess their self-perception of their capability to integrate technology, pedagogy, and content to enhance student learning in all classroom environments. However, it is important to reiterate that the results from the domain of Technology Training that was originally part of the HE-TPaCK survey will not be considered in this study due to a low score of reliability on the Cronbach Alpha test.

The survey assessed faculty self-perception on a five point Likert scale that ranges from strongly agree, agree, neither agree nor disagree, disagree, and strongly disagree. Each one of the ranges were categorized and assigned the same numerical value as used in Garrett (2014) to provide consistency with using the HE-TPaCK tool as a research instrument. The Likert scale values corresponded as follows: strongly agree = 1, agree = 2, neither agree nor disagree = 3, disagree = 4, and strongly disagree = 5. Survey questions 11, 19, 21, 36, 37, 39, 41, 43, 45, 50 and 55 are negatively coded and carry a numerical value as follows: strongly agree = 5, agree = 4, neither agree or disagree = 3, disagree = 2, and strongly agree = 1. It is important to note the numerical categorization of each of the Likert scales as a lower overall score or response indicates a higher self-assessment in each of the subscales for the TPaCK.

In analyzing research question 1, the descriptive statistics for each subscale was populated and can be seen in Table 4. These descriptive statistics include the Mode (Mo), Mean (M), and the standard deviation (SD) as each of these illustrates the relationship between the Likert categories (Garrett, 2014).

Table 4

Descriptive Statistics for TPaCK Domains

Domain Scales	Mo	M	SD
Pedagogy Knowledge (PK)	1.00	1.64	.60
Technology Knowledge (TK)	2.00	2.00	.58
Content Knowledge (CK)	1.00	1.39	.45
Pedagogy Content Knowledge (PCK)	1.00	1.59	.45
Technology Pedagogy Knowledge (TPK)	2.00	1.94	.59
Technology Content Knowledge (TCK)	2.00	1.96	.59
Technology Pedagogy Content Knowledge (TPaCK)	2.00	1.95	.63

Pedagogy Knowledge (PK) Domain

The HE-TPaCK survey items that pertained to faculty perceptions of pedagogy knowledge are 13, 14, 15, and 16. According to Table 4 the mean (M) of pedagogy knowledge is 1.64 and the mode (Mo) is 1.00. These results signify that the majority of the participants strongly agree that they have clear understanding of pedagogy, how to assess student learning and motivate students to learn. More specifically, 46.8% (n=116) strongly agreed and 46.0%

(n=114) agreed that they have a clear understanding of pedagogy. In addition, 48.0% (n=119) strongly agreed and 45.6% (n=113) agreed that they know how to assess student learning. It is important to note that faculty perceptions of this particular area are extremely high with more than 90% of faculty expressing that they strongly agree or agree with the statements in this subscale. The descriptive statistics for all survey items in the pedagogy knowledge subscale can be found in Table 5.

Table 5

Pedagogy Knowledge Frequency Percentages (n=248)

Survey Item	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
13. I have a clear understanding of pedagogy (e.g., designing instructions, assessing students' learning).	46.8	46.0	3.6	3.6	0.0
14. I am familiar with a wide range of practices, strategies, and methods that I can use in my teaching.	47.2	45.6	6.0	3.6	0.0
15. I know how to assess student learning.	48.0	45.6	4.4	1.6	0.4
16. I know how to motivate students to learn.	43.5	47.2	7.3	2.0	0.0

Technology Knowledge (TK) Domain

The HE-TPaCK survey items that pertained to faculty perceptions of technology knowledge are 17, 18, 19, 20, 21 and 22. According to Table 4 the mean (M) of technology knowledge is 2.00 and the mode (Mo) is 2.00. These results signify that the majority of the participants are self-confident in their ability to use technology to enhance student learning. Approximately, 29.8% (n=74) strongly agreed and 52.8% (n=131) agreed they are familiar with a variety of hardware, software, and technology tools used for teaching. Also, 23.0% (n=57) strongly agreed and 55.2% (n=137) agreed they could decide when technology may be detrimental to achieving a learning objective. It is important to note that faculty perceptions of this particular area are once again high, however, approximately 37.4% have issues when troubleshooting technology problems when they arise. The descriptive statistics for all survey items in the technology knowledge subscale can be found in Table 6.

Table 6

Technology Knowledge Frequency Percentages (n=248)

Survey Item	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
17. I am familiar with a variety of hardware, software, and technology tools that I can use for teaching.	29.8	52.8	8.1	9.3	0.0
18. I know how to troubleshoot technology problems when they arise.	19.8	42.7	16.9	17.7	2.8
19. I do not know how to use technology in my everyday life.	3.2	5.6	4.8	39.5	46.8
20. I recognize that technology use can have positive and negative effects.	40.3	57.3	2.0	0.4	0.0
21. I cannot decide when technology can be beneficial to achieving a learning objective.	23.0	52.8	13.3	8.9	2.0
22. I can decide when technology may be detrimental to achieving a learning objective.	23.0	55.2	15.3	4.4	2.0

Content Knowledge (CK) Domain

Survey items 23, 24, 25, 26, 27 and 28 assessed faculty perceptions of content knowledge. According to Table 4 the mean (M) of content knowledge is 1.39 and the mode (Mo) is 1.00. These results signify that the majority of the participants are extremely self-confident in their knowledge of their discipline and their ability to explain and make connections with the content. More specifically, 67.7% (n=168) strongly agreed and 29.8% (n=74) agreed they have a comprehensive understanding of the curriculum they teach. In addition, 54.8% (n=136) strongly agreed and 40.3% (n=100) agreed they stay abreast of new research related to their discipline in order to keep up with their own understanding of their discipline. It is important to note that all participants agreed they understand how knowledge in their discipline is organized. The descriptive statistics for all survey items in the content knowledge subscale can be found in Table 7.

Table 7

Content Knowledge Frequency Percentages (n=248)

Survey Item	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
23. I have a comprehensive understanding of the curriculum I teach.	67.7	29.8	2.0	0.4	0.0
24. I understand how knowledge in my discipline is organized.	64.1	33.9	2.0	0.0	0.0
25. I am familiar with the common preconceptions and misconceptions in my discipline.	56.4	38.7	4.0	0.8	0.0
26. I can explain to students the value of knowing concepts in my discipline.	68.1	31.0	0.4	0.4	0.0
27. I can make connections between the different topics in my discipline.	70.6	28.6	0.4	0.4	0.0
28. I stay abreast of new research related to my discipline in order to keep my own understanding of my discipline updated.	54.8	40.3	3.6	0.8	0.4

Pedagogy Content Knowledge (PCK) Domain

The pedagogy content knowledge domain consisted of survey items 29, 30, 31, 32, 33 and 34. According to Table 4 the mean (M) of pedagogy content knowledge is 1.59 and the mode (Mo) is 1.00. This indicates that the majority of the participants are highly confident in their ability to mix pedagogy and content to provide students with various methods to learn the content. For example, 57.3% (n=142) strongly agreed and 39.1% (n=97) agreed they understand that there is a relationship between content and the teaching methods used to teach that content. In addition, 52.8% (n=131) strongly agreed and 42.7% (n=106) agreed they could provide multiple representations of content in the form of analogies, examples, demonstrations, and classroom activities. The descriptive statistics for all survey items in the pedagogy content knowledge subscale can be found in Table 8.

Table 8

Pedagogy Content Knowledge Frequency Percentages (n=248)

Survey Item	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
29. I understand that there is a relationship between content and the teaching methods used to teach the content.	57.3	39.1	3.6	0.0	0.0
30. I can anticipate students' preconceptions and misconceptions.	33.9	53.2	10.9	1.6	0.4
31. I can address students' preconceptions and misconceptions.	41.1	54.4	4.0	0.0	0.4
32. I understand what topics or concepts are easy or difficult to learn.	49.2	48.0	2.4	0.4	0.0
33. I can provide multiple representations of content in the form of analogies, examples, demonstrations, and classroom activities.	52.8	47.7	4.0	0.4	0.0
34. I can adapt material to students' abilities, prior knowledge, preconceptions, and misconceptions.	50.0	45.6	4.0	0.4	0.0

Technology Pedagogy Knowledge (TPK) Domain

The HE-TPaCK survey items that pertained to faculty perceptions of technology pedagogy knowledge are 35, 36, 37, 38, 39 and 40. According to Table 4 the mean (M) of technology pedagogy knowledge is 1.94 and the mode (Mo) is 2.00. This indicates that a large percentage of the participants are confident in their ability to integrate technology into their pedagogy methods. More specifically, 33.5% (n=83) strongly agreed and 50.8% (n=126) agreed they understand how teaching and learning change when certain technologies are used. Also, 31.4% (n=78) strongly agreed and 54.0% (n=134) agreed they know how to be flexible with the use of technology to support teaching and learning. It is important to note here that 50% of the questions in this subscale are negatively coded. The descriptive statistics for all survey items in technology pedagogy knowledge subscale can be found in Table 9.

Table 9

Technology Pedagogy Knowledge Frequency Percentages (n=248)

Survey Item	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
35. I understand how teaching and learning change when certain technologies are used.	33.5	50.8	12.5	3.2	0.0
36. I do not understand how technology can be integrated into teaching and learning to help students achieve specific pedagogical goals and objectives.	2.0	7.3	10.9	50.0	29.8
37. I do not know how to adapt technologies to support teaching and learning.	2.0	8.1	13.3	48.0	28.6
38. I know how to be flexible with my use of technology to support teaching and learning.	31.4	54.0	11.3	2.8	0.4
39. I cannot refigure technology and apply it to meet instructional needs.	2.8	10.5	23.4	40.3	23.0
40. I understand that in certain situations technology can be used to improve student learning.	46.4	50.0	2.4	0.8	0.4

Technology Content Knowledge (TCK) Domain

Survey items 41, 42, 43, 44, 45 and 46 assessed faculty perceptions of technology content knowledge. According to Table 4 the mean (M) of technology content knowledge is 1.96 and the mode (Mo) is 2.00. These results signify that the majority of the participants agree with the statements in the survey, which discuss the integration of technology with the content. In addition, 25.4% (n=63) strongly agreed and 55.2% (n=137) agreed they understand how the choice of technologies allows and limits the types of content ideas that can be taught. In addition, 33.5% (n=83) strongly agreed and 54.4% (n=135) agreed they are aware of how different technologies can be used to provide multiple and varied representation of the same content. In this subscale it is important to note that half of the survey questions are negatively coded. The descriptive statistics for all survey items in the technology content knowledge subscale can be found in Table 10.

Table 10

Technology Content Knowledge Frequency Percentages (n=248)

Survey Item	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
41. I cannot select and integrate technology tools appropriate for use in specific disciplines (or content)	2.4	6.0	13.7	51.6	26.2
42. I understand how the choice of technologies allows and limits the types of content ideas that can be taught.	25.4	55.2	14.9	3.6	0.8
43. I do not understand how some content decisions can limit the types of technology that can be integrated into teaching and learning.	0.8	8.1	19.8	50.0	21.4
44. I am aware of how different technologies can be used to provide multiple and varied representation of the same content.	33.5	54.4	8.5	3.6	0.0
45. I cannot select specific technologies that are best suited for addressing learning objectives in my discipline.	1.6	6.9	16.1	49.2	25.6
46. I understand that I need to be flexible when using technology for instructional purposes.	46.4	47.6	4.4	1.6	0.0

Technology Pedagogy Content Knowledge (TPaCK) Domain

The HE-TPaCK survey items that pertained to faculty perceptions of technology pedagogy content knowledge are items 47 through 57. According to Table 4 the mean (M) of technology pedagogy content knowledge is 1.95 and the mode (Mo) is 2.00. These results indicate that the majority of the participants agreed they have the ability to integrate technology into the content and pedagogical practices. More specifically, 27.8% (n=69) strongly agreed and 52.4% (n=130) agreed they know how to integrate the use of educational technologies effectively into curriculum-based learning. In addition, 32.7% (n=81) strongly agreed and 55.6% (n=138) agreed they know how to operate classroom technologies and can incorporate them into their particular discipline to enhance student learning. The descriptive statistics for all survey items in the technology, pedagogy and content knowledge subscale can be found in Table 11.

Table 11

Technology Pedagogy Content Knowledge Frequency Percentages (n=248)

Survey Item	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
47. I can effectively integrate educational technologies to increase student opportunities for interaction with ideas.	30.6	50.0	15.7	3.6	0.0
48. I have different opportunities to teach specific curriculum content topics with technology.	31.4	50.8	10.9	5.2	1.6
49. I can use appropriate instructional strategies to teach specific curriculum content topics with technology.	30.0	55.6	13.3	1.6	0.4
50. I cannot determine when a technology resource may fit with one learning situation in my discipline, and not with another.	1.2	6.9	17.1	53.3	21.5
51. I can flexibly incorporate new tools and resources into content and my teaching methods to enhance learning.	29.0	52.8	14.5	3.6	0.0
52. I understand how digital technologies can be used to represent content in a variety of formats.	29.8	56.5	9.7	4.0	0.0
53. I can use teaching methods that are technology-based to teach content and provide opportunities for learners to interact with ideas.	32.7	52.4	11.3	3.6	0.0
54. I understand what makes certain concepts difficult to learn for students and how technology can be used to leverage that knowledge to improve student learning.	23.0	53.2	17.7	5.2	0.8
55. I do not understand how to integrate technology to build upon students' prior knowledge of curriculum content.	0.8	6.1	16.3	53.3	23.6
56. I know how to operate classroom technologies and can incorporate them into my particular discipline to enhance student learning.	32.7	55.6	7.7	3.6	0.4
57. I know how to integrate the use of educational technologies effectively into curriculum- based learning.	27.8	52.4	14.9	4.4	0.4

Research Question 2

The second research question deviates from Garrett (2014) original question and reads "Is there a difference in faculty self-assessment of technological, pedagogical, and content knowledge (TPaCK) based on academic college, academic ranking, academic status, years of experience, and gender as measured by the HE-TPaCK survey? As mentioned in Chapter III, the purpose of this research question is to provide more insight into academic status as suggested by Garrett (2014) and to explore additional independent variables that provides valuable information to the discourse of TPaCK and the university.

Multiple analysis of variance, more specifically a MANOVA, was conducted for each independent variable, which included academic college, academic ranking, academic status, years of experience, and gender. The purpose of conducting the MANOVA was to determine to what extent the above-mentioned independent variable differed across the dependent variables, which are the seven TPaCK domain averages. The number of technology trainings is used as the control variable which is recommended to use when a variable is believed to be related to the dependent variable (Hoy, 2010). The purpose for setting this variable as a control variable is to eliminate any influence from the number of technology trainings attended by the participants regardless of quality, thus setting the tone for a level playing field. The analysis for each independent variable is described below. Independent variables identified as significant at the $p < .05$ level as a result of the MANOVA were further analyzed using the statistical analysis method of follow up ANOVAs (Analysis of Variances). Using the Bonferroni adjustment method, each ANOVA was tested at the $p <. 007$ level. In addition to statistical significance, practical significance was also examined. As reported by Cohen (1988), a N^2 effect size of .02 is interpreted as small, .13 as medium, and .26 as large. The results for academic college, academic ranking, academic status, years of experience, and gender are noted below.

Academic College

Using MANOVA, I examined the differences between academic college and the seven dependent variables of the TPaCK domain. According to the data, there was a significant difference between academic college and the seven subscales of the HE- TPaCK survey, the Wilk's λ =. 69, F(49, 1652)= 1.83, p = .000 and the Effect Size is .05 which is considered small. Since the independent variable of academic college showed a significant difference between subscales, a follow up ANOVA was conducted to determine which subscales differed. Using the Bonferroni method, the ANOVA was tested at the p < .007 level. The ANOVA on the pedagogy knowledge mean score was significant, F(8, 248) = 6.39, p = .000, n^2 = .17 and technology pedagogy knowledge mean score were also significant F(8, 248) = 2.98, p = .003, n^2 = .09. The ANOVAs on the other posttest measures were not significant: technology knowledge mean F(8, 248) = 1.92, p = .057, n^2 = .06; content knowledge mean F(8, 248) = 1.26, p = .260, n^2 = .04; pedagogy content knowledge F(8, 248) = 2.64, p = .009, n^2 = .08; technology content knowledge F(8, 248) = 1.68, p = .103, n^2 = .05; technology pedagogy and content knowledge mean F(8, 248) = 2.39, p = .017, n^2 = .07. In addition to the MANOVA output, Table 12 shows the means of each domain by academic college.

Table 12

Academic College Means by Domain

College	*PK	TK	CK	PCK	*TPK	TCK	TPaCK
School of Medicine	2.26	2.32	1.55	1.85	2.12	2.25	2.30
College of Health Affairs	1.72	2.06	1.48	1.60	1.95	1.95	1.96
College of Sciences	1.34	1.88	1.23	1.40	2.04	1.93	1.81
College of Fine Arts	1.41	1.95	1.33	1.55	1.98	1.93	2.03
College of Liberal Arts	1.70	1.98	1.43	1.66	1.98	1.90	1.95
College of Engineering and Computer Science	1.55	1.63	1.35	1.52	1.63	1.72	1.56
College of Business and Entrepreneurship	1.71	2.07	1.39	1.60	2.02	2.05	2.02
College of Education and P-16 Integration	1.43	1.90	1.28	1.46	1.73	1.88	1.87

* <.007

Academic Ranking

The MANOVA revealed no significant differences between academic rank and the seven subscales of the HE-TPaCK survey. The data showed, Wilk's λ =. 88, $F(21, 681) = 1.50$, p = .070 and the Effect Size of .042 which is considered small. Lack of significance from the MANOVA indicated no further analysis needed. In addition to the MANOVA output, Table 13 shows the means of each domain by academic ranking.

Table 13

Academic Ranking Mean by Domain

Academic Rank	PK	TK	CK	PCK	TPK	TCK	TPaCK
Professor	1.54	1.94	1.30	1.62	1.96	1.96	2.01
Associate Professors	1.54	1.86	1.30	1.48	1.89	1.88	1.84
Assistant Professors	1.79	2.15	1.48	1.65	1.99	1.96	2.03
Instructor/Lecturer	1.66	2.00	1.45	1.59	1.95	2.00	1.95

Academic Status

Using MANOVA, I examined the differences between academic status and the seven dependent variables of the TPaCK domain. According to the data, there was a significant difference between academic status and the seven subscales of the HE- TPaCK survey, the Wilk's λ =. 89, $F(14, 476) = 1.87$, $p = .027$ and the Effect Size is .05 which is considered small. Since the independent variable of academic status showed a significant difference between subscales, a follow up ANOVA was conducted to determine which subscales differed. Using the Bonferroni method, the ANOVA was tested at the $p < .007$ level. ANOVA on the pedagogy knowledge mean score was significant, $F(3, 248) = 5.24$, $p = .002$, $n^2 = .06$ and technology pedagogy knowledge mean score were also significant $F(3, 248) = 5.42$, $p = .001$, $n^2 = .06$. The ANOVAs on the other posttest measures were not significant: technology knowledge mean $F(3, 248) = 2.26$, $p = .081$, $n^2 = .02$; content knowledge mean $F(3, 248) = 3.58$, $p = .014$, $n^2 = .04$; pedagogy content knowledge $F(3, 248) = 2.92$, $p = .034$, $n^2 = .03$; technology content knowledge $F(3, 248) = 4.02$, $p = .008$, $n^2 = .04$; technology pedagogy and content knowledge mean $F(3, 248) = 3.05$, $p = .029$, $n^2 = .03$. In addition to the MANOVA output, Table 14 shows the means of each domain by academic status.

Table 14

Academic Status Means by Domain

Status	*PK	TK	CK	PCK	*TPK	TCK	TPaCK
Tenured	1.47	1.89	1.26	1.51	1.90	1.87	1.88
Tenure-Track	1.73	1.99	1.46	1.68	1.94	1.87	1.96
Neither	1.73	1.65	1.46	1.61	1.98	2.05	2.01

*< .007

Year of Experience

The MANOVA revealed no significant difference found between years of experience and the seven subscales of the HE-TPaCK survey. The data showed, Wilk's λ =. 88, $F(28, 852)$ = 1.03, p = .413 and the Effect Size of .03 which is considered small. As a result of the MANOVA analysis not reporting a significant result no other analysis tests were conducted. In addition to the MANOVA output, Table 15 shows the means of each domain by years of experience.

Table 15

Year of Experience Means by Domain

Years	PK	TK	CK	PCK	TPK	TCK	TPaCK
1-4	1.87	2.05	1.57	1.75	1.97	2.05	2.01
5-9	1.76	2.15	1.44	1.66	2.10	2.09	2.12
10-14	1.54	1.90	1.31	1.46	1.84	1.86	1.85
15-19	1.54	1.91	1.42	1.54	1.91	1.89	1.92
20 +	1.55	1.78	1.31	1.55	1.92	1.92	1.88

Gender

The MANOVA revealed no significant difference found between gender and the seven subscales of the HE-TPaCK survey. The data showed, Wilk's λ =. 96, $F(7, 239) = 1.10$, $p = .363$ and the Effect Size of .03 which is considered small. Lack of significance from the MANOVA indicated no further analysis needed. In addition to the MANOVA output on gender, Table 16 shows the means of each domain by gender.

Table 16

Gender Means by Domain

Gender	PK	TK	CK	PCK	TPK	TCK	TPaCK
Male	1.67	1.96	1.37	1.60	1.95	1.94	1.93
Female	1.62	2.04	1.43	1.57	1.94	1.98	1.99

Summary

In summary, this Chapter presented the results of the HE-TPaCK survey in a newly established university in Texas. Two hundred and forty-eight participants completed the self-assessment survey and the descriptive statistics showed that the majority of these participants agreed that they have the knowledge base to integrate technology, pedagogy, and content into their classes. In addition, after controlling for quality of previous technology trainings attended and eliminating the results from the technology training domain of the survey based on low reliability, two significant results were found in both academic college and academic status. These finding were further analyzed to show that there was a significant difference in both pedagogy knowledge and technology pedagogy knowledge.

CHAPTER V

DISCUSSION OF RESULTS

In this chapter, I further explore the results of this study and provide points of discussion for each of the TPaCK domains along with recommendations and implications for future research. The chapter is organized by first looking at research question 1 and all seven domains of the TPaCK framework ranked from highest to the lowest based on faculty responses. The second research question and each variable is then discussed in the following order; academic college, years of experience, academic rank, gender and finally academic status.

Study Overview

The purpose of conducting this study was to provide insight into the technology, pedagogy and content knowledge of faculty at a newly established university through a self-assessment known as the HE-TPaCK created by Garrett (2014). Although this study was inspired from the work of Garrett's (2014), slight variations included changing the control variable, excluding the technology-training domain, and taking a different approach to the demographic variables, allowing for a different perspective.

This study uses Mishra and Koehler (2006) theoretical framework known as the TPaCK or the Technological Pedagogical and Content Knowledge model, which was originally used to assess K-12 teachers' knowledge in these areas. For this study, I utilized a modified survey created by Garrett (2014), known as the HE-TPaCK survey, to capture the self assessment of higher education faculty on their technological pedagogical and content knowledge. Garrett (2014) constructed this survey from Lux et al. (2011) survey on TPaCK and technology training items from Georgina and Olsen (2008). Although the reported Cronbach Alpha was 0.56 for technology training in Garrett's (2014) instrument, this domain remained in the survey. In this study, a Cronbach Alpha was also conducted and reported a score of 0.67. Heeding to the recommendations of Nunnally's (1978), in which he describes an acceptable reliability coefficient to be .70 or higher, this domain of the survey was excluded from the data and not analyzed. In addition to this variation, the demographic survey question regarding the number of technology trainings attended was used as the control variable for this study. Using this question as a control variable regulated the type of training as well as the quality of training received by participants.

Using TPaCK as the theoretical framework for this study sanctioned a more complex synthesis of the results. As previously mentioned, often times the core content components of technology, pedagogy, and content are seen as separate (Sahin, 2011). However, TPaCK is composed of seven knowledge bases, three of which are the core knowledge bases, and four are produced from interactions among the core knowledge bases (Pamuk et al., 2013). The results of this study are analyzed using all seven knowledge basis and encompass a rationale, recommendations, and implications for future research in the sections to follow.

Research Question 1

The first research question for this study is "What are faculty self-assessment of TPaCK as measured by the HE-TPaCK survey? In analyzing the descriptive statistics for this question, I found that overall, the faculty at this newly established university are confident in all seven domains of the HE-TPaCK survey, based on their self-assessment. The means for the domains ranged from 1.39 – 2.00 with 1 being strongly agree and 2 representing agree on the Lickert scale survey. These high scores attest to the participating faculty's perception of their TPaCK skills. Considering the confidence level with participating faculty, it is possible that predominantly tech savvy faculty or faculty that are interested in technology self-selected to complete the survey, which would align to the high rate of confidence. Table 17 represents the percent of faculty from each college who responded to the survey.

Table 17

Percent of Faculty Who Responded by College

College	Percentage
College of Health Affairs	22%
College of Sciences	12%
College of Fine Arts	15%
College of Liberal Arts	15%
College of Engineering and Computer Science	10%
College of Business and Entrepreneurship	15%
College of Education and P-16 Integration	26%

* Note: The School of Medicine is not included in this table.

Although these results inform the institution of the participating faculty perceptions on their TPaCK skills, it is not considered generalizable since random assignment was not used as the sampling method. Therefore, faculty who responded to this online survey may be different than those who did not respond. This implies a need for all faculty to self-assess their TPaCK skills on a larger scale in order to gather a more comprehensive profile of faculty TPaCK skills at this university. Each of the seven domains are further analyzed by the rank of confidence level below.

Content Knowledge Domain (CK)

Participants in this study strongly agree that they are knowledgeable in their discipline and confident in their ability to explain and make connections to the content. Out of the seven domains, faculty participants at this newly established institution scored highest in the content knowledge domain. Table 18 shows the rank for all seven domains in order from highest confidence to the lowest.

Table 18

Rank of TPaCK Domains

Domain Scales
Content Knowledge (CK)
Pedagogy Content Knowledge (PCK)
Pedagogy Knowledge (PK)
Technology Pedagogy Knowledge (TPK)
Technology Pedagogy Content Knowledge (TPaCK)
Technology Content Knowledge (TCK)
Technology Knowledge (TK)

This outcome is consistent with other research in which content knowledge resulted in the highest mean value when self-assessed by higher education faculty (Garrett, 2014; Larsen, 2014). This result is not surprising as educators in the higher education setting are usually specialized in certain areas and are considered experts in the field. Furthermore, higher education faculty generally conducts research in their field and therefore is consistently keeping up to date with any developments in content.

Pedagogy Content Knowledge (PCK)

The results from the pedagogy content knowledge domain denote that the majority of the participants are highly confident in their ability to mix pedagogy and content to provide students with various methods to learn the discipline. This domain was the second highest out of the seven domains. The confidence shown in this result is consistent with the perceptions that higher education educators are content specialists and are knowledgeable in delivering their content through instruction. With most faculty holding a terminal degree in their field, the confidence portrayed in this domain is not unexpected. In addition, accredited institutions require faculty to be qualified to teach courses in their field of expertise as determined by their degree.

In further examining this result, the descriptive statistics showed the ability to anticipate student's preconceptions and misconceptions as the lowest rating question in in this domain. This could be attributed to several factors such as experience of the faculty member, relationships of faculty members and their student, as well as alignment of courses. To increase confidence in this area, faculty members should make a point to get to know their students along with their students' prior knowledge, abilities, and their preparation to anticipate common misconceptions and then adjust their teaching strategies to increase student learning (National Research Council, 1997). An implication for faculty professional development to increase confidence in this domain is warranted based on the descriptive statistics for pedagogy content knowledge.

Pedagogy Knowledge Domain (PK)

From the seven domains, pedagogy knowledge ranked third with content knowledge and pedagogical content knowledge coming in first and second. Faculty perceived the integration of the content into pedagogical practices to provide various methods of the learning (PCK) content higher than the core domain of pedagogical knowledge (PK). An explanation may be that faculty have been exposed to training or experiences that have been content specific and therefore have a higher confidence level of integrating the content into the pedagogical practices instead of general pedagogical practices associated with "good teaching" (Harr, Eichler, & Renkl, 2014).

The pedagogy knowledge domain indicates over 90% of the participants agree they have a clear understanding of pedagogy, how to assess student learning and motivate students to learn. These findings are consistent with other research, which convey the confidence of faculty efficiently implementing pedagogy into the classroom (Archambault & Crippen, 2009; Garrett 2014, Dong, Chai, Koh, and Tsai 2015; Kushner Benson &Ward, 2013). Pedagogical practices and the understanding of how to incorporate effective pedagogical practices in both face-to-face and online courses is a component of teaching that ensures quality instruction at the higher education level (Coates, 2005). The high self-perception of the knowledge of pedagogical practices suggests faculty at this university believe they are adequately prepared in the area of pedagogy. Prior training on pedagogy or experience through doctoral programs may contribute to the high confidence of the participating faculty. In addition, the faculty at this newly established university predominantly come from teaching institutions, which could also explain the high confidence in pedagogy. Before the University of Transition was established, two completely separate teaching focused institutions existed, and most of the faculty from those institutions were hired into the new University of Transition.

Technology Pedagogy Knowledge (TPK)

The descriptive statistics results in the domain of technology pedagogy knowledge provide insight into how participant faculty rate their ability to integrate technology into their instructional practices. Their confidence in this domain indicates that faculty is aware of different technology applications that support pedagogy and implement these sufficiently in the classroom setting.

However, one finding that is important to note is that 36.7% of the participants reported that they do not have the knowledge base to reconfigure technology and apply it to meet instructional needs. This suggests that although faculty may be attempting to transfer new technology knowledge through professional development or personal research, there are some who struggle with manipulating that resource to match the desired instructional outcomes in their content area. According to Hughes (2005), faculty interpretation of technology's value for supporting instruction impacts one's ability to develop technology supported pedagogy. How an instructor values technology impacts his or her persistence in reconfiguring knowledge that impacts instruction. In addition to value, instructor's belief that a certain piece of technology can enhance their teaching also impacts transfer into the classroom. For example, everyone has a smartphone and knows how to use it, but not everyone knows how to effectively teach with a smartphone. Based on these results there are implications for faculty professional development and the need to create a support system to assist with the reconfiguration of technology to ensure transfer of knowledge into classroom practices.

Technology Pedagogy and Content Knowledge (TPaCK)

The results of technology pedagogy and content knowledge reflect the ability of faculty to integrate technology into their content and pedagogical practices. Overall the perspective of the participants indicate that they possess the technological pedagogical and content knowledge as well as skills and characteristics, which comprise good teaching (Garrett, 2014; Lux et al., 2011). This integration and relationship with all three main components is the heart of Mishra and Koehler (2006) framework of the TPaCK. Overall, the perspective of the participants indicates that they have the technological pedagogical and content knowledge, which comprise good teaching characteristics (Garrett, 2014; Lux et al., 2011).

To achieve a true TPCK knowledge base, an educator must be able to explain the connection between the technology being used and the pedagogical practice related to the content (Kushner Benson & Ward, 2013). This knowledge base is a gradual process that one develops over time. In considering that TPaCK was rated higher than TCK and TK, it is possible that faculty participating in this study isolated each one of the domains into separate constructs. This displays that each domain is separate, instead of considering the complex interactions of the all the domains to create one's TPaCK. This result implies the need for further professional development on the TPaCK framework as well as clarification of the different domains that comprise the model before working on developing TPaCK skills within faculty. However, to expand TPaCK knowledge of faculty it will require flexibility, willingness to try new instructional technology tools, a growth mindset, and the ability to monitor and adjust instructional practices (Dweck, 2016; Niess, 2011; Messina & Tabone, 2011).

Technology Content Knowledge (TCK)

Technology Content Knowledge is the domain that represents a faculty members understanding of the relationship of technology and content and how when integrated together can improve student learning. As previously mentioned, integration of technology is more effective if faculty believe technology is valuable before they implement into their content or classroom (Ottenbreit-Leftwich, Glazewski, Newby, & Ertmer, 2010). Consistent with previous research, participants agreed that they understand the need to incorporate technology into the content and have the knowledge base to do so effectively (Cox & Graham, 2009; Garrett, 2014; Larsen, 2014). In further investigating the descriptive statistics results of this domain, 22.1% of the participants do not know or are unsure how to select specific technologies that are best suited for addressing learning objectives in their discipline. With the plethora of potential technology applications available to educators, developing a process to determine which technology best fits the content is imperative. An additional challenge behind selecting specific technologies and linking them to the content or learning objective lies in the planning, especially when differentiating for individual students (Muhammad, 2016).

Intuitively through the continued use of technology tools, some faculty will adopt new practices, which will increase the use of technology in the higher education classroom (Lux et al., 2011). However, this haphazard approach may not move the needle in the area of technology integration at the desired pace as inferred by the University of Transition's goals. This may indicate the need to incorporate a systematic approach to professional development in addition to a plan of action that addresses the needs of faculty to effectively integrate technology into the classroom. This plan may include a comprehensive protocol for selecting technology, professional development on how to utilize the technology and reconfigure to match their content, as well as an instructional support system to assist with planning and transfer into the classroom.

Technology Knowledge Domain (TK)

The technology knowledge domain, which refers to the knowledge about various technologies from pen and paper to digital technologies such as software, Internet etc. was self-assessed by the participants to be confident. As we continue to move forward into the digital age, understanding and using technology is no longer a choice, but a necessity. This movement of increased technology is not only seen in our everyday lives, but it is also evident in the field of education and is an essential component of teacher education (Blocher, Armfield, & Sujo-Montes, 2011; Larsen, 2014). Although we can physically feel the push to implement technology, the skills needed to troubleshoot issues when they arise with technology are still lacking (Archambault & Crippen, 2009).

Similar to Garrett (2014), out of the seven domains, technology knowledge was scored the lowest by participants. One explanation for the low score is the lack of familiarity with the classroom and technology set up at the different locations. Faculty have been charged with teaching in both locations as well as satellite locations. The classroom set up is inconsistent across these locations and therefore could attribute to the lack of self-confidence in software, troubleshooting, and overall implementation of technology in the classroom. As the transformation continues it will be imperative that a communication plan is created outlining the different technologies faculty will be utilizing along with a comprehensive plan of support, which includes professional development. Furthermore, although faculty use technology and technology is ubiquitous, knowledge regarding how it works or how to fix it is a specialized skill. Most of the technology that is integrated into the field of education and in our everyday lives, is intentionally designed to be user-friendly and intuitive. Users do not need to understand the technical components of what makes the technology function. An implication for this domain is to seek more intuitive technology at the higher education level as well as utilize a comprehensive plan of support to assist faculty with troubleshooting technology issues.

Research Question 2

The second research question dives deeper into the differences within the seven domain and reads "Is there a difference in faculty self-assessment of technological, pedagogical, and content knowledge (TPaCK) based on academic college, academic ranking, academic status, years of experience, and gender as measured by the HE-TPaCK survey? The organization for this section includes a discussion of each variable in the order of academic college, years of experience, academic rank, gender and finally academic status.

Academic College

The results for academic college indicated a significant difference ($p < .007$) in both pedagogy knowledge (PK) and technology pedagogy knowledge (TPK) between the academic colleges when controlling for the number of technology trainings. In further examining the difference in PK within academic colleges, the College of Science had the highest mean. Table 19 visually represents the rank of the colleges for the PK domain.

Table 19

Rank of Academic Colleges for PK Domain

Academic Colleges
College of Sciences
College of Fine Arts
College of Education and P-16 Integration
College of Engineering and Computer Science
College of Liberal Arts
College of Business and Entrepreneurship
College of Health Affairs
School of Medicine

The significant difference in pedagogical knowledge (p = . 000) among academic colleges could be attributed to many different factors such as prior training in pedagogy, exposure to pedagogical practice in faculty's own educational experience, as well as content. For example, the College of Science may have scored higher in Pedagogical Knowledge, as it lends itself to more hands-on and experiential learning in science courses through the use of labs. In addition, a valid reason for the College of Education and P-16 Integration high PK score is the formal training that faculty may have received in the area of pedagogy knowledge, as well as pedagogy being a concept within their disciplines. The lowest PK was the School of Medicine, which is a new edition to the university. Faculty in this college may not have received as much training in pedagogical practices as they have with the content they will be teaching. It is also possible that faculty in the School of Medicine could be identified as full professors with very little teaching experience.

The second significant result (p = .003) showed that there is a difference in TPK among academic colleges. Table 20 provides a visual representation of the ranking of academic colleges in the area of TPK.

Table 20

Rank of Academic Colleges for TPK Domain

Academic Colleges
College of Engineering and Computer Science
College of Education and P-16 Integration
College of Health Affairs
College of Fine Arts
College of Liberal Arts
College of Business and Entrepreneurship
College of Sciences
School of Medicine

In the TPK domain the College of Engineering and Computer Science had the highest mean. This result may not be surprising as the College of Computer Science and Engineering logically integrates technology into the curriculum and pedagogy for that discipline. In addition, the College of Education and P-16 Integration as well as the College of Health Affairs are disciplines that necessitate technology in pedagogical practices and subsequently integrate technology.

It is important to note that both significant results in the domains of PK and TPK incorporate pedagogy. These results prompt the question "What type of pedagogical training is needed before an individual becomes an educator in higher education?" Robinson and Hope (2013) posit that there is a need to train graduate students on pedagogy in addition to providing them with a solid research foundation. Training graduate students in pedagogy would prepare them to implement effective instructional strategies at any level regardless of the discipline, which could close the gap between academic colleges. As an additional benefit, even if the graduate students is not interested in instructing, the skills obtained through pedagogical training has the potential to assist these individuals with training, presenting at conferences and working with others in their respective fields.

Academic Rank

The MANOVA for academic rank showed no significant difference ($p > .05$) among professors, associate professors, assistant professors and lecturers/adjuncts based on the MANOVA test when controlling for technology training. This result suggests that no matter what level or rank a teacher holds, their self-perceptions of fluency of knowing is the same. This variable further warrants investigation, as this high confidence level among a range of experience is interesting.

Although academic rank did not confirm a statistically significant result, the descriptive statistics provide insight into the self-assessment of each of these groups. Professors showed a higher self-assessment in the area of pedagogy knowledge (m=1.54), while associate professors scored higher in the self-assessment of technology knowledge, content knowledge, pedagogy content knowledge, technology pedagogy content knowledge, technology content knowledge, and technology, pedagogy, and content knowledge. Both of these groups have tenured status. However, associate professors' perceptions in almost all the domains except for pedagogy knowledge, is higher than professors. This may be explained by the difference in expectations during the entrance of tenure status or by demands based on their discipline of expertise. On another note, both assistant professors and lecturers scored lower in all the previously mentioned domains. To some degree, this result is expected since faculty that are ranked as assistant professor or lecturer/adjunct are often newer to the field and may have less years of experience. However, for this study this is an illogical conclusion as 80% of the participants indicated they have five or more years of teaching experience. Since the primary role of non-tenure track faculty is pedagogical, and compared to tenured and tenure-track faculty, the fact that their teaching loads are typically higher, is concerning. This result implies a need to develop professional learning opportunities for all faculty regardless of academic rank.

Gender

The results for the variable of gender showed no significant difference ($p > .05$) among male and female participants based on the MANOVA test when controlling for technology training. These results are similar to Garrett (2014) in which no statistical difference for gender was found when compared to each domain of the TPaCK framework. Historically, when analyzing the digital divide, gender has been found to be an important factor when looking at technology as a whole (Bain & Rice, 2006). The field of technology has previously been seen as a male dominated field. In more recent years, however, gender no longer seems to play such a significant role in regards to access, use, and implementation of technology in the area of higher education (YiLi, Wang, & Campbell, 2015). The change in the gender disparity may be related to the number of females who are engaged in post-secondary education as well as the efforts of primary and secondary schooling to entice females into STEM related fields.

Although there was no significant difference ($p > .05$) among males and females based on the MANOVA test, the descriptive statistics provide insight into the self-assessment of each of these groups at this particular university. For instance, males out-scored the females on the self-assessment in the areas of technology knowledge, content knowledge, technology content knowledge, and technology pedagogy content knowledge while the female group rated themselves higher in the areas of pedagogy knowledge, pedagogy content knowledge, and technology pedagogy knowledge. These results allude to the confidence of males in the participant group in regards to the domains dealing with technology and content while the confidence in pedagogy is highlighted with the female participants.

Academic Status

Similar to the results of the academic college variable, the results for academic status indicated a significant difference ($p < .007$) in both pedagogy knowledge (PK) and technology pedagogy knowledge (TPK) when controlling for the number of technology trainings. Tenured participants had the highest self-assessment mean for pedagogy knowledge and for technology pedagogy knowledge. This result is not surprising as 80% of the participants reported having five or more years of teaching experience, which alludes to the lack of novices in this study. It is also important to note that tenured faculty must be evaluated on their teaching, research and service. Because of these additional expectations and the time that is required to become a tenured professor, these individuals are confident in their pedagogical and technological pedagogical knowledge and skills. This may imply that once again a consideration of a system wide professional development plan is needed to ensure that all faculty, especially tenure-track and non tenure track instructors, have the opportunity to engage in learning about pedagogical practice and technological pedagogical practices.

Years of Experience

The results for years of experience showed no significant difference ($p > .05$) among participants based on the MANOVA test when controlling for technology training. In analyzing the implications of the non-significant result, one possible explanation could be the closing of the digital divide between faculty in higher education. Younger faculty who have grown up with and educated in the digital age are now entering the field of higher education. These digital natives come with a technology background as well as the skills and confidence to implement technology into their practice (Akcayir, Dundar, & Akcayir, 2016). In addition, some seasoned faculty members who are digital immigrants have adapted to the use of technology either by force, expectation, or interest within their respective fields. Digital immigrants who are rapidly seeking ways to assimilate to technology driven education such as self-exploration and professional development, are also becoming well versed in implementing technology into their practice (Prensky, 2001; Larsen, 2014). The closing of the gap in the digital divide goes beyond the field of education as more and more basic life functions and needs become digitized. From online banking, to ordering your groceries online, and even online management systems, technology has become the norm and by default people are being forced to use it. Therefore, this close in the digital divide among faculty could be a factor of why years of experience did not play an important role in the participant's self-assessment of their TPaCK.

Overall, the results for each of these variables and domains provide insight into the continued discussion of TPaCK as a theoretical framework, implications for the University of Transition, and insight to policy makers in regards to incentives and institutional support that would promote the use of technology for the purpose of instruction. More specifically, this study makes a stance for the emphasis of student learning as well as preparing students for the workforce in the digital age.

As previously mentioned, significant results ($p < .007$) were identified in both academic college and academic status with differences present in pedagogical knowledge (PK) and technological pedagogical knowledge (TPK). The theme of pedagogy and the importance of integrating technology into pedagogical practices have appeared throughout the discussion. The common implications of professional development as well as creating a support system for transfer and application in the classroom has been the focus and is further discussed in the recommendations below.

Recommendations

Recommendations for this study are based on the emerging themes of the discussion which include professional development, a support system for faculty, and improving pedagogical practices and technology integration to benefit student learning. In order for professional development to improve student learning, it must be grounded in student needs, researched-based, collaborative, built in a system, built on effective training processes and evaluated (Iowa Association of School Boards, 2015). These components are the basis for each suggestion and should be considered when taking action on any recommendation presented. Recommendations include developing a plan for professional development, adding an instructional coach/mentoring component, and finally, involving administrators and faculty technology leaders to lead the change of growing faculty knowledge and skills in the each area of the TPaCK framework.

Professional development. Although the overall TPaCK self-assessment from participating faculty are confident in their abilities, the University of Transition should develop an implementation plan for building faculty knowledge and skills through system wide professional development based on the discrepancy of knowledge in TPaCK between faculty among academic colleges as well as academic status. While some universities may have a professional development model or plan in place, using TPaCK as the framework addresses all three components of content, pedagogy, and technology. Universities can help develop faculty

TPaCK by creating a professional development model or plan that includes skills such as problem solving technology issues, exposing faculty to new technology, and ongoing opportunities to practice technical and instructional skills while considering pedagogy and content (Larsen, 2014).

Faculty members need to know how to navigate new technology as well as use it instructionally. As mentioned by Harris, Mishra, and Koehler (2009) and Kushner Benson and Ward (2013), professional development that addresses only technology skills is insufficient, and exposing teachers to educational technologies, possible curriculum-based uses tools, and providing research on the importance of integration is not enough. Professional Development needs to be designed to fit teaching practices instead of focusing on learning how to use technology A, B or C (Lawless & Pellegrino, 2007; Rienties et al., 2013). Knowledge and skills within the professional development plan should also be scaffolded throughout an extended period of time instead of a one-stop workshops. It will be beneficial to differentiate professional development from the novice to the advanced to meet the needs of individual faculty members attending professional development. Finally, faculty professional development should be multifaceted to include reflective and collaborative opportunities, as learning is a social construct and therefore should be incorporated in the style of professional development as well (Alvarez et al., 2009).

Faculty professional development is an investment in not only the human capital of instructors, but in the students. Universities should consider which entity will lead the implementation of the professional development plan and must be prepared to offer financial support to that entity. This will ensure that the plan is being implemented with fidelity and the professional development offered, wherever that responsibility lies, is of high quality. A logical home for the professional development would be the Faculty Center for Teaching and Learning, or a version thereof. When considering the professional development plan, it is important to keep in mind that faculty need to be able to update their skills and expertise in a safe and cost effective manner on a continuous basis (Alvarez et al., 2009; Rienties et al., 2013).

Incorporate an instructional coach model or mentoring program for TPaCK. Although it is important to have a professional development plan in place, it is equally imperative to consider the follow up and support system offered so that outcomes can be achieved. A critical aspect to consider is the transfer rate of practices that are introduced to participants in professional development to the classroom. For example, in a study conducted by Ebert-May et al. (2011) in looking at the transfer of teaching practices to produce a student-centered classroom after a professional development, only 20% of participants actually put the practices into place. The reason for such low transfer rate is most commonly attributed to insufficient time and practice, lack of resources, and absence of institutional support (Dancy & Henderson, 2010; Henderson & Dancy, 2009; Walczyk & Cotner, 2008). To mediate a low transfer rate, universities ought to consider putting an instructional coach model or a comprehensive mentoring program into place.

Many universities may already have a mentoring program in place; however, there remains a range of implementation and purposes throughout. For example, most mentoring programs in of higher education are geared towards new faculty. The range varies especially for these mentoring programs that are subject to department or college discretion and focus on organization policy or research, and not teaching and learning. As seen from the results, in this study there is a difference in pedagogical knowledge and technological knowledge between colleges, which sugggests the need to revamp or incorporate a university-wide framework for mentoring or coaching. According to Thibault (2017), the instructional coaching approach offers great promise as a means of professional development in the higher education.

A credible model to incorporate at the higher education level is the Knight et al. (2015) coaching impact cycle of identify, learn, and improve. The first step *identify* would involve the coach and the protégé collaborating to set a goal based on some type of student evidence or performance and determine a selected strategy to meet that goal. The second step, *learn,* would consist of the coach explaining the strategy and modeling when needed. The final step of *improve* allows for the coach to monitor mastery of implementation and reflect with the protégé on practice. If a coaching model is implemented using a similar framework, it is recommended that all faculty regardless of academic status or college be required to participate in the coaching cycle on a regular basis. To provide some guidelines, the National Research Council (2012) recommends that at least two out of the three following strategies are met to ensure a successful program change that impacts instructional practice: (1) a sustained focused effort that lasts from 4 weeks to a semester or longer based on need (2) reflection and feedback on instructional practices and (3) a methodical focus on changing faculty beliefs about instructional practices.

Involve administrators and technology leaders in leading the change. According to Bell (2001) and Zhan (2011), in order for a positive change in technology training and implementation to occur, leaders of the organization must be involved in the professional development, as well as the teaching and learning. As established by the University of Transition, one of the goals is to create a "university of the 21st century that uses blended online learning as well as new and highly technologically-equipped classrooms" (The University of Transition, p.1, 2015). To meet this outcome, the university will need to have the administration and faculty technology leaders promote the change, as well as role model the implementation in their own positions and practices. This recommendation is based on the low response rate from participants. Whether potential participants did not complete the survey because of the lack of confidence in the domains, were not tech savvy, or were not interested in the study, the low response rate of 16% speaks to the level of engagement of faculty. This implies that administrators and technology leaders will need to further study options to engage faculty regardless of technological adverse perceptions or ability.

Furthermore, if the expectation is integrated into the tenure and promotion process, it would be valued by faculty and most likely become part of a faculty member's efforts and workload. This has implications for policy and faculty incentives in the area of technology integration in higher education. In addition to being involved in the change and practicing through role modeling, another recommendation would be for the administration to periodically conduct assessments of faculty in the seven TPaCK domains (Larsen, 2014). This will allow for the university to tailor the professional development plan based on a needs assessment.

Limitations

Before diving into the implications for future research, it is important to revisit and revise the limitation of this study to help future researchers expand, replicate, or inform future studies. The following are possible limitations to this study:

1. It is possible that predominantly tech savvy faculty or faculty who are interested in technology self-selected to complete the survey which resulted in a sample size of only 248 which, although acceptable, may limit the study. Replication at the same university or comparable institution may strengthen validity of the study.

2. Using the subgroups tenure, tenure-track, and non-tenure track may skew the results, as some faculty may not candidly express their honest opinion in fear of possible repercussions to future promotions.
3. Due to the dependence on faculty's willingness and availability to participate in the survey, convenience sampling could pose a possible limitation to this study.
4. The lack of causality or the explanations of the cause and effect relationships between variables and TPaCK scores is a limitation to this study. The discrepancy in validity and the exclusion of one of the original HE-TPaCK domains is also a limitation to this study.

Implications for Future Research

This study was intended to add to the discourse and the limited research related to higher education faculty's perceptions of technological, pedagogical, and content knowledge (TPaCK) and more specifically technology tools being implemented in the classroom. Although this study yields significant results in academic college and academic status in the domains of pedagogy knowledge and technology pedagogy knowledge, there are areas of interest that could deepen the discourse regarding TPaCK and provide a different lens to analyze the TPaCK framework at the higher education level. The following are some implications for future research:

Collect and analyze data on the quality of technology training faculty are attending. The survey used in this study encompasses a general demographic question regarding the type of technology training received, which was not formally analyzed in this study. Faculty professional development is optional at this institution and is based on individual interest and availability. However, the responses from faculty participants mostly revolved around professional development topics such as using the course management system and the faculty portfolio platform. The question did not adequately provide information on quality or type of professional development they were attending. Including a qualitative data set through interviews or focus groups would provide insight into the types of professional development faculty are receiving or are interested in, where they are obtaining this training, and the quality of the training would be a beneficial addition to the work. Obtaining qualitative data would also help operationalize the TPaCK domains. This addition would provide a holistic view of faculty needs as well as serve as an evaluative tool for the professional development that is being provided through the university.

Analyze and correlate higher education faculty self-assessment of TPaCK to student performance or student's perceptions of faculty TPaCK. In further exploring faculty perceptions of their TPaCK skills, the next logical step is to add an additional factor such as student grades, test scores, student retention or interviewing students on their perceptions of faculty TPaCK expertise. Another layer could be to create an observation tool to assess teachers' TPaCK skills in the classroom in addition to the student perspective or performance (Baran, Chuang, & Thompson, 2011). Adding these additional factors would provide a means to triangulate results with faculty self-perceptions to provide a deeper understanding of the implementation and the interactions of TPaCK in the classroom.

Further refine surveys used for the assessment of TPaCK in all areas including higher education. Over 141 instruments have been used to study TPaCK all with varying validity and reliability (Kohler, Shin, and Mishra, 2012). The number of instruments found in the literature, which is on the rise due to modifications for particular groups, warrants the demand for further investigation. There is a need to conduct more research on TPaCK instruments being used in the field to intentionally narrow the amount of TPaCK instruments to those with strong reliability and validity (Larsen, 2014).

Conclusion

Issues of technology integration continue to confront higher education in the way classes are held and in the teaching and learning practices that are used to deliver these courses. It is reported that more than 1 in 4 students are enrolled in an online or distance learning course and the trend is on the rise (Babson Survey Research Group, 2015). With the continued trend of newly established universities and the development of goals around innovative and technological ways to serve students, a framework such as TPaCK becomes important to develop, create, and evaluate programs and build faculty capacity and skills in the seven domains.

To summarize, this study investigated the perceptions of tenure and non-tenure faculty on technological, pedagogical, and content knowledge (TPaCK) at a recently established university in Texas. Similar to Garrett (2014), this study compared and contrasted the technological, pedagogical, and content knowledge (TPaCK) of faculty use of technology tools in face-to-face, blended learning and online environments as methods to enhance learning based on academic college, academic rank, academic status, years of experience, and gender. The faculty participants in this study assessed their TPaCK with high confidence in all domains with the lowest being technology knowledge and the highest being content knowledge. In addition, a significant difference in academic college and academic status in the areas of pedagogy knowledge and technology pedagogy knowledge was identified.

Teacher's knowledge is influenced through factors such as background, school environment, and socioeconomics (Harris & Hofer, 2011; Garrett, 2014). It is important for leaders and administrators to take time to analyze faculty self-perceptions in areas such as TPaCK especially when creating a new organization. Results provide insight for analyzing institutional structures and processes such as faculty professional development and the role of the centralized entity for professional development. Professor development of TPaCK has not been consistently discussed outside of educational programs and is usually faced with the hurdle of the traditional assumption that subject matter knowledge is adequate to teach college level courses (Kushner Benson & Ward, 2013; (Herring, Koehler, & Mishra, 2016). However, the TPaCK model has the potential to increase the range of faculty instructional methods and the integration of technology to better prepare students for 21st century jobs. (Herring, Koehler, & Mishra, 2016).

Further research needs to be conducted to add to the discourse of TPaCK in the field of higher education with some of the implications for future research including collecting data on quality of technology trainings offered to faculty, triangulation of other variables in addition to self-assessment surveys, and a meta-analysis of the instruments that are being used to collect information on faculty TPaCK. With the modifications of TPaCK into what it is today and with the continued momentum to further investigate the dynamic framework, this knowledge will not stay static.

REFERENCES

Akcayir, M., Dundar, H., & Akcayir, G. (2016). What makes you a digital native? Is it enough to be born after 1980? *Computers in Human Behavior, 60*, 435-440.

Allen, E., & Seaman, J. (2014). *Grade change: Tracking online education in the United States*. Retrieved from http://www.onlinelearningsurvey.com/reports/gradechange.pdf

Alvarez, I., Guasch, T., & Espasa, A. (2009). University teacher roles and competencies in online learning environments: A theoretical analysis of teaching and learning practices. *European Journal of Teacher Education, 32*(3), 321-336.

Archambault, L., & Barnett, J. (2010). Revisiting technological pedagogical content knowledge: Exploring the TPaCK framework. *Computers & Education, 55*, 1656-1662.

Archambault, L., & Crippen, K. (2009). Examining TPaCK among K-12 online distance educators in the United States. *Contemporary Issues in Technology and Teacher Education, 9*(1) 71-88. Retrieved from http://www.citejournal.org/vol9/iss1/general/article2.cfm

Archambault, L., Wetzel, K., Foulger, T. S., & Williams, M. K. (2010). Professional development 2.0; Transforming teacher education pedagogy with 21st century tools. *Journal of Digital Learning in Teacher Education, 27*(1), 4-11.

Austin, A. E. (2003). Creating a bridge to the future: Preparing new faculty to face changing expectations in a shifting context. *The Review of Higher Education, 26*(2), 119-144. doi:10.1353/rhe.2002.0031

Aycock, A., Garnham, C., & Kaleta, R. (2002). Lessons learned from the hybrid course project. *Teaching Technology Today, 8*(6).

Bain, C. D., & Rice, M. L. (2006). The influence of gender on attitudes, perceptions, and uses of technology. *Journal of Research on Technology in Education, 39*, 119-132.

Balkin, R. S., Ricard, S. J., Garcia, R., & Lancaster, C. (2011). Assessing factors in adolescent adjustment as precursors to recidivism in court-referred youth. *Measurement and Evaluation in Counseling and Development, 44*, 52-59. doi:10.1177/0748175610391611

Ballard, M. (2017, March 8). Eight Louisiana technical and community colleges to merge campuses: here's why [Supplemental material]. *The Advocate*. Retrieved from www.theadvocate.com/baton-rouge/news/education/article_56b842d0-0441-11e7-86000-9b894aaa8bac.html

Baran, E., Chuang, H., & Thompson, A. (2011). TPaCK: An emerging research and development tool for teacher educators. *TOJET: The Turkish Online Journal of Educational Technology, 10*(4), 370-377.

Bell, R. (2001). Implicit instruction in technology integration and the nature of science: There's no such thing as a free lunch. *Contemporary Issues in Technology and Teacher Education, 1*(4). Retrieved from http://www.citejournal.org/volume-1/issue-4-01/science/article2-thm-19

Blocher, M., Armfield, S., & Sujo-Montes, E. (2011). Contextually based professional development. *Computers in the Schools: Interdisciplinary Journal of Practice Theory and Applied Research, 28*(2), 158-169.

Borg, W. R., & Gall, M. D. (1983). *Educational research* (4th ed.). New York, NY: Longman.

Coates, H. (2005). The value of student engagement for higher education quality assurance. *Quality in Higher Education, 11*(1), 25-36. doi:10.1080/13538320500074915

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Cox, B. S., & Graham, C. R. (2009). Using an elaborated model of the TPaCK framework to analyze and depict teacher knowledge. *Tech Trends, 53*(5).

Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. Philadelphia, PA: Harcourt Brace Jovanovich College Publishers.

Czajka, C. D., & McConnell, D. (2016). Situated instructional coaching: a case study of faculty professional development. *International Journal of STEM Education, 3*(10). doi:10.1186/s40594-016-0044-1

Dancy, M., & Henderson, C. (2010). Pedagogical practices and instructional change of physics faculty. *American Journal of Physics, 78*(10), 1056-1063.

Darling-Hammond, L. (2006). Constructing 21st century education. *Journal of Teacher Education, 57*. doi:10.1177/0022487105285962

Dong, Y., Chai, C. S., Koh, J. H., & Tsai, C. C. (2015). Exploring the profiles and interplays of pre-service and in-service teachers' technological pedagogical content knowledge (TPaCK) in China. *Educational Technology and Society, 18*(1), 158-169.

Dweck, C. (2016). *Mindset: The new psychology of success* (Rev. ed.). New York : Ballantine Books.

Dziuban, C., Hartman, J., Moskal, P., Sorg, S., & Truman, B. (2004). Blended learning. *Educause Center for Applied Research Bulletin, 7*, 1-12.

Ebert-May, D., Derting, T. L., Hodder, J., Momsen, J. L., Long, T. M., & Jardeleza, S. E. (2011). What we say is not what we do: Effective evaluation of faculty professional development programs. *BioScience, 61*(7), 550-558.

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), 1-4.

Freeman, D. (2002). The hidden side of the work: Teacher knowledge and learning to teach. *Language Teaching, 35*, 1-13.

Gall, M. D., Gall, J. P., & Borg, W. R. (2007). *Educational research: An introduction* (8th ed.). New York, NY: Pearson.

Garrett, K. N. (2014). A quantitative study of higher education faculty self-assessments of technological, pedagogical, and content knowledge (TPaCK) and technology training. *Dissertation Abstracts International: Section A. Humanities and Social Sciences*, 3639104.

Georgina, D. A., & Olson, M. R. (2008). Integration of technology into higher education: A review of faculty self-perceptions. *Journal of Higher Education and Technology, 11*(1), 1-8.

Golde, C. M., & Dore, T. M. (2001). *At cross purposes: What the experience of todays doctoral students reveal about doctoral education*. Retrieved from http://www.phd-survey.org/report%20final.pdf

Graham, R. C., Burgoyne, N., Cantrell, P., Smith, L., St. Clair, L., & Harris, R. (2009). TPaCK development in science teaching: Measuring the TPaCK confidence of in-service science teachers. *Tech Trends, 53*, 70-79.

Gravetter, F. J., & Forzano, L. B. (2016). *Research methods for the behavioral sciences* (5th ed.). Stamford, CT: Cengage Learning.

Harr, N., Eichler, A., & Renkl, A. (2014). Integrating pedagogical content knowledge and pedagogical/psychological knowledge in mathematics. *Front Psychol, 5*. doi:10.3389/fpsyg.2014.00924

Harris, J., & Hofer, M. (2009). Instructional planning activity types as vehicles for curriculum-based TPaCK development. In C. D. Maddux (Ed.), *Research highlights in technology and teacher education* (pp. 99-108). Chesapeake, VA: AACE.

Harris, J. B., & Hofer, M. J. (2011). Technological pedagogical content knowledge (TPaCK) in action: A descriptive study of secondary teachers' curriculum-based, technology-related instructional planning. *Journal of Research on Technology in Education, 43*(3), 211-229.

Harris, J. B., & Hofer, M. J. (2017). "TPaCK Stories"; Schools and school districts repurposing a theoretical construct for technology related professional development. *Journal of Research on Technology in Education, 49*(1), 1-15. doi:10.1080/15391523.2017.1295408

Harris, J., Mishra, P., & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types: curriculum-based technology integration reframed. *Journal of Research on Technology in Education, 41*(4), 25-45.

Hearn, J., & Anderson, M. (2002). Conflict in academic departments: An analysis of disputes over faculty promotion and tenure. *Research in Higher Education, 43*(5), 503-529.

Henderson, C., & Dancy, M. (2009). Impact of physics education research on the teaching of introductory quantitative physics in the United States. *Physical Review Special Topics-Physics Education Research, 5*(2), 020107.

Herring, M. C., Koehler, M. J., & Mishra, P. (2016). *Handbook of technological pedagogical content knowledge (TPaCK) for educators* (2nd ed.). New York: Routledge.

Hew, K. F., & Cheung, W. S. (2014). U*sing blended learning: Evidence-based practices* (pp. 1-13). Singapore: Springer. doi:10.10007/978-981-287-089-6

Horn, M. B., & Staker, H. (2011). *The rise of K-12 blended learning*. Mountain View, CA: Innosight Institute. Retrieved from http://www.innosightinstitute.org/innosight/wp-content/uploads/2011/The-Rise-of-K-12-Blended-Learning.pdf

Hoy, W. K. (2010). *Quantitative research in education: A primer*. Thousand Oaks, CA: SAGE Publishing.

Hughes, J. (2005). The role of teacher knowledge and learning experiences in forming technology-integrated pedagogy. *Journal of Technology and Teacher Education, 13*(2), 277-302.

Iowa Association of School Boards. (2015). *Professional development: A key strategy for improving student learning*. Retrieved from http://www.ia-sb.org/StudnetAchievement.aspx?id=458

Jang, S. J., & Chen, K. C. (2010). From PCK to TPaCK: Developing a transformative model for preservice science teachers. *Journal of Science Education and Technology, 19*(6), 553-564.

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2015). *The NMC horizon report: 2015 higher education edition*. Washington, DC: U.S. Government Printing Office.

Jones, W. A. (2011). Variation among academic disciplines: An update on analytical frameworks and research. *Journal of the Professoriate, 6*(1), 9-27.

Knight, J., Elford, M., Hock, M., Dunekack, D., Bradley, B., Deshler, D., & Knight, D. (2015). 3 steps to great coaching: A simple but powerful instructional coaching cycle nets results. *Journal of Staff Development, 36*(1), 11-18.

Knolton, D. V. (2014). Technological. pedagogical, content knowledge (TPaCK): An exploratory study of adjunct faculty technology proficiency. *Dissertation Abstracts International: Section A. Humanities and Social Sciences*, 3680719.

Koehler, M. J. (2011). *Technological pedagogical and content knowledge model*. Retrieved from http://www.TPaCK.org

Koehler, M. J., Mishra, P., Kereluik, K., Shin, T. S., & Graham, C. R. (2014). The technological pedagogical content knowledge framework. In *Handbook of Research on Educational Communications and Technology* (pp. 101-111).

Koehler, M. J., Mishra, P., & Yahya, K. (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy, & technology. *Computer Education, 49*(3), 740-762.

Koehler, M. J., Shin, T. S., & Mishra, P. (2012). How do we measure TPaCK? Let me count the ways. In R. N. Ronau, C. R. Rakes, & M. L. Niess (Eds.), *Educational technology, teacher knowledge, and classroom impact: A research handbook on frameworks and approaches* (pp. 16-31). Hershey, PA: IGI Global.

Koh, J. H., & Divaharan, S. (2011). Developing pre-service teachers' technology integration expertise through the TPaCK developing instructional model. *Journal of Educational Computing Research, 44*(1), 35-58.

Kushner Benson, S. N., & Ward, C. L. (2013). Teaching with technology: Using TPaCK to understand teaching expertise in online higher education. *Educational Computing Research, 48*(2), 153-172.

Larsen, N. A. (2014). Examining the differences in technological pedagogical content knowledge (TPaCK) self-assessment scores of foreign language instructors and first-line supervisors in six institutes of higher education (IHE) in California. *Dissertation Abstracts International: Section A. Humanities and Social Sciences*.

Lavadia, L. (2017). Technological, pedagogical, and content knowledge (TPaCK): An Educational Landscape for Tertiary Science Faculty. *Dissertation Abstracts International: Section A. Humanities and Social Sciences*, 10280318.

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research, 77*(4), 575-614.

Lux, N. J., Bangert, A. W., & Whittier, D. B. (2011). The development of an instrument to assess preservice teacher's technological content knowledge. *Journal of Educational Computing Research, 45*(4), 415-431.

Maeng, J. L., Mulvey, B. K., Smetana, L. K., & Bell, R. L. (2013). Preservice teachers' TPaCK: Using technology to support inquiry instruction. *Journal of Science Education and Technology, 22*, 838-857.

McBain, L. (2012). College and university mergers: An update on recent trends. *American Association of State Colleges and Universities*, May 3, 2012. 1-5.

Messina, L., & Tabone, S. (2011). Integrating technology into instructional practices focusing on teacher knowledge. *Procedia- Social and Behavioral Sciences, 46*, 1015-1027.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teacher College Record, 108*(6), 1017-1054.

Muhammad, A. J. (2016). Utilizing technology to enhance learning environments: The Net Gen student. *Journal of Family and Consumer Sciences, 108*(2), 61-63. doi:10.14307/JFCS108.2.61

National Research Council. (1997). *Science teaching reconsidered: A handbook*. Washington, DC: The National Academies Press. doi:10.17226/5287

National Research Council. (2012). *Discipline-based education research: Understanding and improving learning in undergraduate science and engineering*. Washington DC: The National Academic Press.

National Staff Development Council. (2001). *National Staff Development Councils standards for staff development*. Oxford: Author.

Niess, M. L. (2011). Investigating TPaCK: Knowledge growth in teaching with technology. *Journal of Educational Computing Research, 44*(3), 299-317.

Nunnally, J. (1978). *Psychometric theory*. New York, NY: McGraw-Hill.

Oleson, A., & Hora, M. (2014). Teaching the way they were taught? Revisiting the sources of teaching knowledge and the role of prior experience in shaping faculty teaching practices. *Higher Education, 68*, 29-45.

Ottenbreit-Leftwich, A. T., Glazewski, K. D., Newby, T. J., & Ertmer, P. A. (2010). Teacher value beliefs associated with using technology: Addressing professional and student needs. *Computer and Education, 55*(3), 1321-1335. doi:10.1016/j.compedu.2010.06.002

Pamuk, S., Ergun, M., Cakir, R., Yilmaz, H. B., & Ayas, C. (2013). Exploring relationships among TPaCK components and development of the TPaCK instrument. *Springer Science and Business, 20*, 241-263.

Pierce, S. (2014). Merger causes and consequences. *Inside Higher Education*. Retrieved from www.insidehighered.com/views/2014/09/18/essay-issues-colleges-consider-when-mergers-are-being-discussed

Postareff, L., Lindblom-Ylanne, S., & Nevgi, A. (2007). The effect of pedagogical training on teaching in higher education. *Teaching and Teacher Education, 23*(5), 557-571.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9*(5), 1-6.

Rienties, B., Brouwer, N., Bohle- Carbonell, K., Townsend, D., Rozendal, A. P., Van der Loo, J., . . . Lygo-Baker, S. (2013). Online training of TPaCK skills of higher education scholar: A cross- institutional impact study. *European Journal of Teacher Education, 36*(4), 480-495.

Robinson, T. E., & Hope, W. C. (2013). Teaching in higher education: Is there a need for training in pedagogy in graduate degree programs? *Research in Higher Education, 21*.

Sahin, I. (2011). Development of survey of technological pedagogical and content knowledge. *Educational Technology, 10*(1), 97-105.

Salkind, N. (2010). *Encyclopedia of research design*. Thousand Oak, CA: Sage Publications.

Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., & Mishra, P. (2009). Technological pedagogical content knowledge (TPaCK): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education, 42*(2), 123-149.

Scott, L. C. (2009). *Through the wicked spot: A case study of professors' experience of teaching online* (Doctoral dissertation). Available from ProQuest Dissertation and Theses database (Publication No. ATT 3379753

Seltzer, R. (2017, August 1). Higher ed mergers are difficult, likely to grow in popularity, speakers say. *Inside Higher Ed, ,*. doi:www.insidehighered.com/news/2017/08/01/higher-ed-mergers-are-difficult-likely=grow-popularity-speakers-say

Shepherd, C., Alpert, M., & Koeller, M. (2007). Increasing the efficacy of educators teaching online. *International Journal of Social Sciences, 2*(3), 173-179.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22.

Smith, T. C. (2005). Fifty-one competencies for online instruction. *Journal of Educators Online, 2*(2), 1-18.

Soley-Bori, M. (2013). *Dealing with missing data: Key assumptions and method for applied analysis*. https://www.bu.edu/sph/files/2014/05/Marina-tech-report.pdf

Stoltzfus, M., Scragg, B., & Tressler, C. (2015). Mind the gap: Connecting K-12 and higher education educators to improve the student experience. *Educause Review, 50*(2).

Thibault, M. (2017). Instructional coaching in higher education: Partnering to infuse ELL instructional practices into social studies courses. *Dissertation Abstracts International: Section A. Humanities and Social Sciences*, 10268386.

University of Transition. (2015). *Faculty tenure and promotion*. Retrieved from www.utrgv.edu/hop/policies/adm-06-505.pdf

University of Transition. (2015). *History of the University of Texas Rio Grande Valley*. Retrieved from http://www,utrgv.edu/en-us/about-utrgv/history/index.htm

University of Transition. (2015). *History of UT Rio Grande Valley*. Retrieved from http://www.utrgv.edu/en-us/about-utrgv/history/index.htm

University of Transition. (2016). *College of Education and P-16 integration: Division of academic affairs*. Retrieved from http://utrgv.edu/cep/departments/index.htm

University of Transition. (2016). *Enrollment reports: Office of the VP for Strategic Enrollment*. Retrieved from http://www.utrgv.edu/student-enrollment/reports/index.htm

University of Transition. (2016). *The CEP directory of faculty*.

University of Transition. (2016). *The colleges that make up UTRGV*. Retrieved from http://www.utrgv.edu/en-us/acadmics/colleges/

University of Transition. (2016). *UTRGV online courses- fall 2015 & 2016* (CBM008). Edinburg, TX: Author.

University of Transition. (2016). *Why choose UTRGV?* Retrieved from http://www.utrgv.edu/en-us/admissions/why-choose-turgv/index.htm

University of Transition. (2015). *A new university in south Texas: Key points*.

Walczyk, J., & Cotner, S. (2008). Obstacles to instructional innovation according to college science and mathematics faculty. *Journal of Research in Science Teaching, 7*, 361-367.

Ward, C. L., & Kushner Benson, S. N. (2010). Developing new schemas for online teaching and learning: TPaCK. *Journal of Online Teaching and Learning, 6*(2), 482-490.

Yang, S. C., & Liu, S. F. (2004). Case study of online workshops for the professional development of teachers. *Computers in Human Behavior, 20*, 733-761.

YiLi, Wang, Q., & Campbell, J. (2015). Investigating gender and racial/ethnic invariance in use of course management system in higher education. *Education Sciences, 5*, 179-198.

Zhan, Y. (2011). Discourse analysis basing on TPaCK framework: What perservice teachers focus on during instructional design? *Journal of Distance Education, 6*, 73-78.

APPENDIX

APPENDIX

HE-TPaCK SURVEY

Demographic Information

1. Gender
    a. Female
    b. Male
2. Academic ranking that best fits your current position
    a. Professor
    b. Associate Professor
    c. Assistant Professor
    d. Instructor/Lecturer
3. Tenure Status
    a. Tenured
    b. Tenured-track
    c. Neither
4. Total number of years of teaching experience
    a. 0
    b. 1-4 years
    c. 5-9 years
    d. 10-14 years

e. 15-19 years

f. 20 + years

5. What academic college are you a member of?

    a. School of Medicine

    b. College of Health Affairs

    c. College of Sciences

    d. College of Liberal Arts

    e. College of Fine Arts

    f. College of Engineering and Computer Science

    g. College of Business and Entrepreneurship

    h. College of Education and P-16 Integration

    i. Honors College

    j. Graduate College

    k. University College

6. What is your discipline of expertise?

7. How many technology trainings have you attended in the last year?

    a. 0

    b. 1-3

    c. 4-6

    d. 7-9

    e. 10+

8. Describe the technology training you have participated in.

Please read each item carefully and then rate to what extent you agree with the statement using the scale below. Each statement will be about your perception of your teaching knowledge and experience.

Using the following scale, to what extent do you agree with the statement below?

Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree
1	2	3	4	5

HE-TPaCK Items

Technology Training (TT)

9. Technology training would enhance my teaching.
10. It is the University's responsibility to train me to use technologies that will enhance my teaching.
11. The University should not make technology training a requirement for faculty.
12. Technology training should be offered in each academic department at my University.

Pedagogical Knowledge Domain (PK)

13. I have a clear understanding of pedagogy (e.g., designing instruction, assessing students' learning).
14. I am familiar with a wide range of practices, strategies, and methods that I can use in my teaching.
15. I know how to assess student learning.

16. I know how to motivate students to learn.

Technology Knowledge Domain (TK)

17. I am familiar with a variety of hardware, software, and technology tools that I can use for teaching.
18. I know how to troubleshoot technology problems when they arise.
19. I do not know how to use technology in my everyday life.
20. I recognize that technology use can have positive and negative effects.
21. I cannot decide when technology can be beneficial to achieving a learning objective.
22. I can decide when technology may be detrimental to achieving a learning objective.

Content Knowledge Domain (CK)

23. I have a comprehensive understanding of the curriculum I teach.
24. I understand how knowledge in my discipline is organized.
25. I am familiar with the common preconceptions and misconceptions in my discipline.
26. I can explain to students the value of knowing concepts in my discipline.
27. I can make connections between the different topics in my discipline.
28. I stay abreast of new research related to my discipline in order to keep my own understanding of my discipline updated.

Pedagogical Content Knowledge Domain (PCK)

29. I understand that there is a relationship between content and the teaching methods used to teach that content.
30. I can anticipate students' preconceptions and misconceptions.
31. I can address students' preconceptions and misconceptions.
32. I understand what topics or concepts are easy or difficult to learn

33. I can provide multiple representations of content in the form of analogies, examples, demonstrations, and classroom activities.
34. I can adapt material to students' abilities, prior knowledge, preconceptions, and misconceptions.

Technological Pedagogical Knowledge Domain (TPK)

35. I understand how teaching and learning change when certain technologies are used.
36. I do not understand how technology can be integrated into teaching and learning to help students achieve specific pedagogical goals and objectives.
37. I do not know how to adapt technologies to support teaching and learning.
38. I know how to be flexible with my use of technology to support teaching and learning.
39. I cannot reconfigure technology and apply it to meet instructional needs.
40. I understand that in certain situations technology can be used to improve student learning.

Technological Content Knowledge Domain (TCK)

41. I cannot select and integrate technological tools appropriate for use in specific disciplines (or content).
42. I understand how the choice of technologies allows and limits the types of content ideas that can be taught.
43. I do not understand how some content decisions can limit the types of technology that can be integrated into teaching and learning.
44. I am aware of how different technologies can be used to provide multiple and varied representation of the same content.

45. I cannot select specific technologies that are best suited for addressing learning objectives in my discipline.
46. I understand that I need to be flexible when using technology for instructional purposes.

Technological Pedagogical Content Knowledge Domain (TPCK)

47. I can effectively integrate educational technologies to increase student opportunities for interaction with ideas.
48. I have different opportunities to teach specific curriculum content topics with technology.
49. I can use appropriate instructional strategies to teach specific curriculum content topics with technology.
50. I cannot determine when a technology resource may fit with one learning situation in my discipline, and not with another.
51. I can flexibly incorporate new tools and resources into content and my teaching methods to enhance learning.
52. I understand how digital technologies can be used to represent content in a variety of formats.
53. I can use teaching methods that are technology-based to teach content and provide opportunities for learners to interact with ideas.
54. I understand what makes certain concepts difficult to learn for students and how technology can be used to leverage that knowledge to improve student learning.
55. I do not understand how to integrate technology to build upon students' prior knowledge of curriculum content.

56. I know how to operate classroom technologies and can incorporate them into my particular discipline to enhance student learning.
57. I know how to integrate the use of educational technologies effectively into curriculum-based learning.

BIOGRAPHICAL SKETCH

Jessica Daniell Hruska was born in Harlingen, TX and continues to be a life long resident of the Rio Grande Valley. After completing her primary education in Kona, Hawaii she graduated from Harlingen High School South in 2001. Following her dream to be a fighting Texas Aggie, she enrolled at Texas A&M College Station in 2003 after graduating Blinn College with an Associates Degree in Applied Science. Jessica graduated from Texas A&M in 2005 with a Bachelor’s Degree in Animal Science. After graduation Jessica was exposed to the field of education and became very passionate about becoming an educator. In 2007 she was hired as an 8^{th} grade Science teacher in Harlingen and two years later committed to pursuing a Master’s Degree in Curriculum and Instruction with an Emphasis in Science from the University of Texas – Brownsville. Marking the completion of her Master’s Degree in 2011, Jessica became interested in higher education teaching and learning. In 2012, Jessica embarked on her journey to earn a Doctorate in Curriculum and Instruction with a Specialization in Higher Education Teaching. During her Doctorate coursework she had been recruited as an External Instructional Coach and Professional Development Specialist for Educate Texas. In continuing to follow her passion to work with adult learners, Jessica took the position of Special Projects and Grants Specialist for the Harlingen Consolidated Independent School District. In May of 2018, Jessica gradated with her Doctorate and plans to continue her work with adult learners while bridging the gap between higher education and secondary education. Jessica can be reached at 17517 Arroyo Bank Drive Harlingen, TX 78552.